R-03-13

A generic study of discrete fracture network transport properties using FracMan/MAFIC

Nils Outters, Golder Associates

August 2003

Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co
Box 5864
SE-102 40 Stockholm Sweden
Tel 08-459 84 00
+46 8 459 84 00
Fax 08-661 57 19
+46 8 661 57 19

ISSN 1402-3091
SKB Rapport R-03-13

A generic study of discrete fracture network transport properties using FracMan/MAFIC

Nils Outters, Golder Associates

August 2003

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

A pdf-version of this document can be downloaded from www.skb.se

Abstract

The project studies the transport properties of channels through discrete fracture network model (DFN). The DFN model consists of three sets of stochastic fractures of a typical Swedish fractured rock mass. The pathway analysis provides pathway characteristics. These characteristics are the CCDF (Complementary Cumulative Density Function) of V, 1/v, 1/(bv), τ and β. V is the magnitude of the flow velocity in the whole DFN model (Eulerian), v is the flow velocity along a path (Lagrangian), b is the half-aperture of the fracture, τ is the residence time of the particles and β is a Lagrangian parameter that defines the transport resistance.

This project combines FracMan/FracWorks for fracture network generation with FracMan/MAFIC for flow and particle tracking and transport.

The hydraulic transport modelling of flow pathways will be based on a base case DFN with variation cases. These variations will concern mainly the boundary conditions of the model, the geometry of the DFN, and the pathway calculation method. The method is based on stochastically generated fractures, each separate case is modelled by 20 realisations.

The Base Case model is set-up to reflect the hydraulic behaviour of a typical Swedish fractured rock mass. The DFN model used was developed by Stigsson et al. (2001) to model the hydraulic behaviour of the prototype repository of the Äspö HRL. The size of the model is in the 100m scale.

The project provided the following results:

- Alternative streamline routing algorithm implemented in MAFIC (Case 5) provides results that are very similar to the Base Case
- Alternative fracture intensity P_{32} set to 50% of the original fracture intensity produces results very similar to the Base Case. A high level of confidence in the fracture intensity P_{32} from field data is therefore not required for transport calculations as long as the fracture intensity is sufficient.
- Alternative fracture intensity P_{32} set to 10% of the original fracture intensity produces results that are different from the Base Case. A fracture intensity too low can greatly affect the connectivity of the DFN.
- The use of the Doe law and the cubic law as a relationship between the fracture aperture and the transmissivity presents significant but not large differences.
- The use of a linear relationship between the fracture aperture and the transmissivity was found difficult to calibrate and is inappropriate for the wide range of transmissivities used in the study.
- A correlation between the discharge at the upstream boundaries and the general characteristics of the pathways could not be observed.
- The CCDFs of the travel time of the particles show similar results for all cases. The results can still change by some orders of magnitude depending on the boundary conditions.
- The CCDFs of the retention factor are similar for all cases using the MAFIC transport solutions. The PAWorks solution (pipe network analysis) is rather different and presents lower retention factors within a smaller range.

- The CCDFs of the ratio 1/bv of the Lagrangian data are similar for all cases using the MAFIC transport solutions. The PAWorks solution is rather different and presents lower ratio 1/bv within a smaller range.
- The Eulerian CCDFs of 1/v and 1/bv show that all cases behave in a similar way except when the fracture intensity is low.

1 Introduction

1.1 Background

The PAWorks 3 project (Outters et al.) studied the transport properties of channels through discrete fracture network model (DFN). The DFN model consisted of two sets of stochastic fractures at different scales and the canister locations of a hypothetical repository layout. The pathway analysis carried out provided pathway parameters (pathway length, pathway width, transport aperture, reactive surface area, pathway transmissivity), canister statistics (average number of pathways per canister, percentage of canister locations with pathways) and visualisation of pathways.

1.2 Purpose and objectives

The analytical solutions for solute transport require data that characterise the transport pathways through the rock mass. These characteristics are the CCDF (Complementary Cumulative Density Function) of V, 1/v, 1/(bv), τ and β. V is the magnitude of the flow velocity in the whole DFN model (Eulerian), v is the flow velocity along a path (Lagrangian), b is the half-aperture of the fracture, τ is the residence time of the particles and β is a Lagrangian parameter dependent only on the advective water movement and fracture characteristics.

This study uses particle tracking to derive the following pathway characteristics in DFN models:

- v
- 1/v
- 1/bv
- τ
- β

2 Modelling strategy

This project combines FracMan/FracWorks for fracture network generation with FracMan/MAFIC for flow and particle tracking and transport.

2.1 The FracMan approach

Discrete Fracture Network (DFN) hydrogeology is based on two fundamental empirical observations:

- flow and transport in geological materials are controlled by structural features
- the hydraulic conductivity (transmissivity) of geological materials tends to follow a log normal or similarly skewed distribution

As a result of the first observation, it is desirable to have a hydrogeological model that can model structural features to as fine level of detail as possible. As a result of the second observation, it can be assumed that the vast majority of the structural fractures will not contribute significantly to flow and transport, and can therefore be ignored. This leads to the use of a DFN approach which concentrates on an accurate representation of conductive structures and flow barriers, sacrificing accuracy in the representation of smaller scale or less transmissive features.

The conceptual model used in the DFN approach assumes that discrete fractures provide the primary hydraulic flow paths and connections, and that accurate representation of flow path geometry is a key to successful hydrogeologic analysis. Discrete fractures may be fractures, faults, karsts, or paleochannels, depending on the scale and geology. Discrete fractures may be one, two, or three-dimensional features. In the present study, fractures are treated as 2D features (tessellated to triangular elements). Discrete fractures are generated in realistic three-dimensional networks based on the structural geology and statistical information of the fracturing, and can be conditioned to local measurements.

The key assumptions of the DFN approach as applied in this project may be summarised as follows:

- A range of scales of discrete features can be used to represent flow and transport behavior at any scale.
- Discrete feature geometric and hydraulic properties can be derived from structural information and hydraulic tests.
- Discrete features can be represented by a combination of two-dimensional structures such as plates.
- Flow in discrete features can be described by the same laws as used for continuum approaches (i.e., the Navier-Stokes and Darcy equations).
- Meaningful boundary conditions can be defined and assigned to discrete features at the edge of the model.
- Discrete features that have not been intersected or measured can be described statistically based on those features that have been intersected and characterized.
- Practical problems can be described by a limited number of stochastic realisations of the fracture pattern.

The key limitations of the DFN approach as applied in this project may be summarised as follows:

- The number of discrete features that can be modelled is limited by time, budget and available computational power.
- Hydraulically significant features may have different properties from the geologically identified features used to generate statistics.
- More complex geological structures may be difficult to represent by simple geometric features.
- Variations occur within fracture planes and at fracture intersections.

Below follows a summary of what fracture parameters are needed in the construction of the DFN model.

Fracture orientation distributions

Fractures with similar orientations can be sorted into fracture sets. The orientation of the fracture in each set is defined by a statistical distribution.

Fracture size distributions

The sizes of the fractures in a fracture set are defined by their area distribution.

Fracture spatial model

Fracture trace maps can present different aspects that are not necessarily dependent of the fracture size or orientation. This aspect mainly depends on the spatial distribution of the fracture traces within a given surface. Fractures can be heavily clustered and regularly dispersed within the surface or can be located in small groups. A spatial analysis of a trace map permits to characterise the clustering of fractures.

Fracture set intensity and transmissivity distribution

Fracture set intensity can be expressed as linear frequency, trace length density and fracture area density. In this project, we use the areal intensity P_{32}.

Fracture areal intensity (P_{32}) is defined as the total area of fractures per unit volume of rock. The fracture areal intensity P_{32} is expressed in m^2 /m^3.

Fracture hydraulic transmissivity distributions

The hydraulic behaviour of a fracture network depends mainly on the transmissivity of the fractures. The transmissivity T of a single fracture in a borehole section of 1 m length in an impermeable rock is equivalent to the conductivity K of the same 1 m long borehole section in a continuous porous material.

The transmissivity statistical distributions of the conductive fractures are estimated by the statistical analysis of packer test results.

Fracture transport aperture distributions

The transport behaviour of a fracture network depends mainly on the aperture of the fractures. The fracture transport aperture is calculated as a function of the hydraulic transmissivity.

2.2 Computations

MAFIC (Matrix/Fracture Interaction Code) was developed by Golder Associates to simulate transient flow and solute transport through three-dimensional rock masses with discrete fracture networks. Flow and solute transport can be simulated in both the fractures and the rock matrix. MAFIC provides flow and transport simulation for hydrogeological conceptual models generated by FracMan/FracWorks.

The hydraulic transport modelling of flow pathways will be based on a base case DFN with variation cases. These variations will concern mainly the boundary conditions of the model, the geometry of the DFN, and the pathway calculation method. Since the method is based on stochastically generated fractures, each separate case will be modelled by a certain number of realisations. The number of realisations and the number of released particles in the DFN will depend on the computer resources and the computing time available. A number of 20 realisations is used in the present study, given the reasonable computing time it requires.

2.3 Output parameters

The output of the calculations will be the CCDFs (Complementary Cumulative Density Function) of

- Eulerian velocity V.
  This is the velocity of the water monitored in every element of the model according to the global coordinate system. The FEM mesh of the model used for flow computations is made of triangular elements. The base functions used in each triangular element for head calculation are linear in this project. Hence the potential field in each element is constant. Hence the fluid velocity in each element is constant.
  Each realisation model is made of a FEM mesh of about 1.5 million elements. The CCDF of the eulerian velocity is hence calculated with 1.5 million data.
- Inverse Lagrangian velocity $1/v_i$
  This is the inverse of the velocity monitored along a particle pathway in the local coordinate system.
  MAFIC is able to deliver the coordinates of a particle at any time in the model.
  The time of monitoring is both defined according to the user requirements and also set by MAFIC as soon as a particle passes the boundary of an element.
  Consequently, a particle pathway is defined by a series of small pathway “elements” characterized by their position and time.
  The Lagrangian velocity v_i at a given time is equal to the fluid velocity (Eulerian) in the element *i* where the particle is located at this time.
  The CCDFs of $1/v_i$ are calculated with the Lagrangian velocities for all released particles, including the particles that did not reach the downstream boundary.
- Aperture weighted inverse Lagrangian velocity $1/(b_i v_i)$
  This is the inverse of the Lagrangian velocity times the half-aperture of the crossed element i. The CCDF is calculated with the data from all crossed elements for all released particles, including the particles that did not reach the downstream boundary.
- τ
  This is the advective travel time of a particle in the model, defined as the difference between the time when the particle is released at the upstream boundary and the time when the particle reaches the downstream boundary. Particles that have not reached the downstream boundary are discarded. This parameter is produced automatically by MAFIC.

- β

  The β factor (transport resistance) is important in the Painter *et al.* (1998) analytical solution for solute transport with fracture diffusion and sorption, and the semi-analytical solution for transport with matrix diffusion and sorption. The β factor is calculated for a particle j that reaches the down-stream boundary as:

$$\beta_j = \sum_{i=1}^{n} \frac{l_i}{v_i \cdot b_i} \qquad 2\text{-}1$$

where: l_i is the distance travelled by the particle j in element i

v_i is the Lagrangian velocity of the particle j in element i where a particle is located at a given time.

b_i is the half aperture of element i

3 Base Case model set-up

3.1 Introduction

The Base Case model is set-up to reflect the hydraulic behaviour of a typical Swedish fractured rock mass. Since the results of the present study are to be in accordance with the results of previous analyses, it is useful to set-up a model which properties are similar to the ones of the previous studies.

In the PAWorks 3 project (Outters et al., 2000), the geometric and hydraulic properties of the DFN model was based on the prototype repository and true block scale in the Äspö HRL, Sweden. Since then, the DFN for the prototype repository was updated by Stigsson et al. (2001). Stigsson et al. (2001) carried out an extensive analysis of pump tests allowing a better understanding of the fracture set definition and their hydraulic properties. This is the model that will be used in this study.

3.2 Model size

The size of the model was chosen in the 100m scale. This size was selected based on safety assessment and computation time considerations.

3.3 Monte Carlo simulations

Since the DFN model characteristics are stochastic, the modelling is carried out with Monte Carlo simulations. A total of 20 realisations are carried out for the Base Case and the variation cases.

3.4 Boundary conditions

3.4.1 Hydraulic boundaries

The boundary conditions are defined to obtain a one-directional flow.

The shape of the model is a cube of 100m sides. The flow direction is forced from one vertical face of the model domain to the opposite face by assigning them constant head boundary conditions. The rest of the faces are sealed (no-flow condition). A head gradient of 0.1% (0.1m head variation over a 100m model length) is applied between the two fixed head boundaries.

3.4.2 Conditions of particle release

The particle release area is set to a square centred on the middle of the upstream boundary 50m x 50m. (see Figure 3.4-1 below). The time scale allowed for particles to travel through the whole model is set to 10^{16} s. This is a very long time to allow all released particles to reach the downstream boundary.

Particles are released along the fracture traces at the upstream boundary. The number of particles released in a fracture is proportional to the flux in this fracture.

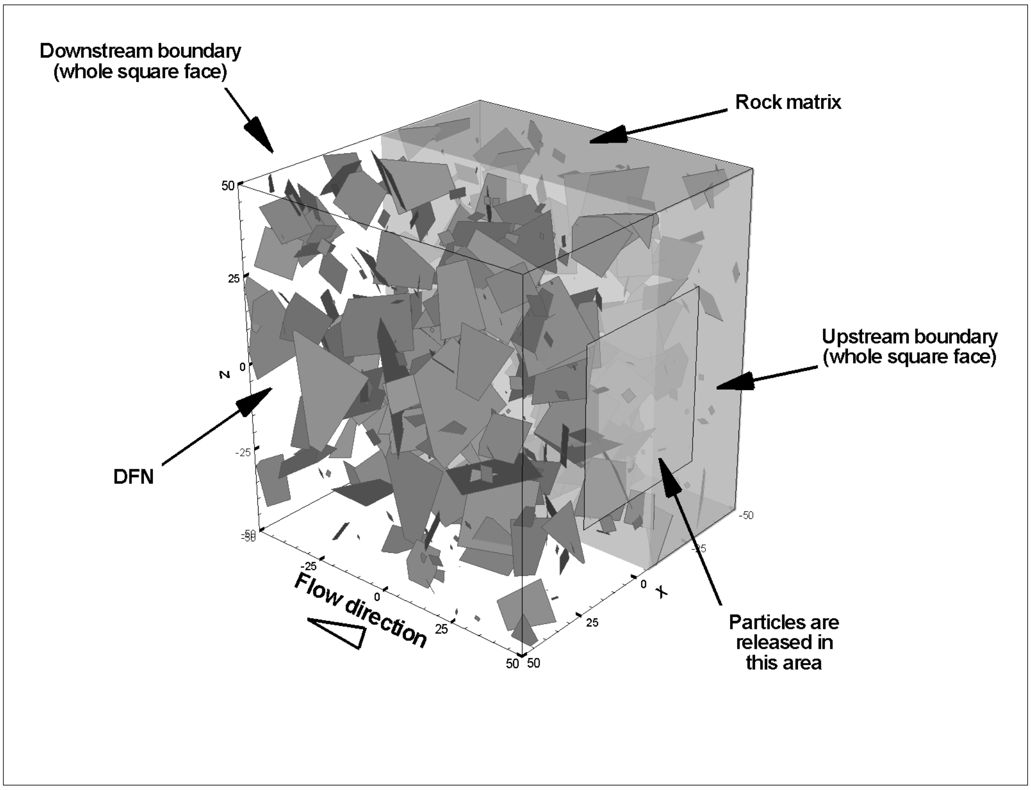

Figure 3.4-1 *Boundary conditions of the model.*

3.5 Dispersion factors α_T and α_L

Particle dispersion is simulated stochastically using orthogonal, normally distributed, lateral and transverse dispersion vectors. The magnitude of the dispersion is defined by the dispersion factors.

The default values of transverse and lateral dispersion factors that are used in the project are:

- α_L (longitudinal) = 1m
- α_T (transverse) = 0.1m

3.6 Summary of DFN parameters

The characteristics of the DFN are presented in the Table 3.6-1 below:

Table 3.6-1 Definition of the DFN

Parameter	***Used data***	***Data from***	***Reference***
Orientation Fisher Distribution	Set / Strike; Dip / Dispersion K 1 / 212.8; 83.7 / 3.96 2 / 126.9; 86.8 / 10.53 3 / 17.9; 7.5 / 9.32	Pilot and Exploratory holes.	Prototype Repository DFN Model 2
Size (radius[m]), lognormal distribution	Set / Mean / Std dev 1 / 2 / 2 2 / 8 / 2 3 / 5 / 4	TBM tunnel.	Lapointe TR95-15
Spatial model	BART model (fracture termination probability of 37 %).	TBM tunnel.	SKB R-99-43, p. 32 SKB ICR-96-05
Natural Fracture intensity P_{32n}	Set / P_{32c} 1 / 0.26 2 / 0.85 3 / 0.18	From 1m and 3m section pump tests in exploratory holes.	Prototype Repository DFN model 2(+)
Transmissivity distribution $log_{10}(T)$ Not correlated with size	Set / Mean / Std dev 1,2,3 / -8.2 Arithm: 1.173e-7 / 1.05 Arithm: 2.177e-6	Deterministic + background fractures	TBS
Transport Aperture	Doe law (0.5 $T^{½}$)	This project.	SKB R-99-43, p. 32 SKB ICR-94-09
Model size	100m x 100m x 100m	This project.	This project.
Centre point co-ordinates	North = 0 m East = 0 m Up = 0 m	This project.	This project.
Flow boundary conditions	See figure 3.4-1	This project.	This project.
Transport boundary conditions	Flux-weighted injection on the upstream boundary face. See figure 3.4-1	This project.	This project.
Dispersion coefficients	α_L=1m α_T=0.1m	This project.	This project.

4 Variant Cases

4.1 Introduction

The sensitivity of the output parameters to the model configuration is tested with variants of the Base Case model. The variants consider the following model parameters:

- Pathway analysis methodology
- fracture intensity
- in-plane fracture transmissivity heterogeneity
- alternative pathway intersection mixing
- alternative computations of fracture aperture

4.2 Case Definitions

4.2.1 Case 1: Comparison against PAWorks solution

Case 1 presents the comparison of the MAFIC pathway solution against pathway analysis solutions from the channel network (CN) code PAWorks.

In the MAFIC flow solution, as used in the Base Case, the DFN is discretized in a 3D FEM mesh. Each fracture keeps its three dimensional structure. Fluid flow is possible in the whole fracture plane.

In the PAWorks approach the DFN is first discretized into one-dimensional elements (pipe elements). The boundary conditions are the same as for the Base Case. A steady state flow solution in the pipe network is computed with MAFIC (using the option of one-dimensional flow). However, there are no particles released in the model. Instead of that, the pathways are determined by an analysis of the MAFIC flow solution with the pathway search algorithm feature in PAWorks. This methodology allows a more detailed definition of the pathway characteristics.

In the present project, the pathway definition is based on the search of pipes with the highest flux possible. This means that at any branching in the pipe network, only the pipe with the highest flux is selected to be part of the pathway; all branching pipes with lower flux are discarded.

4.2.2 Case 2: Heterogeneous transmissivity in fracture planes

In Case 2, each fracture of the DFN is treated as heterogeneous and assigned a stochastic distribution of transmissivity values. The resolution of the heterogeneity of a fracture is a direct function of the triangular element discretisation of this fracture. This triangular mesh is used in the FE solution of flow and transport. The discretisation level is defined in Case 2 to reach a realistic pattern of transmissivities within the fracture. On the other hand, the number of element in the fractures is limited by computing capacities as explained above.

The generation of the stochastic transmissivity pattern is achieved by:

- Generating a DFN model which P_{32} is 50% of the P_{32} of the Base Case P_{32}
- Tuning the maximum size of the fracture elements so that the maximum number of elements per DFN realisation is reached

This ensures an optimal discretisation of the DFN models (see Figure 4.2-1 below)

An element area of $5m^2$ was used in this case since it corresponds to a total number of triangular fracture elements of about 1.5 million. A finer discretisation of the model would produce a total number of elements for the whole model above the computing capacity.

A stochastic continuum field is generated on each fracture plane. This field is set consistent with:

- the spatial location of known transmissivity (three locations)
- a spatial correlation structure, i.e a fractal dimension of 4 in our case

The transmissivity statistical distribution is kept the same as in the Base Case.

The transmissivity-aperture relationship follows the Doe law as in the Base Case.

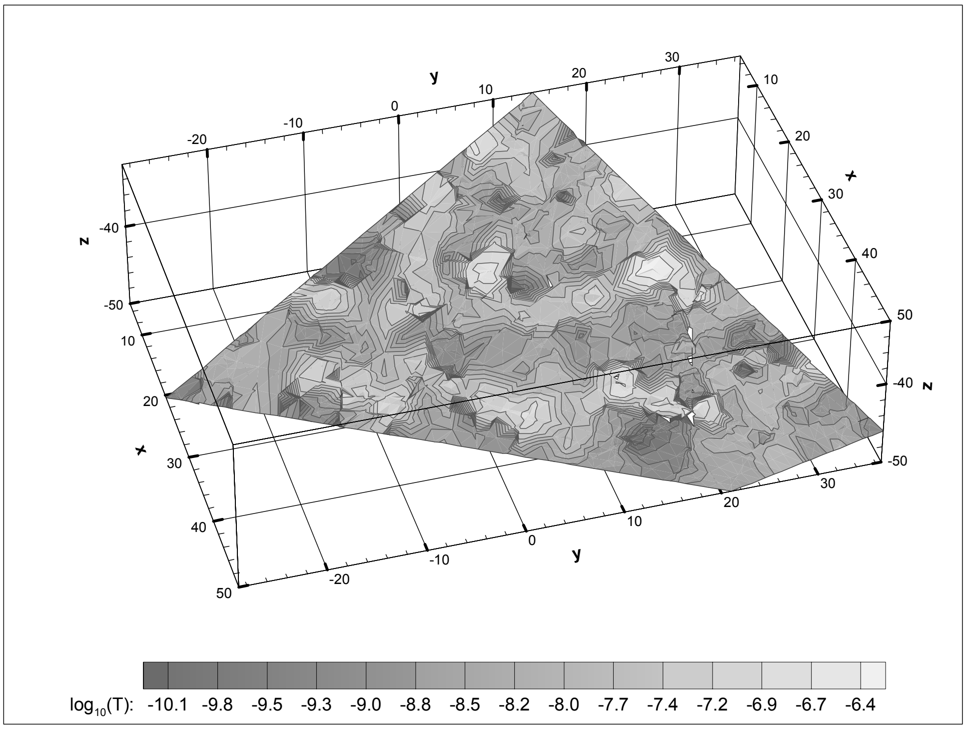

Figure 4.2-1 *Stochastic distribution of transmissivity in a fracture plane.*

4.2.3 Case 4: Alternative fracture intensity P_{32}

Case 4 presents the influence of alternative fracture intensity P_{32} on the transport pathway properties. Two cases were studied:

- Case 4a: 10% of the P_{32} of the Base Case.
- Case 4b: 50% of the P_{32} of the Base Case.

The understanding of the influence of the fracture intensity on the results is important because there is presumably a fracture intensity sufficiently high that the rock mass behaviour converges to that of an equivalent continuum.

A regular fracture meshing for the Base Case gives a number of elements of about 1.5 million for the original P_{32}. For the same fracture intensity, a refined meshing of the fractures would increase the number of elements to a value above the computational possible limit.

4.2.4 Case 5: Streamline routing of particles

Case 5 addressed the issue of mixing at intersections. MAFIC and PAWorks assume 100% mixing at intersections, and the results from the Base Case and Cases 1 through 4 reflect that assumption.

The characteristics and the boundary conditions in Case 5 are the same as in the Base Case. The only difference with the Base Case is that Case 5 will use a revised particle tracking algorithm that supports streamline routing such that there is no mixing at intersections.

Results from Case 5 can be compared directly against the Base Case.

4.2.5 Case 7: Alternative computations of fracture aperture

The fracture transmissivity T in the Base Case follows the Doe law, which makes T a quadratic function of the fracture aperture. Case 7 presents two alternative methods of computation of the fracture aperture that are the following:

- Case 7a: The fracture aperture will be derived from the fracture transmissivity using the cubic law:

$$b=0.01.T^{1/3} \quad \text{4-1}$$

- Case7b: The fracture aperture will be derived from the fracture transmissivity using a linear relationship. A satisfactory linear relationship between transmissivity and aperture could only be established within a range of transmissivity T [10^{-9}; 10^{-5}]. This relationship is:

$$b=142.T \quad \text{4-2}$$

5 Results

5.1 Base Case

5.1.1 Introduction

A total of 20 realisations were carried out. A target number of particles to be released in each model is set to 1000. Since the flow conditions at the particle release area slightly vary from one realisation to another, the released number of particles also varies around 1000.

The time conditions are set up so that even slow particles can reach the downstream boundary and exit the system. Still some particles can remain stuck in the FE mesh due to the FE solution, which assures a continuous head field but not a continuous flow filed at all locations.

Particle pathways are illustrated in Figure 5.1-1 and Figure 5.1-2. Figure 5.1-1 below shows a three dimensional view of the particle pathway in one model of the Base Case. The colour of the pathway sections illustrates the time of the position of the particles. Note that the particles are positioned along lines in the particle release area. These are the intersections of fractures with the upstream boundary.

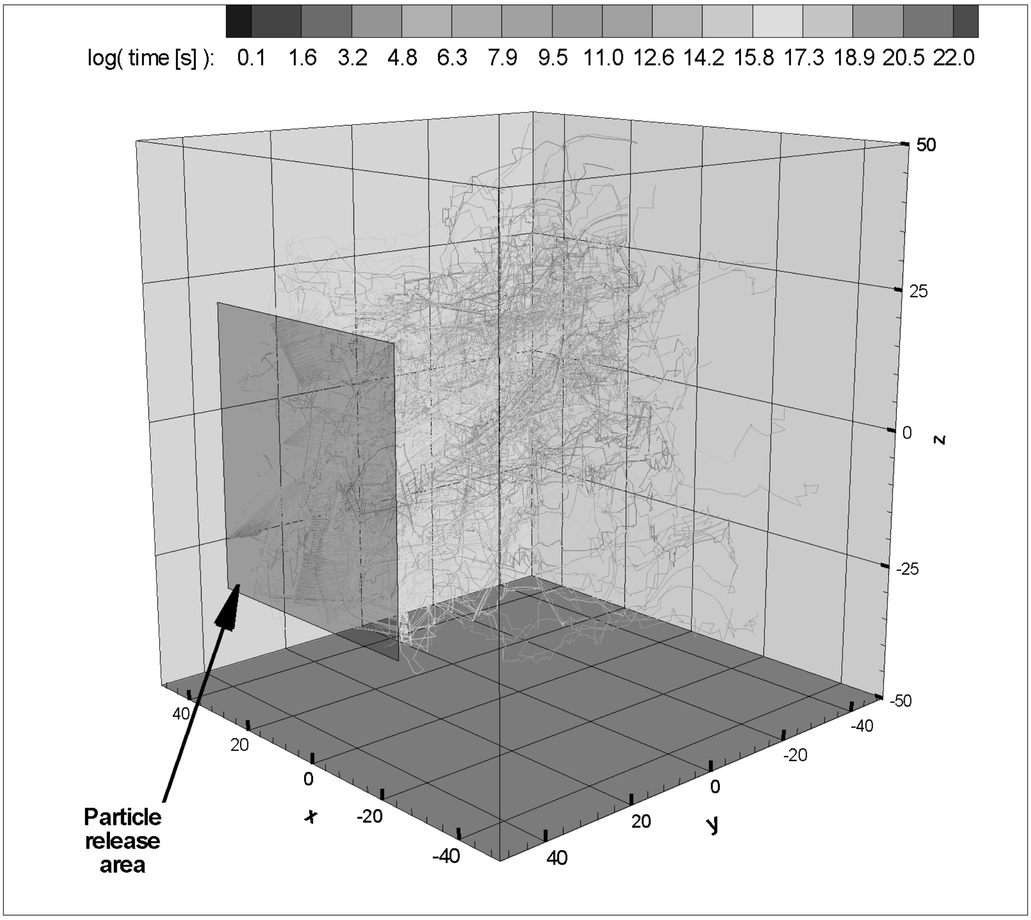

Figure 5.1-1 *Three dimensional view of the particle pathway in one model of the Base Case.*

Figure 5.1-2 below shows a top view of the particle pathway in one model of the Base Case. The colour of the pathway sections illustrates the time of the position of the particles. Note the tendency of all particles to drift towards the x-direction when getting closer to the downstream boundary. This is a typical effect of the anisotropic flow conditions due to a preferred orientation of one of the sub-vertical fracture sets.

An overall drift of the particles in the vertical plane has not been observed.

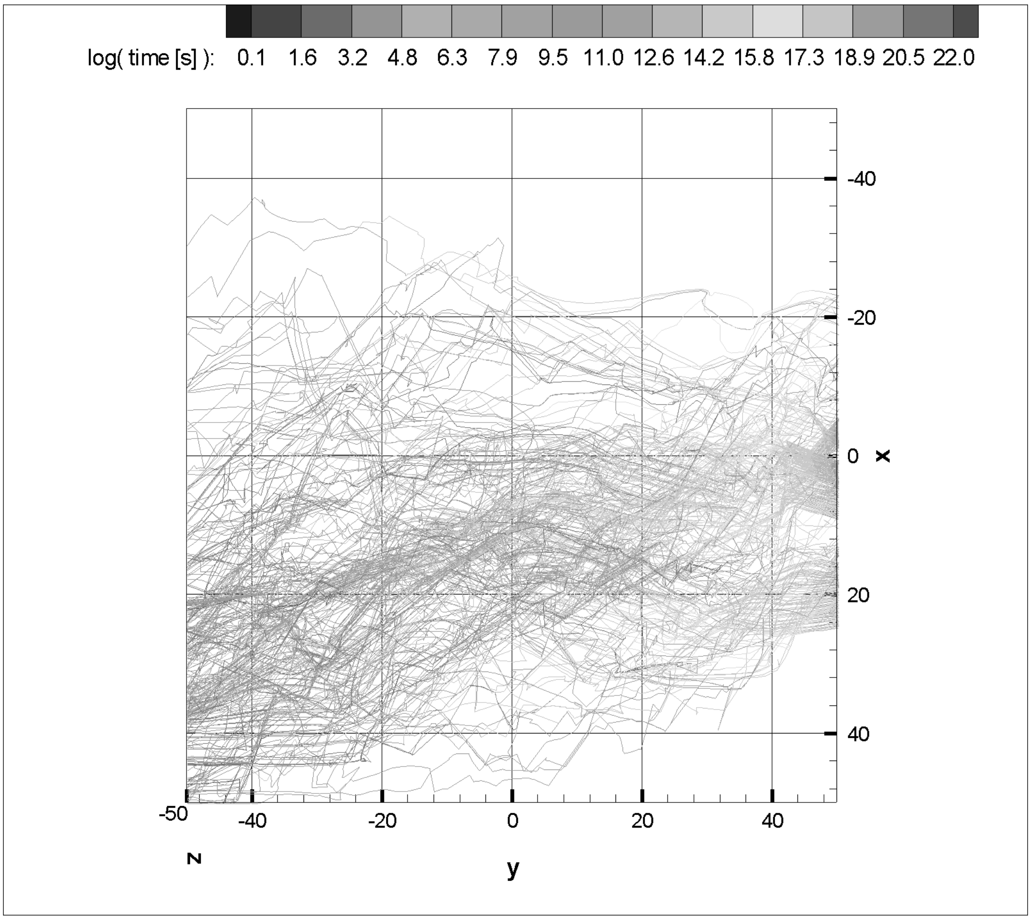

Figure 5.1-2 *Top view of the particle pathway in one realization of the Base Case*

Figure 5.1-3 below shows a typical particle pathway in one realization of the base case. The colour of the contours in the fracture planes illustrates the fluid pressure expressed in head along the pathway. Note that the pathway direction is not linear within the fractures. This is caused by the pressure potential within fractures being not constant.

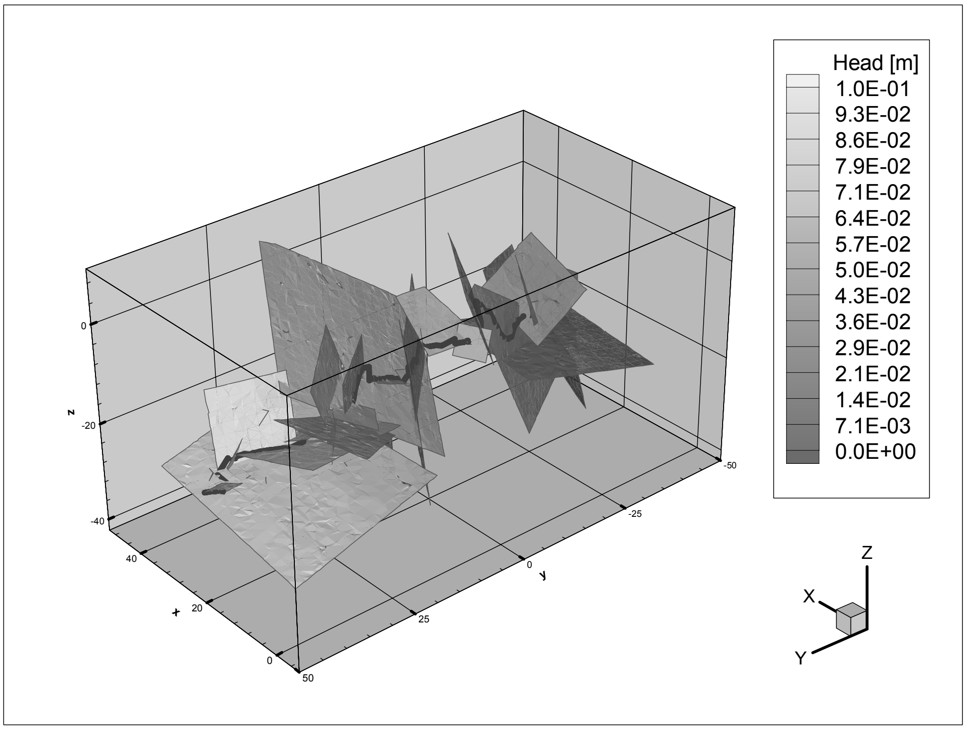

Figure 5.1-3 *A particle pathway and the fractures where the particle travels.*

5.1.2 Lagrangian results

The Lagrangian (local co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

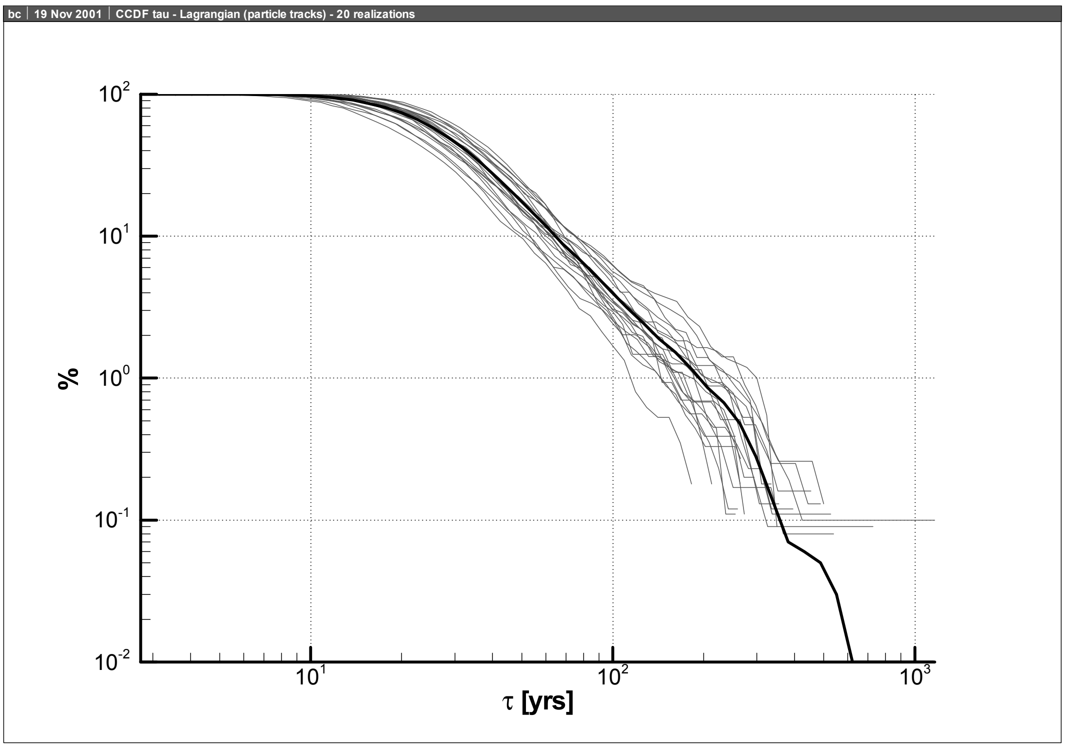

Figure 5.1-1 *CCDFs of τ in years for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

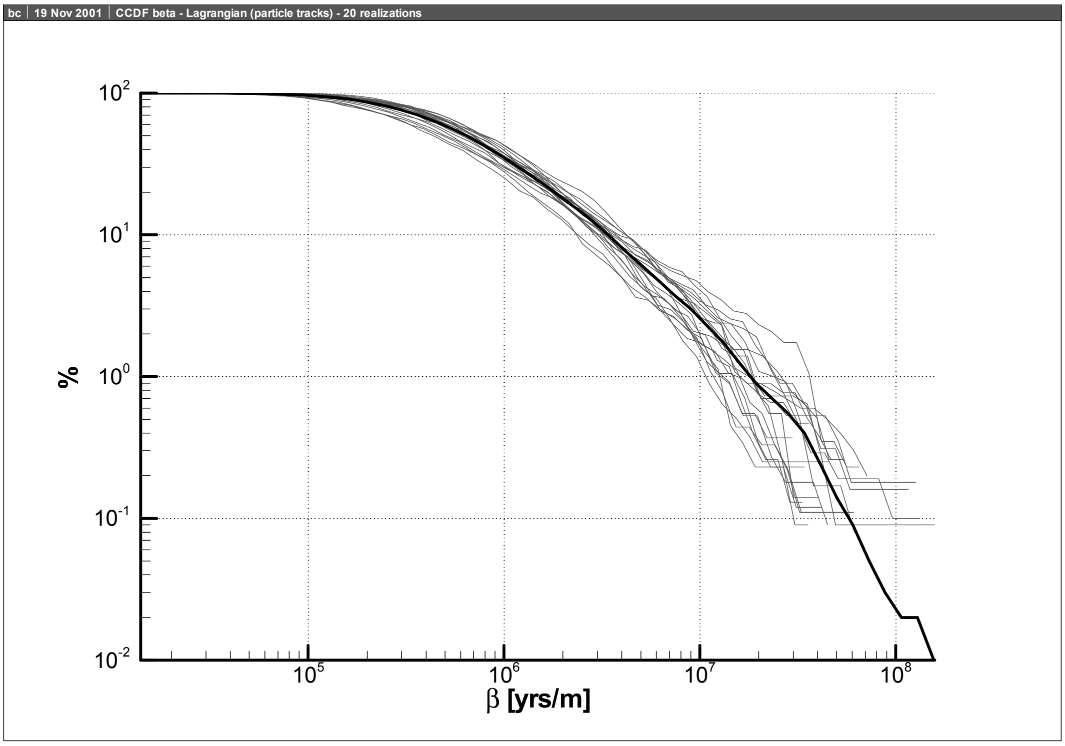

Figure 5.1-2 *CCDFs of β in years/m for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

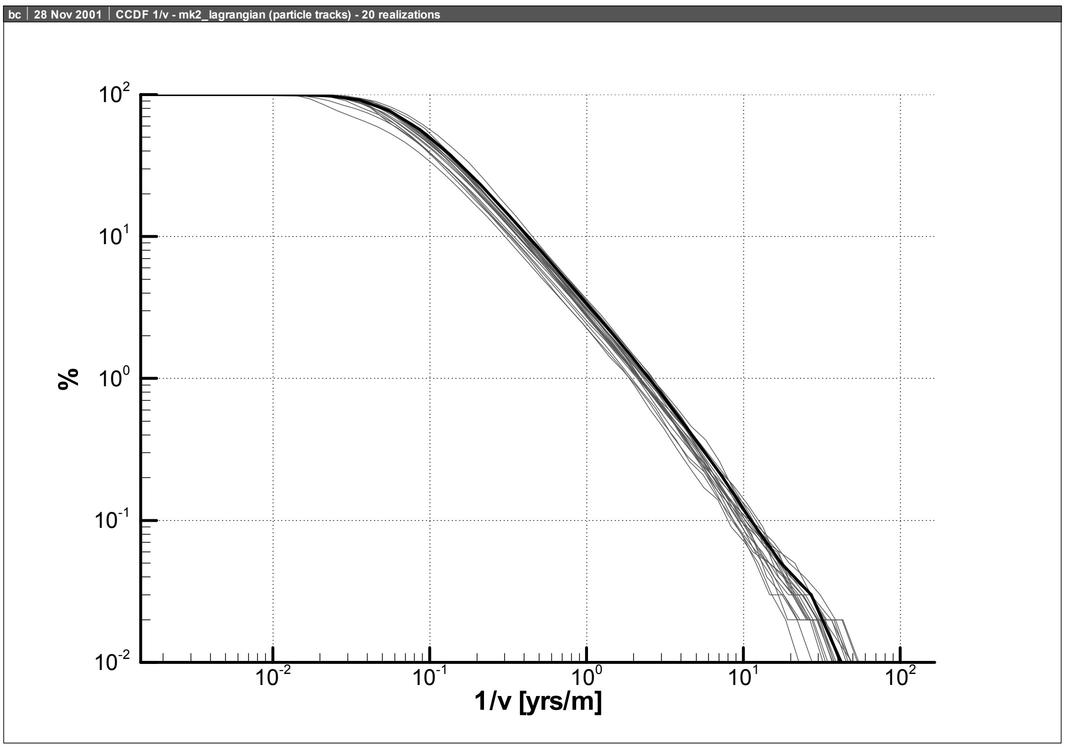

Figure 5.1-3 CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.

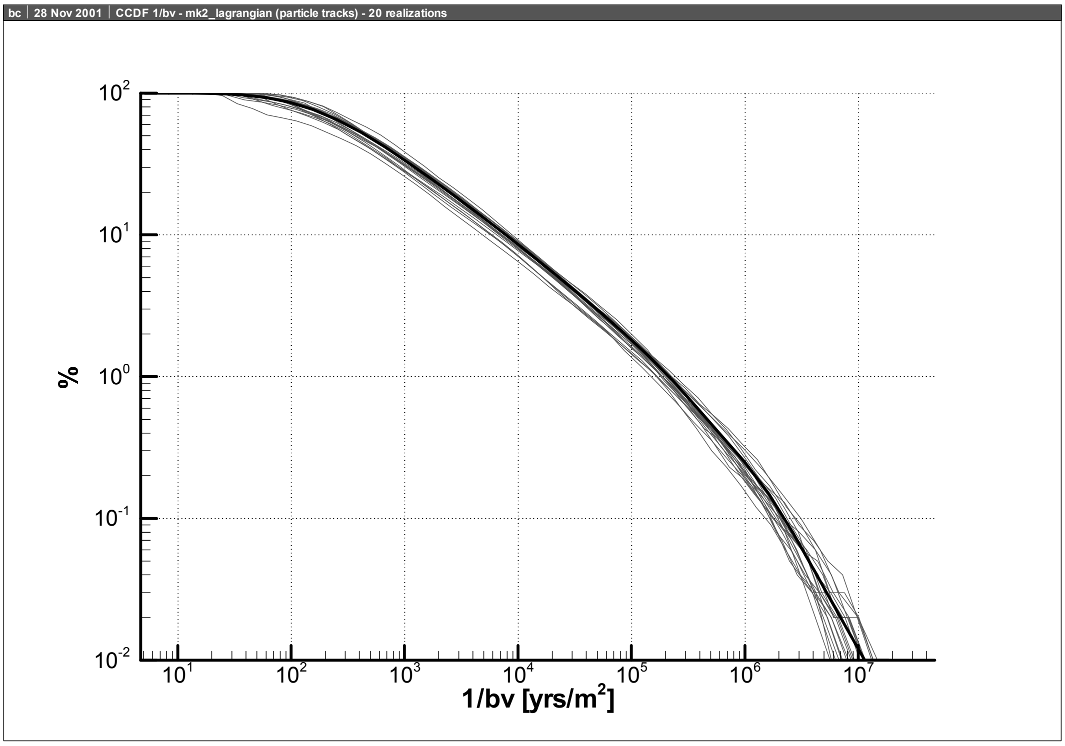

Figure 5.1-4 CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.

5.1.3 Eulerian results

The Eulerian (world co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

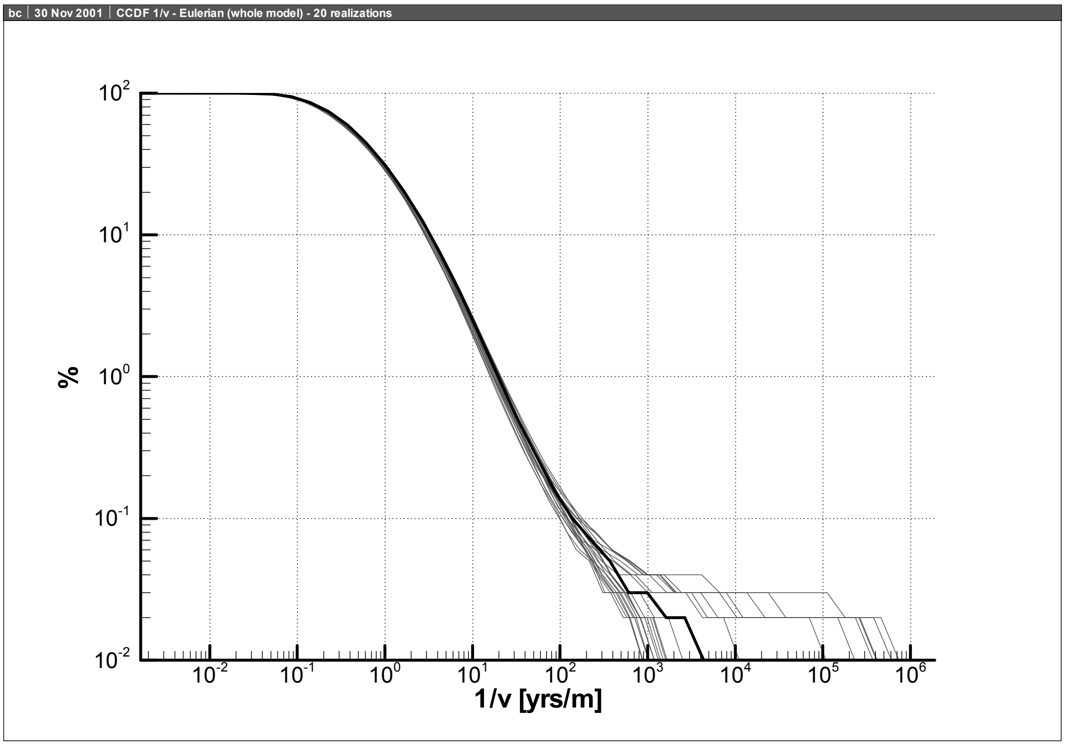

Figure 5.1-1 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/v from Lagrangian and Eulerian results shows that the Eulerian velocity can be lower than the Lagrangian velocity by several order of magnitude.

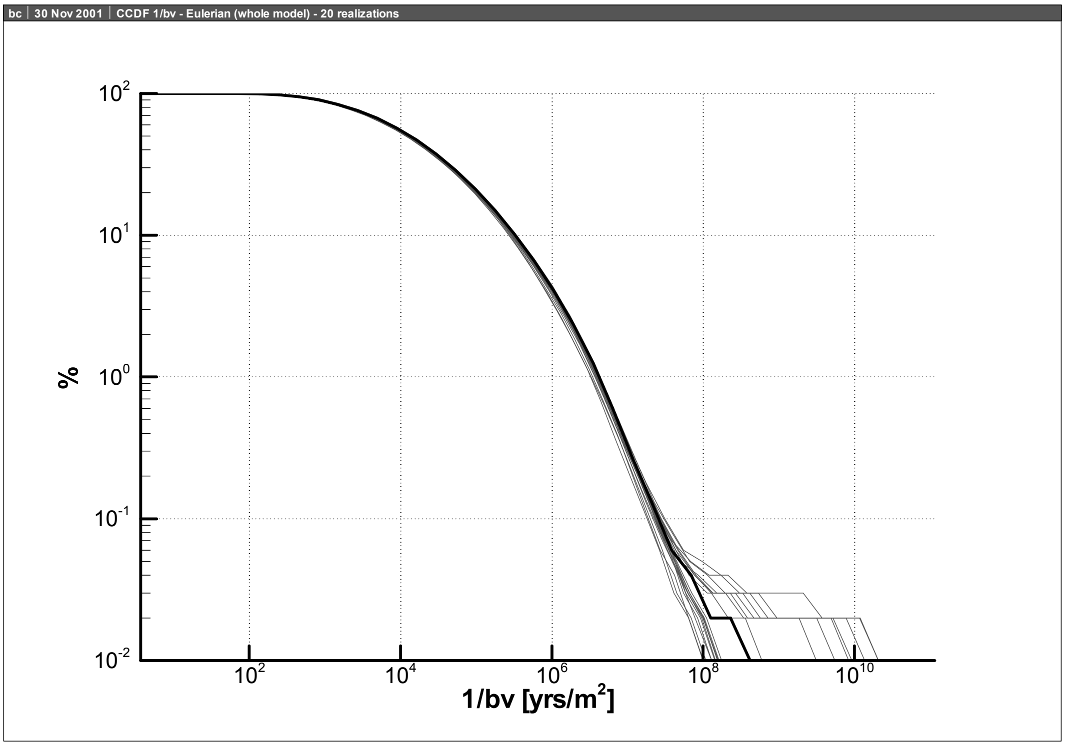

Figure 5.1-2 *CCDFs of 1/bv in years/m² for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/bv from Lagrangian and Eulerian results shows that the Eulerian 1/bv ratio can be higher than the Lagrangian 1/bv ratio by several order of magnitude.

5.2 Case 1a: Base Case with pathway analysis

5.2.1 Introduction

A total of 20 realisations were carried out. The PAWorks phase is set up to search 10 different pathways. This limited number of pathways compared to the 1000 particles released in the Base Case is due to the computing time it takes to search the pathways with PAWorks. The research of 10 different pathways produced relevant data within the time frame of this project.

5.2.2 Lagrangian results

The analysis of the Lagrangian results for travel time and the transport resistance factor are based on 200 values (20 realisations, 10 pathways per realisations). This explains the high dispersion that can be observed in Figure 5.2-1 and Figure 5.2-2. This effect is somewhat softened in Figure 5.2-3 and Figure 5.2-4 but still present.

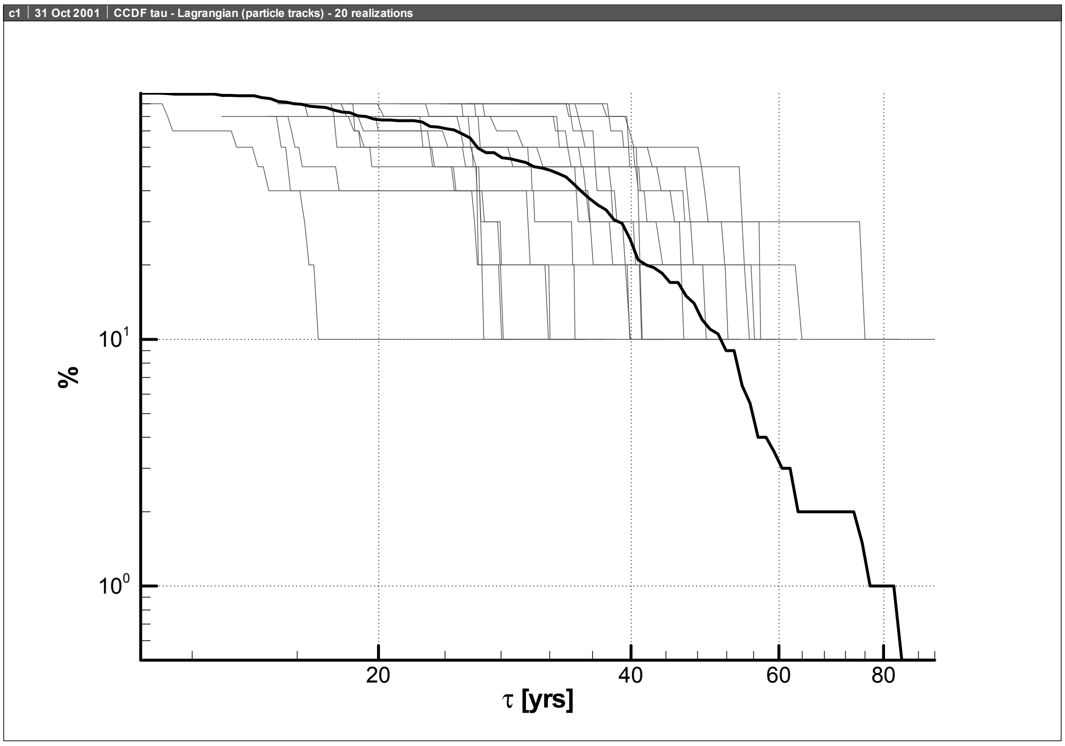

Figure 5.2-1 *CCDFs of τ in years. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

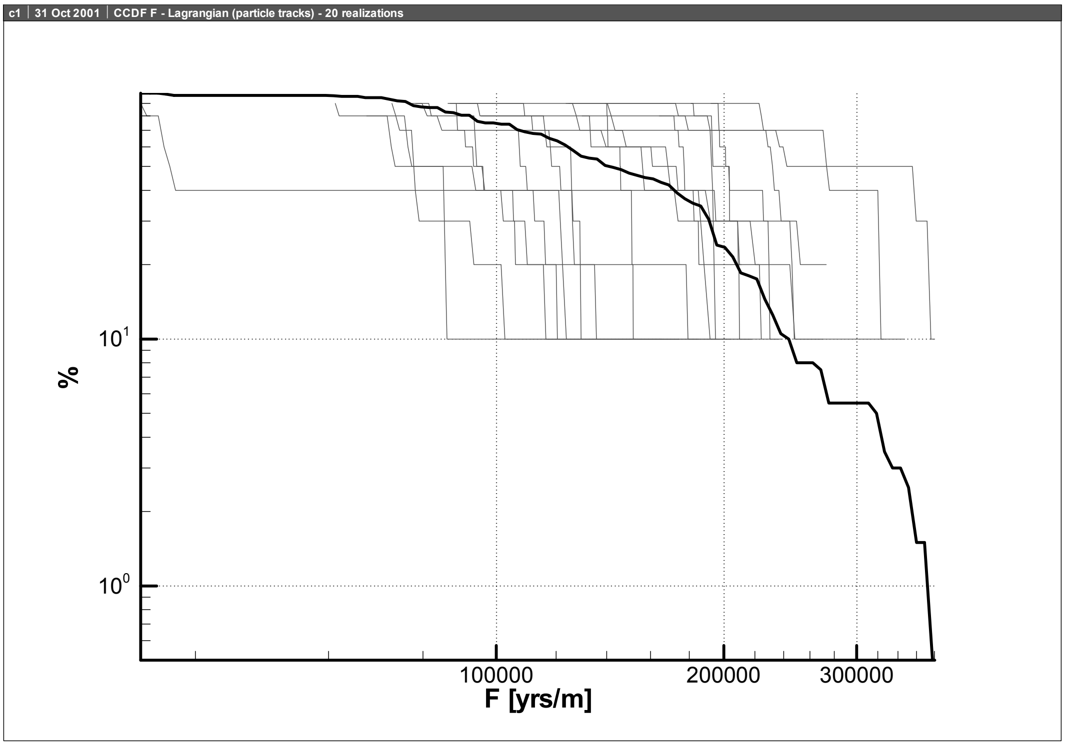

Figure 5.2-2 *CCDFs of β in years/m. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

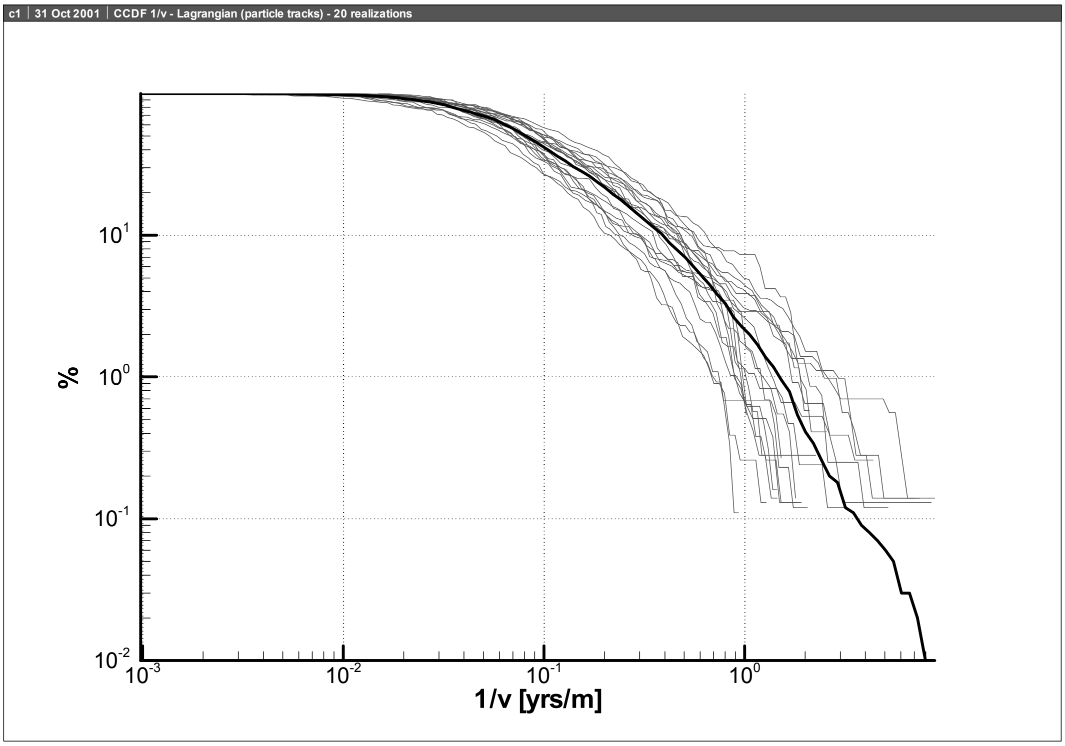

Figure 5.2-3 *CCDFs of 1/v in years/m for all pathways. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

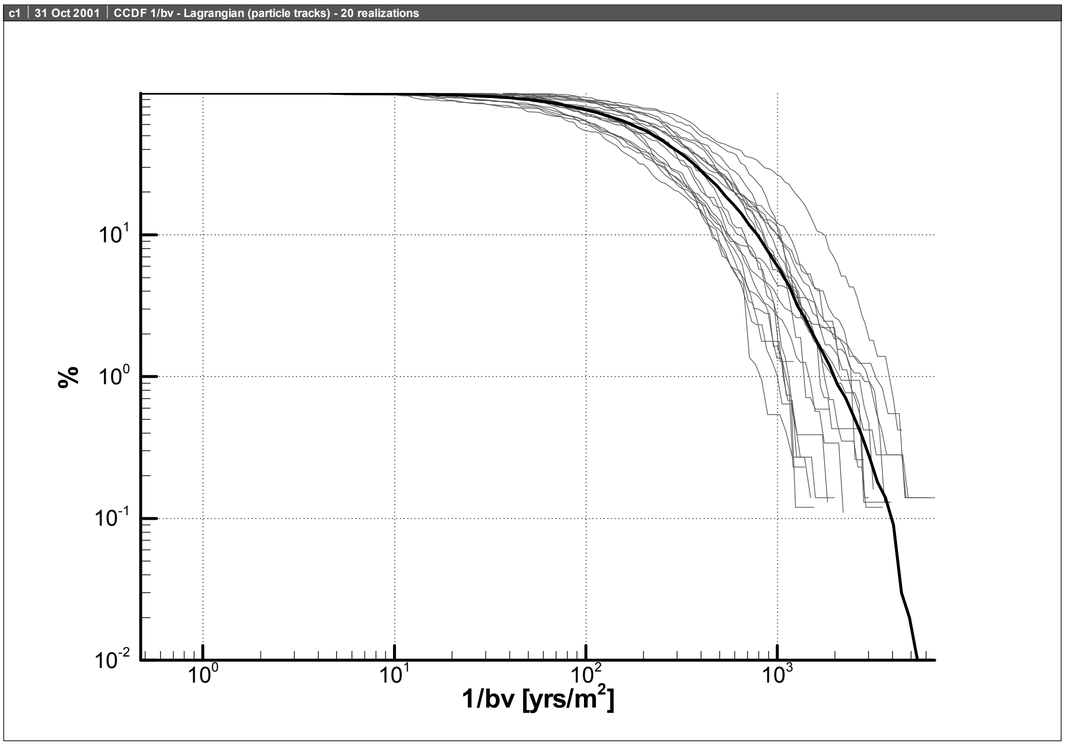

Figure 5.2-4 *CCDFs of 1/bv in years/m^2 for all pathways. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

5.3 Case 2: Heterogeneous Transmissivity on Fracture Plane

5.3.1 Introduction

A total of 20 realisations were carried out. A target number of particles to be released in each model is set to 500 but varies from realisation to realisation depending on the total inflow through the boundary.

The time conditions are set up so that even slow particles can reach the downstream boundary and exit the system.

5.3.2 Lagrangian results

The Lagrangian (local co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

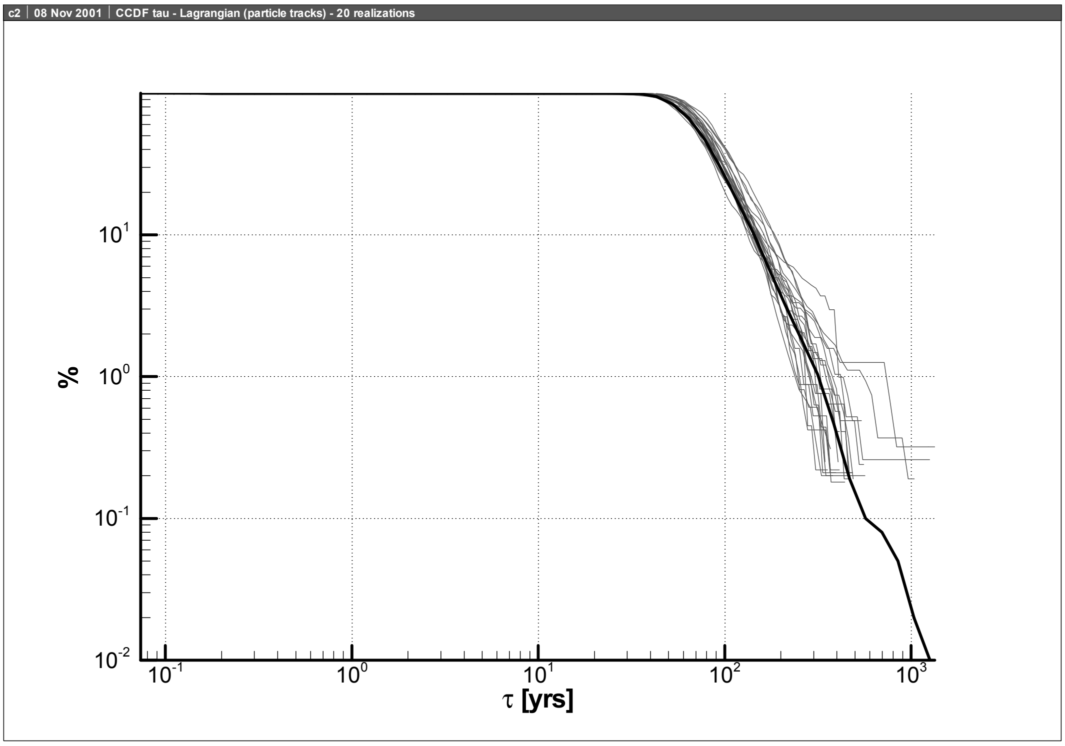

Figure 5.3-1 *CCDFs of τ in years for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

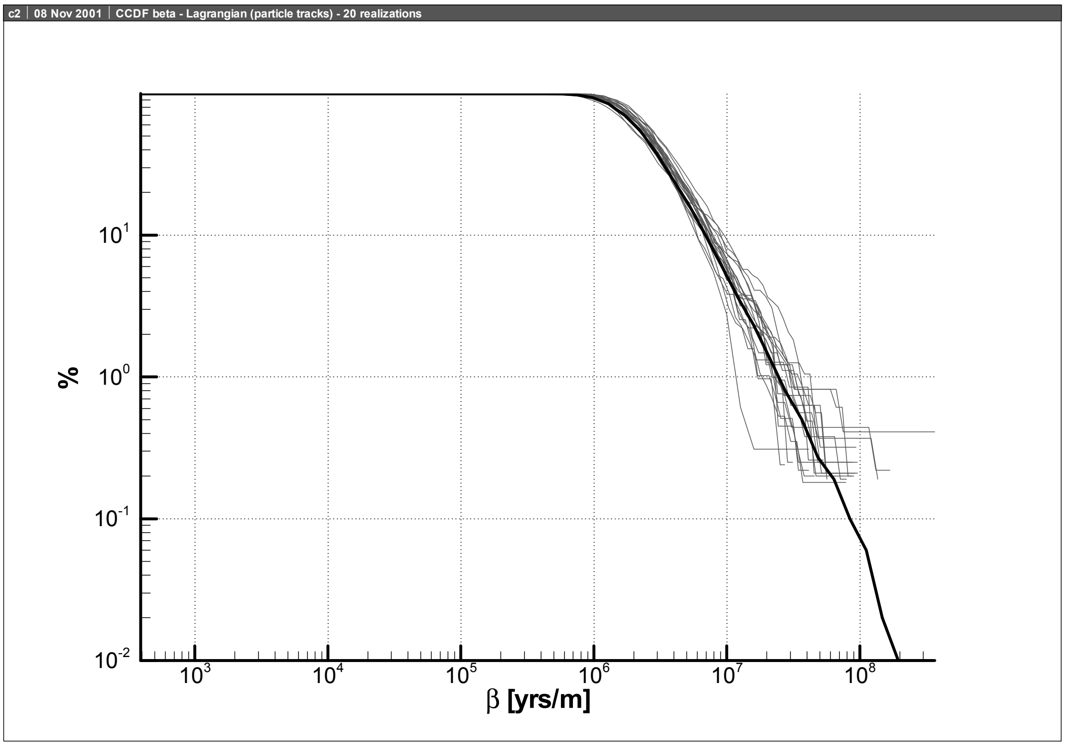

Figure 5.3-2 *CCDFs of β in years/m for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

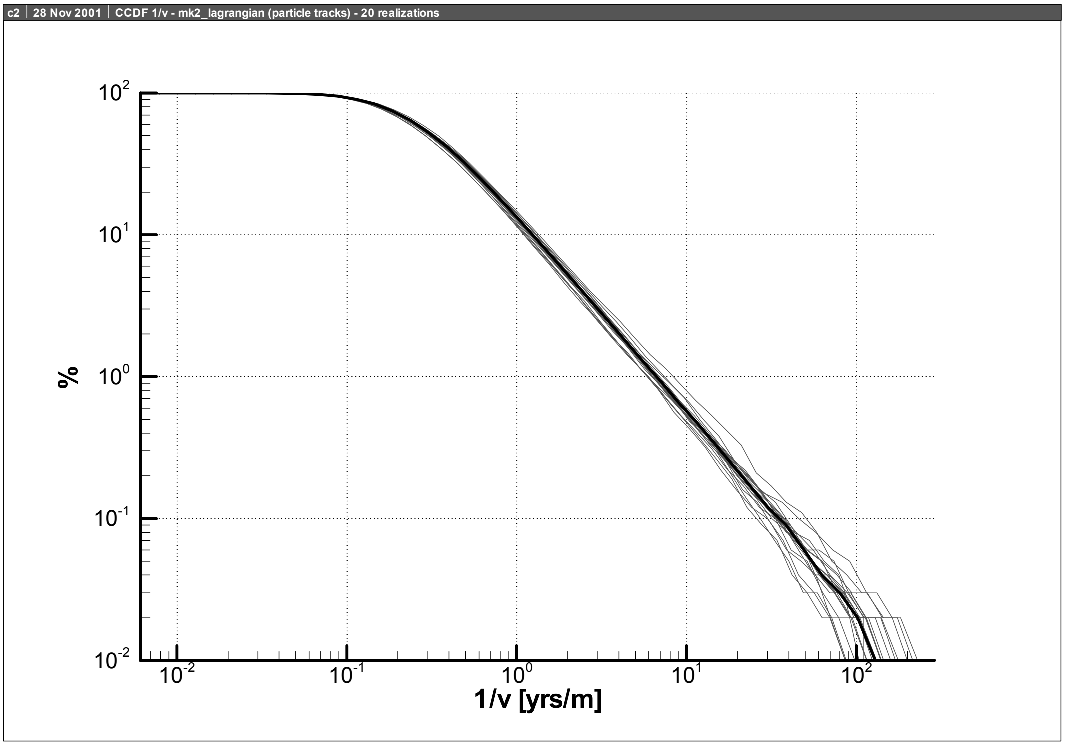

Figure 5.3-3 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

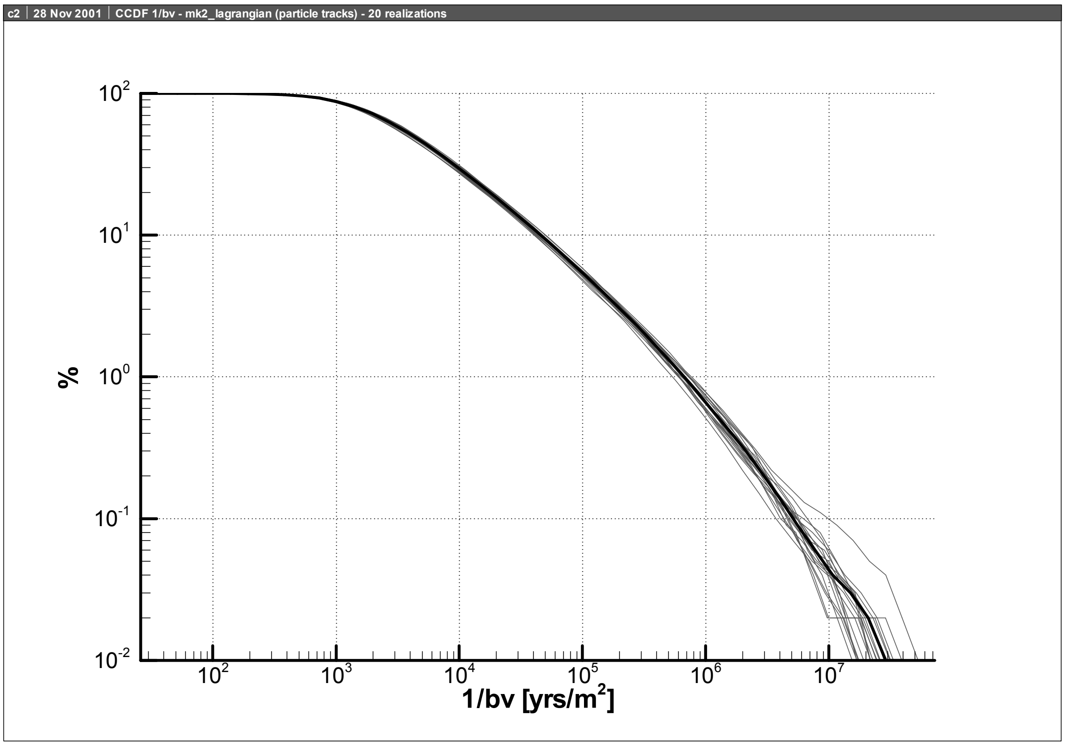

Figure 5.3-4 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

The two figures above show a low dispersion of the measured data between realisations.

5.3.3 Eulerian results

The Eulerian (world co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

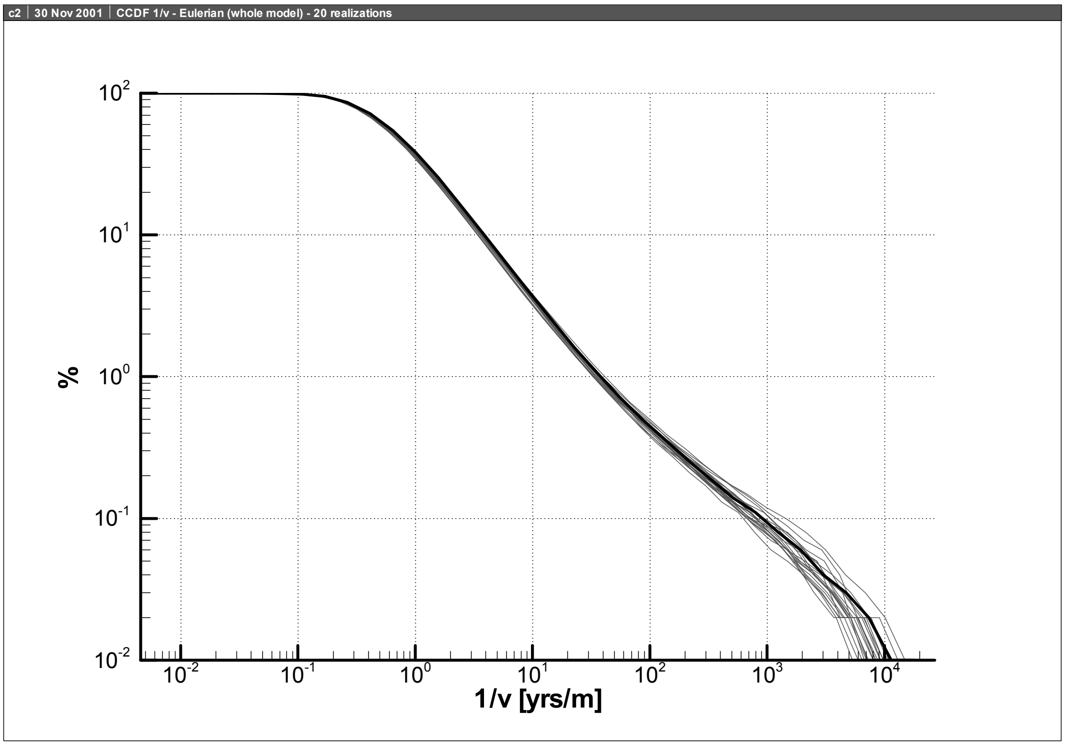

Figure 5.3-1 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

Figure 5.3-1 shows a low dispersion of 1/v between realisations.

A comparison between the CCDFs of 1/v from Lagrangian and Eulerian results shows that the Eulerian velocity can be slower than the Lagrangian velocity by several order of magnitude.

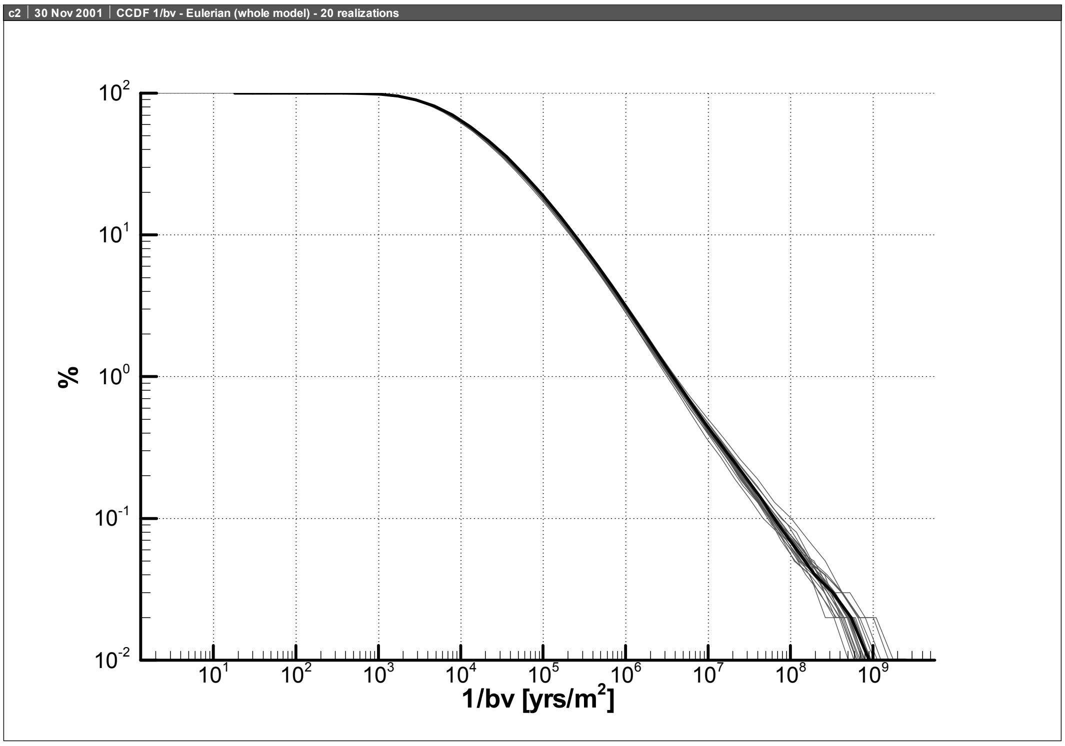

Figure 5.3-2 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/bv from Lagrangian and Eulerian results shows that the Eulerian 1/bv ratio can be higher than the Lagrangian 1/bv ratio by several order of magnitude.

5.4 Case 4a: Alternative Fracture Intensity 10% P_{32}

5.4.1 Introduction

A total of 20 realisations were carried out. A target number of particles to be released in each model is set to 500 but varies from realisation to realisation depending on the total inflow through the boundary.

The large variation of the flow conditions at the particle release area can be explained by the low fracture intensity which was used in Case 4a. It results in a decrease in the number of pathways connected from the upstream boundary. The limited number of pathways amplifies the effect of variability between individual pathways.

5.4.2 Lagrangian results

The Lagrangian (local co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

The small number of released particles in some realisations and the high variation in the flow conditions explain the high dispersion that can be observed in Figure 5.4-1 and

Figure 5.4-2. This effect is somewhat softened in Figure 5.4-3 and Figure 5.4-4 but still present.

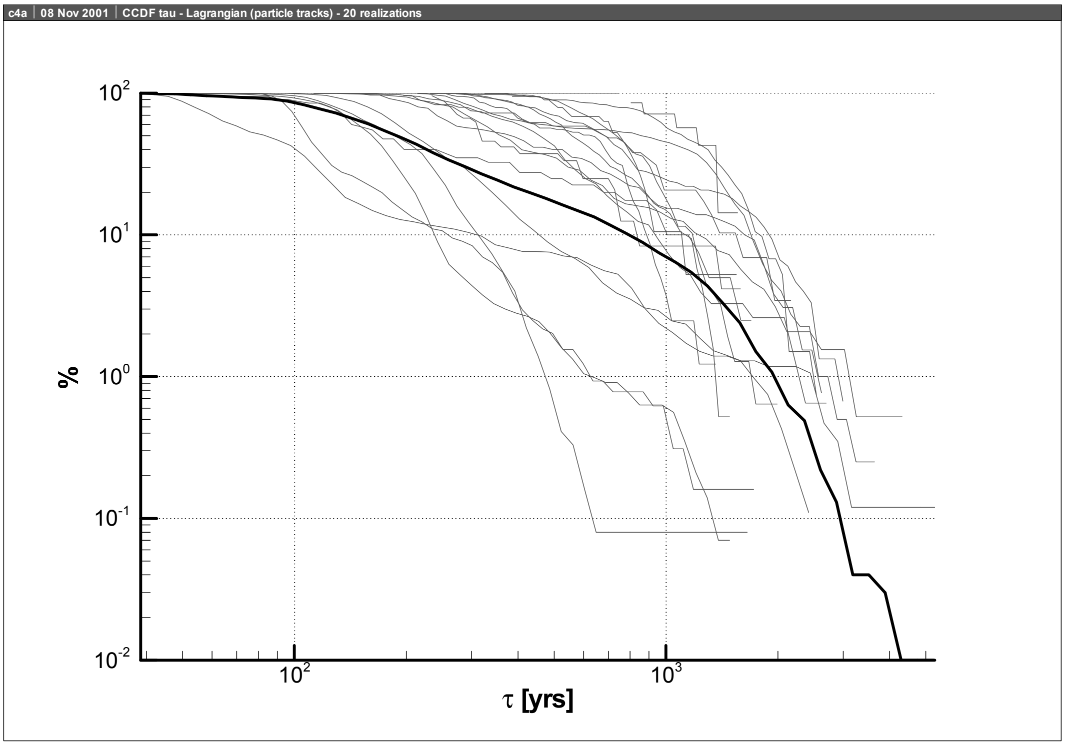

Figure 5.4-1 *CCDFs of τ in years for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

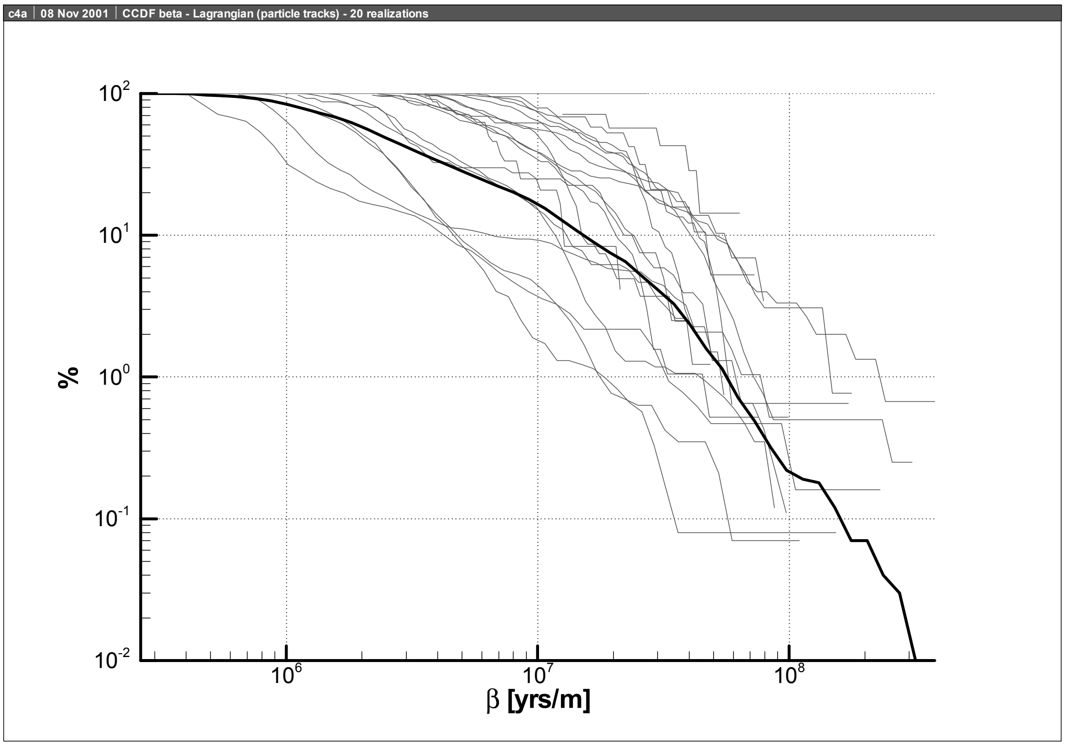

Figure 5.4-2 *CCDFs of β in years/m for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

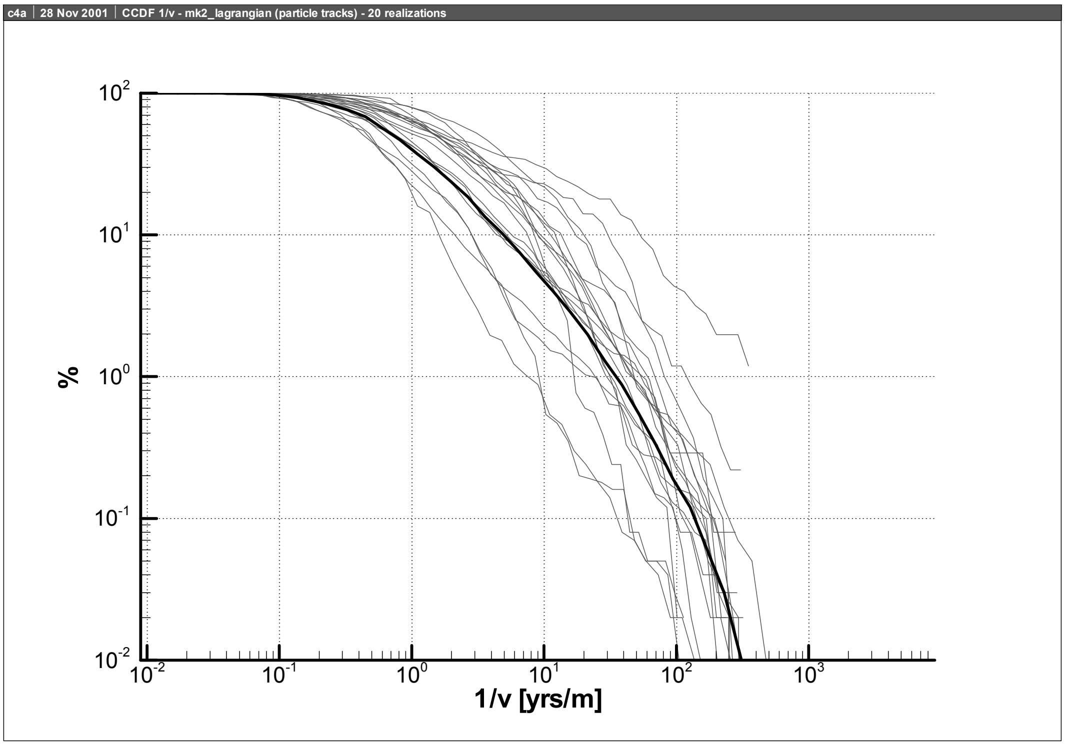

Figure 5.4-3 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

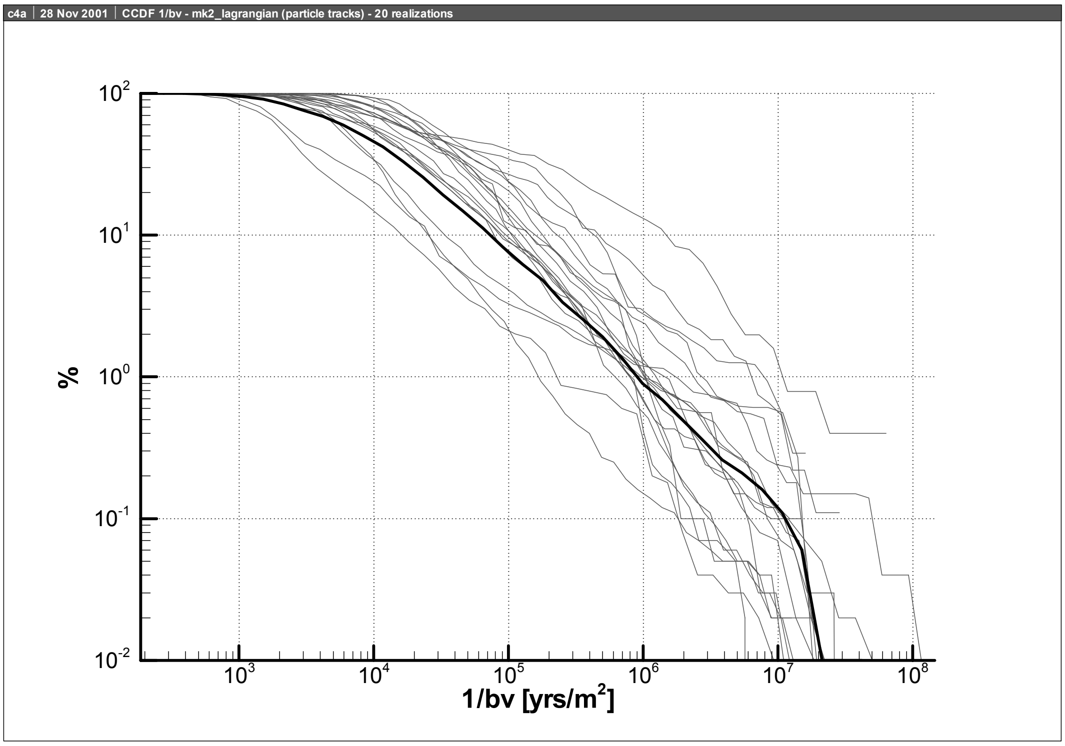

Figure 5.4-4 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

5.4.3 Eulerian results

The Eulerian (world co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

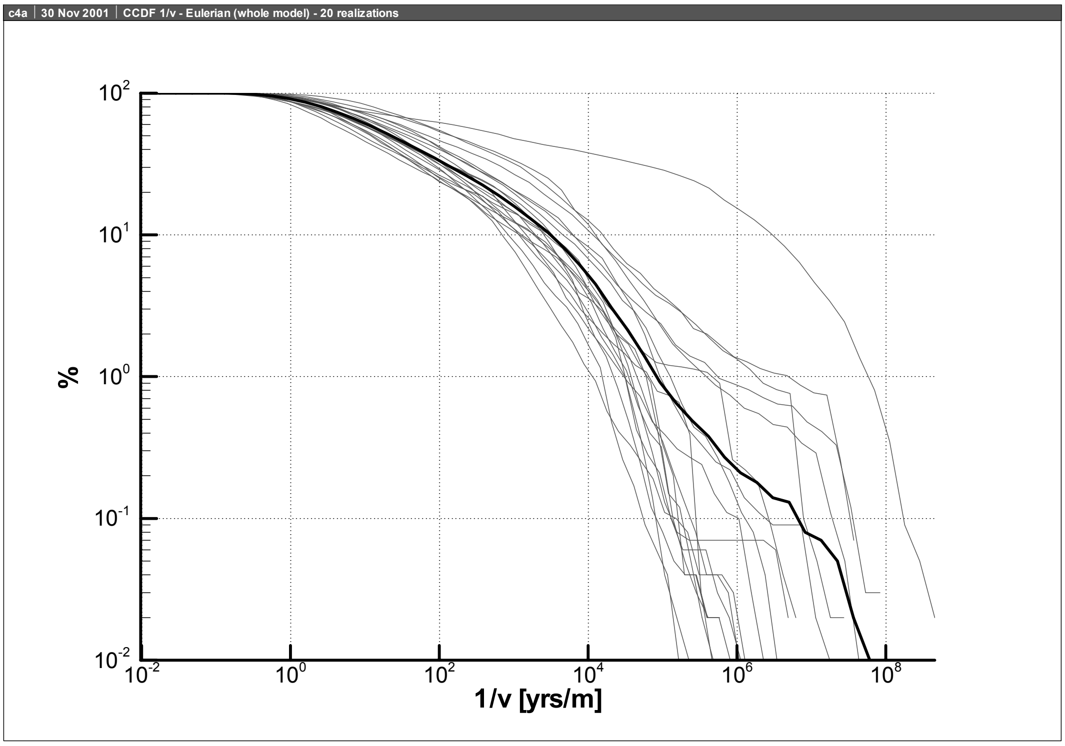

Figure 5.4-1 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

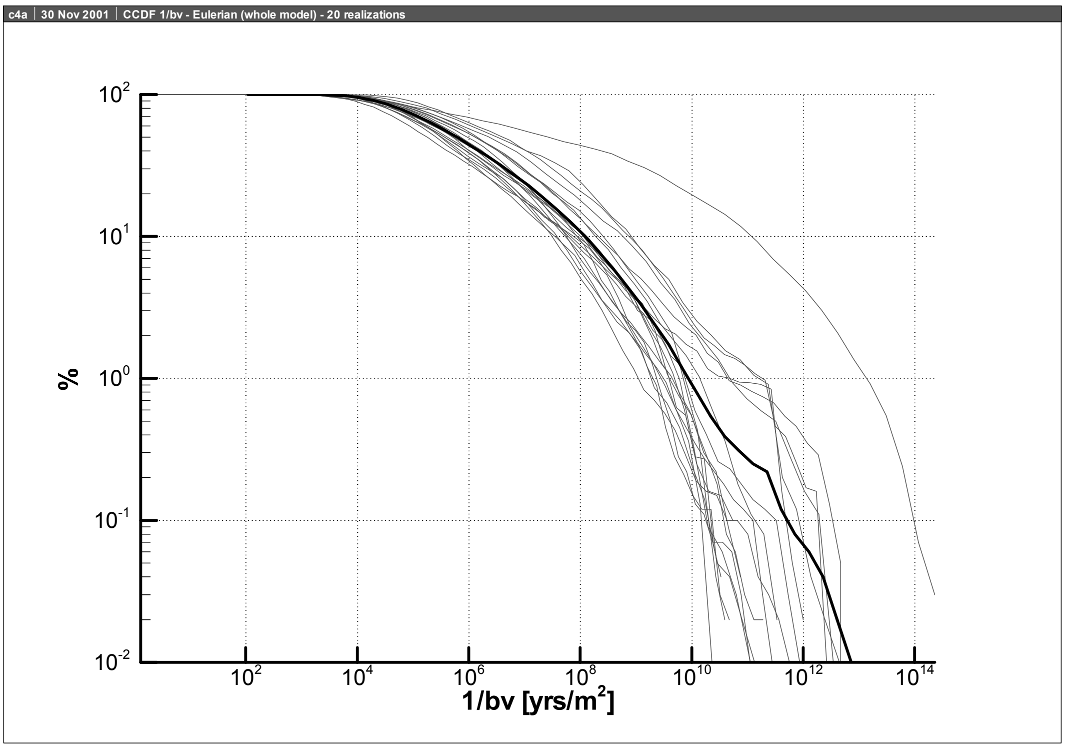

Figure 5.4-2 *CCDFs of 1/bv in years/m² for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

5.5 Case 4b: Alternative Fracture Intensity 50% P_{32}

5.5.1 Introduction

A total of 20 realisations were carried out. A target number of particles to be released in each model is set to 500.

The fracture intensity of Case 4b is five times larger than in Case 4a. This increases significantly the number of connected pathways across the model. The 20 realisations have a similar fracture connectivity.

5.5.2 Lagrangian results

The Lagrangian (local co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

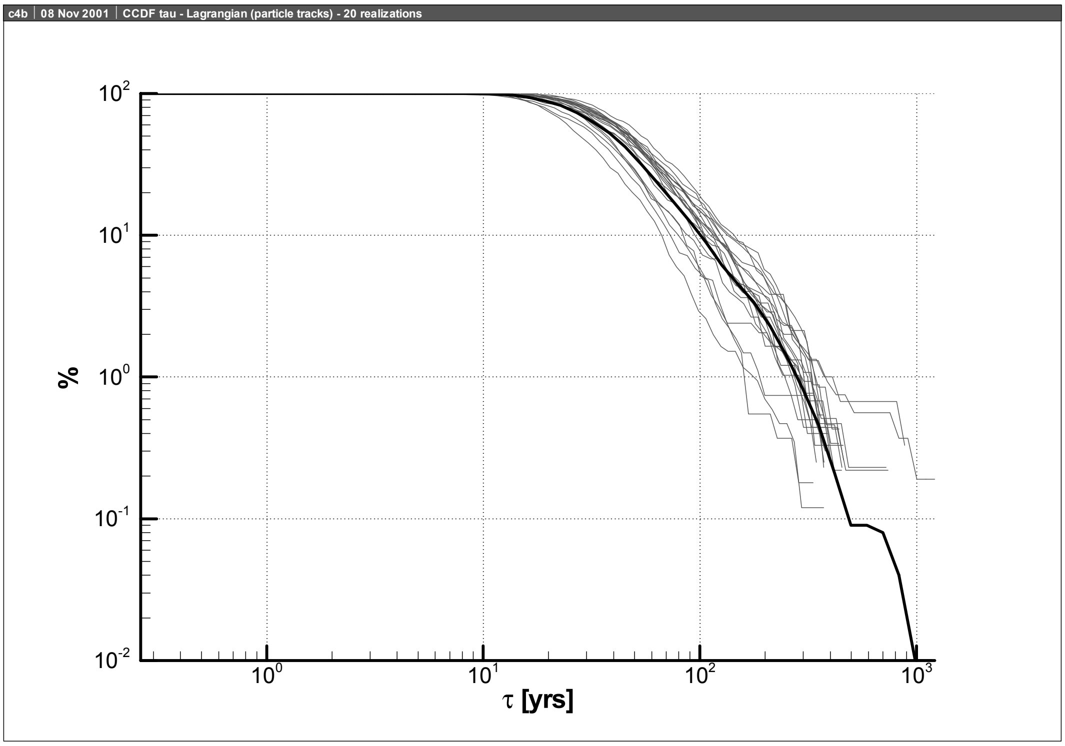

Figure 5.5-1 *CCDFs of τ in years for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

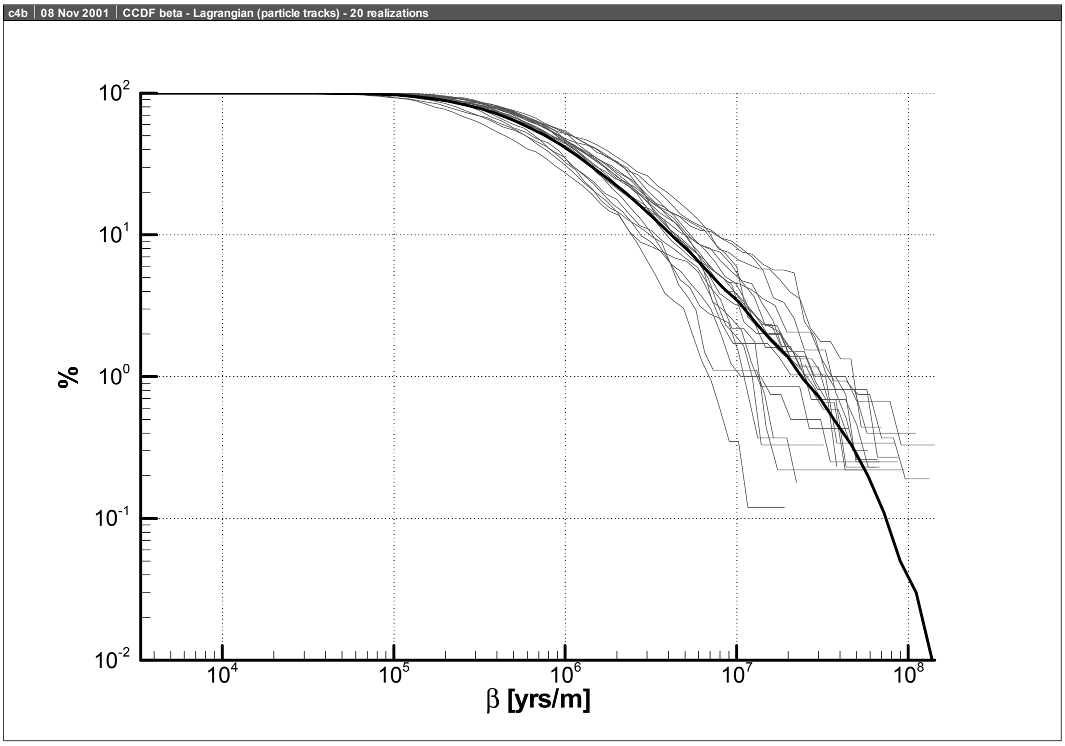

Figure 5.5-2 *CCDFs of* β *in years/m for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

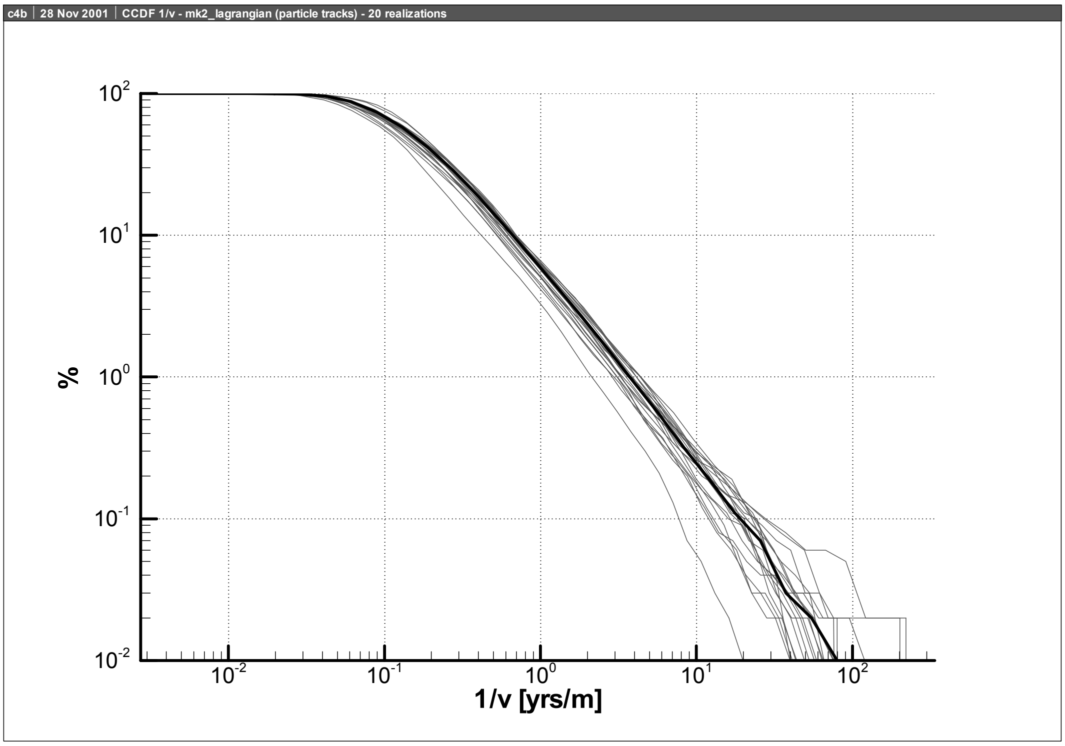

Figure 5.5-3 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

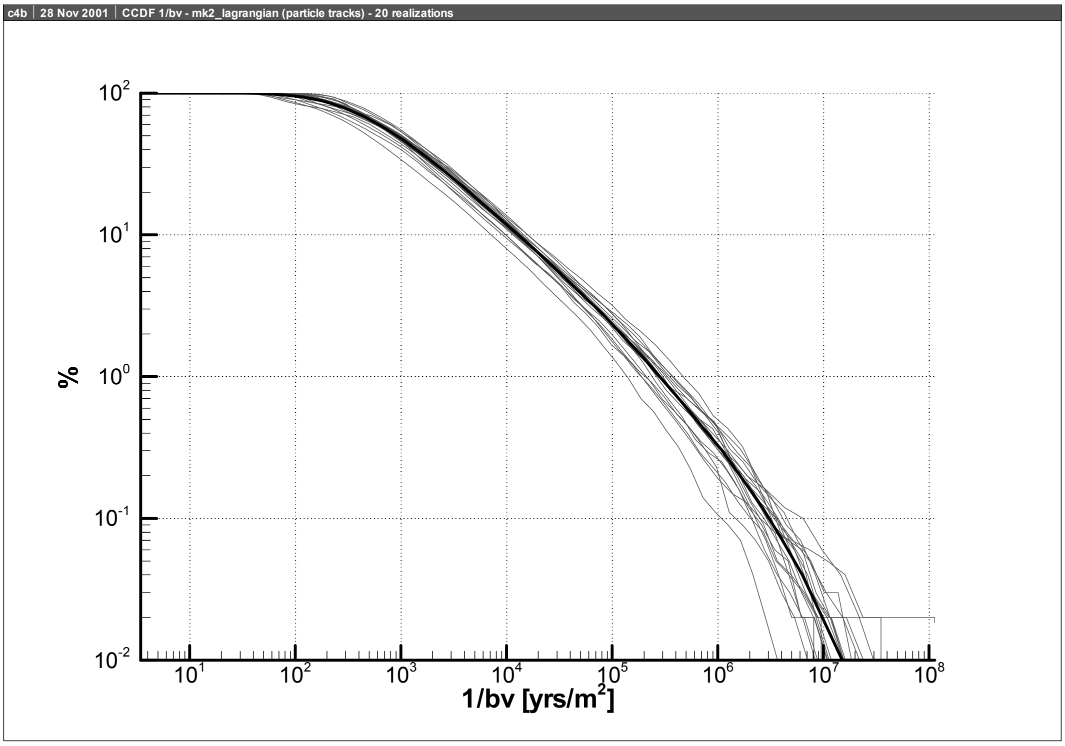

Figure 5.5-4 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

5.5.3 Eulerian results

The Eulerian (world co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

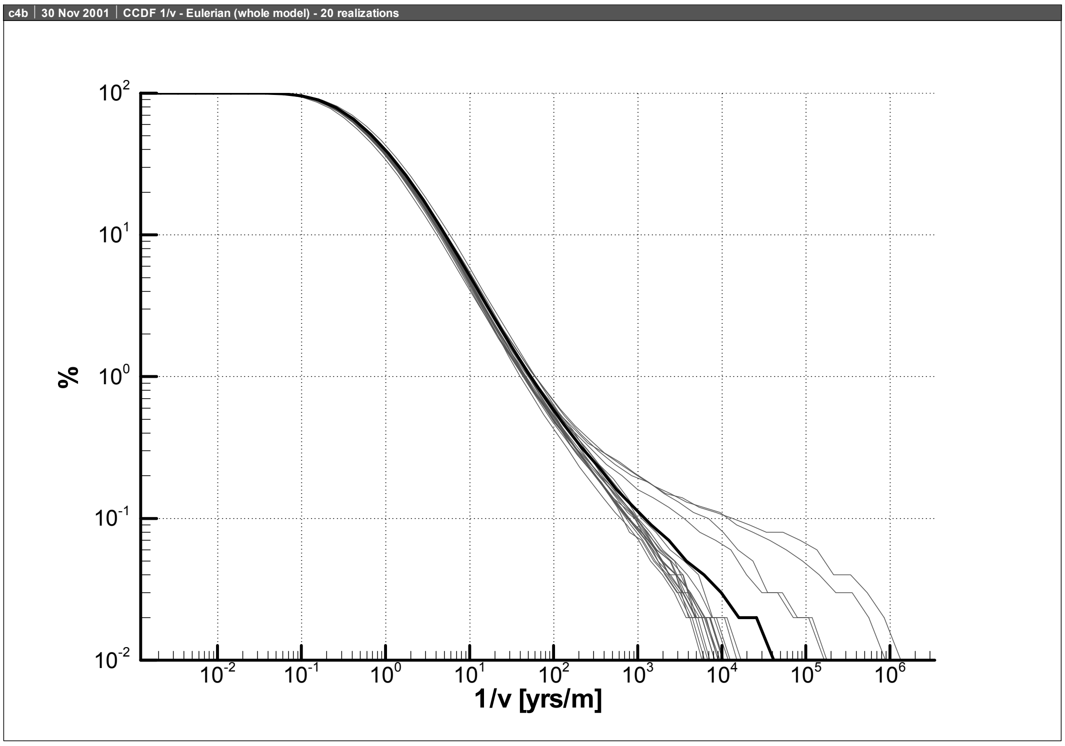

Figure 5.5-1 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

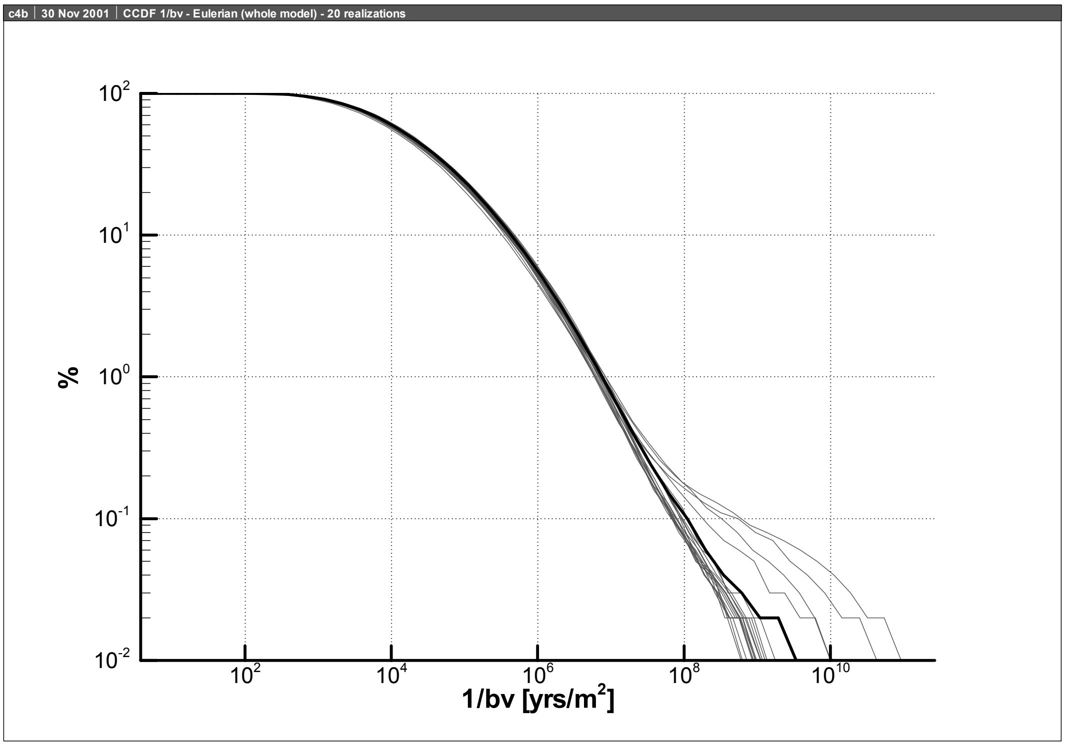

Figure 5.5-2 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/v and 1/bv from Base Case and Case 4b shows that the two cases are similar.

5.6 Case 5: Streamline Routing

5.6.1 Introduction

A total of 20 realisations were carried out. A target number of particles to be released in each model is set to 500 but varies from realisation to realisation depending on the total inflow through the boundary.

The time conditions are set up so that even slow particles can reach the downstream boundary and exit the system.

5.6.2 Lagrangian results

The Lagrangian (local co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

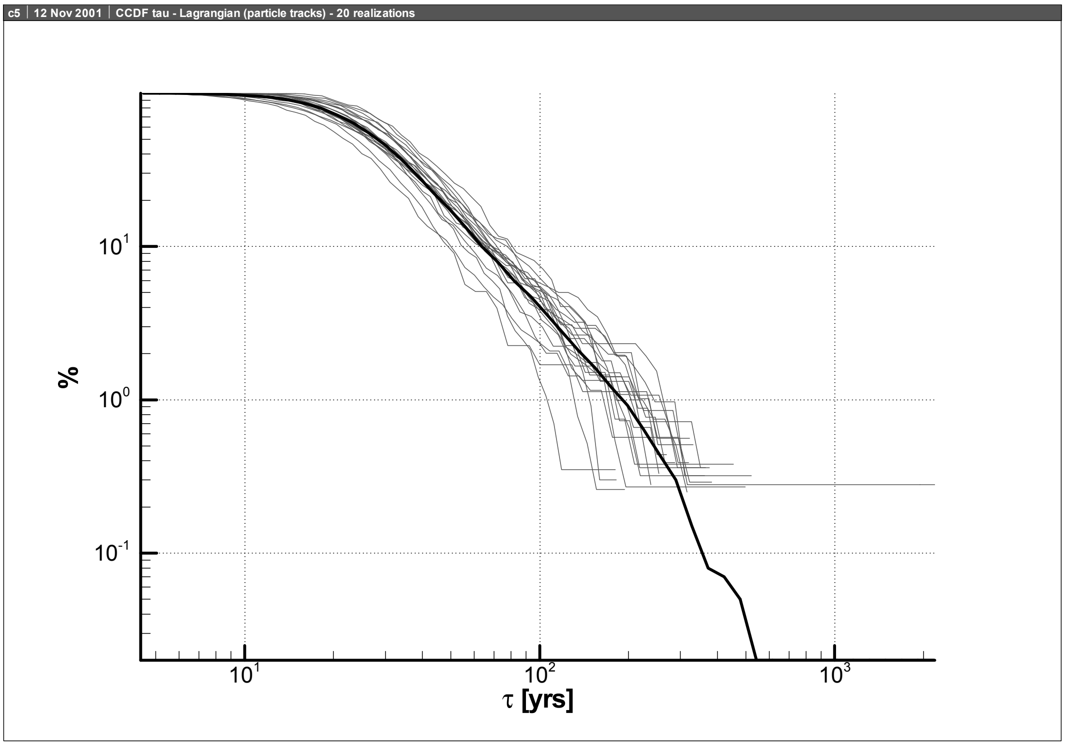

Figure 5.6-1 *CCDFs of τ in years for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

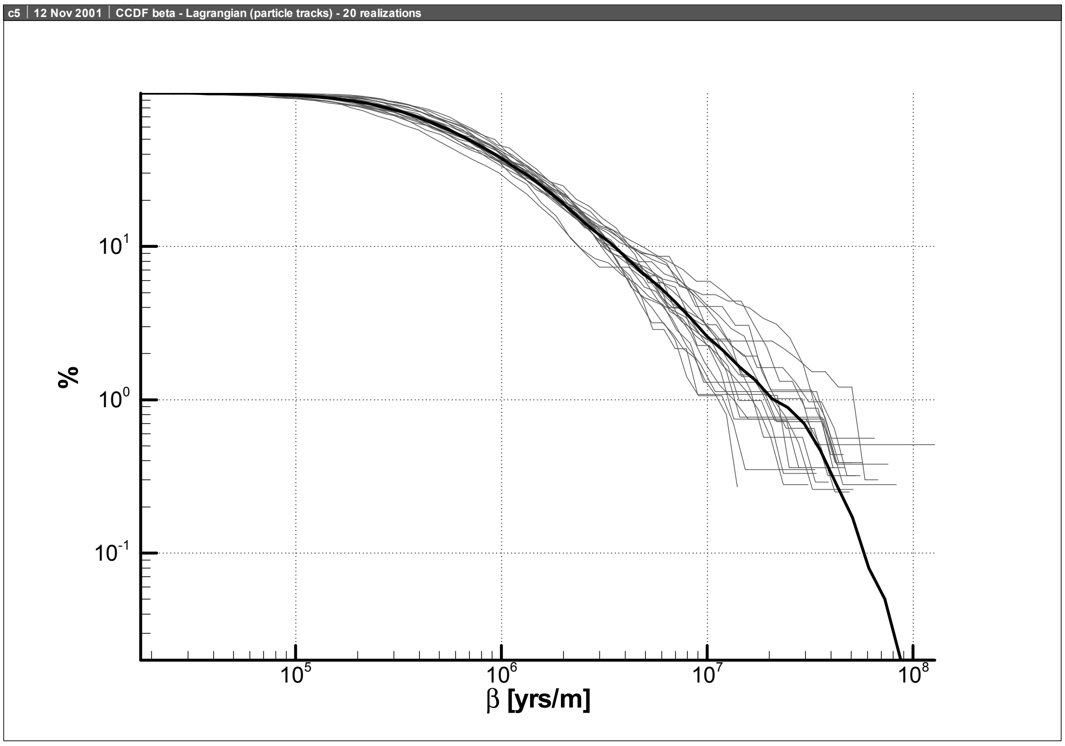

Figure 5.6-2 *CCDFs of β in years/m for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

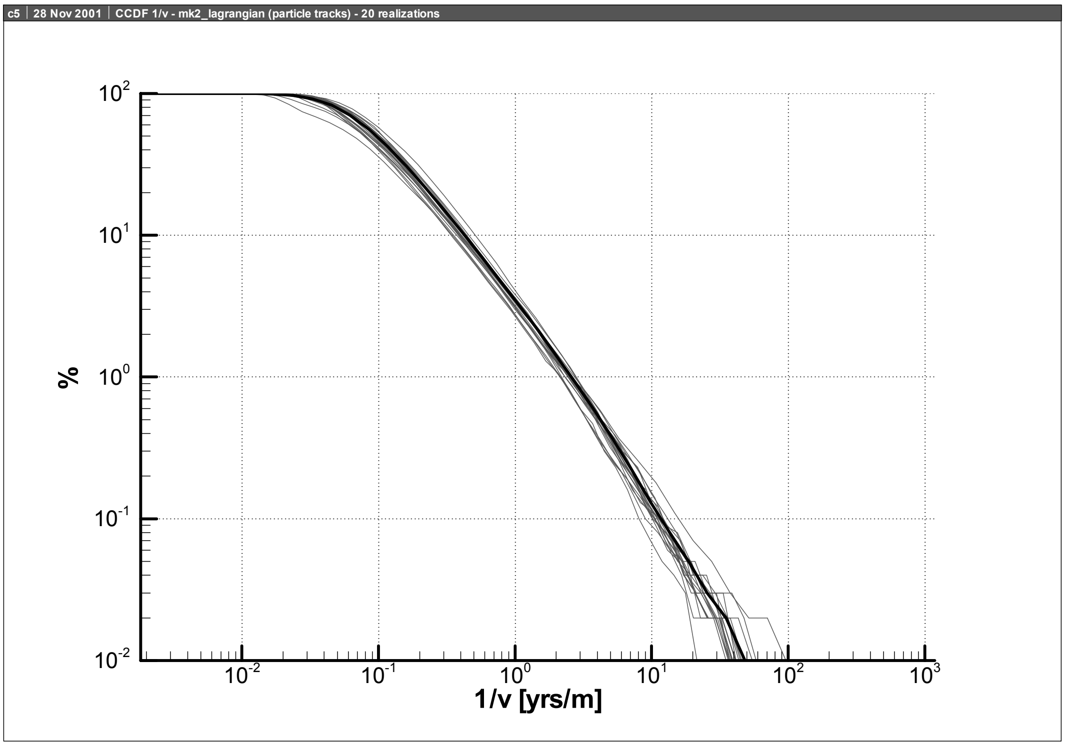

Figure 5.6-3 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

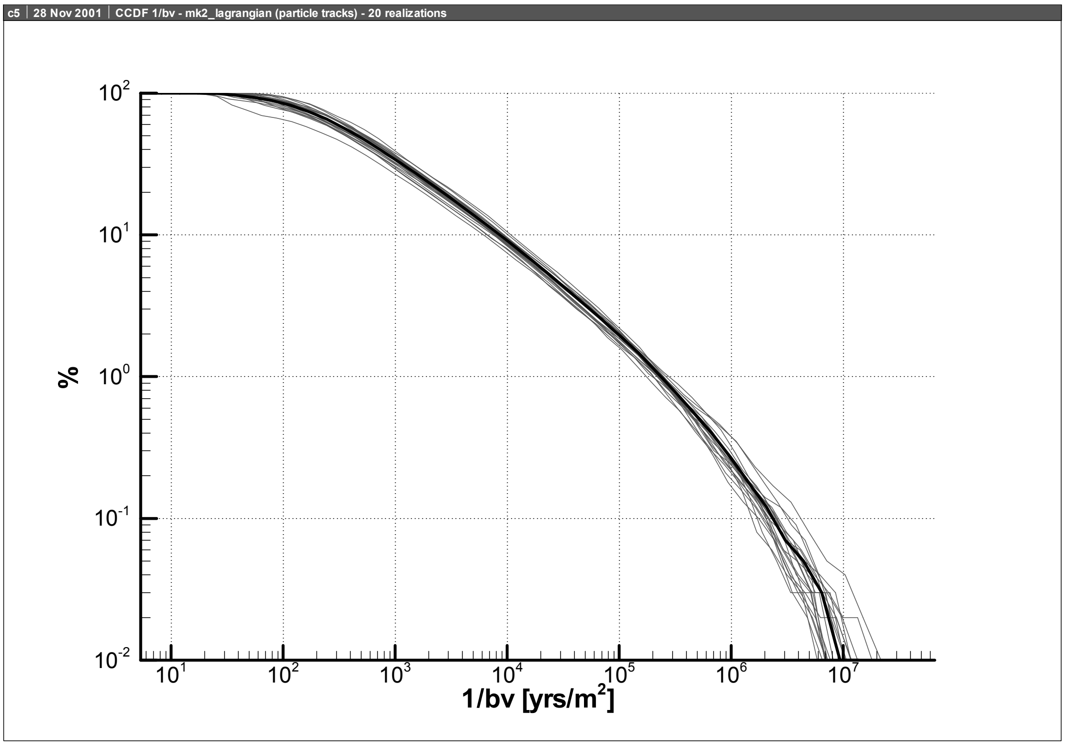

Figure 5.6-4 *CCDFs of 1/bv in years/m² for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

5.6.3 Eulerian results

The Eulerian (world co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

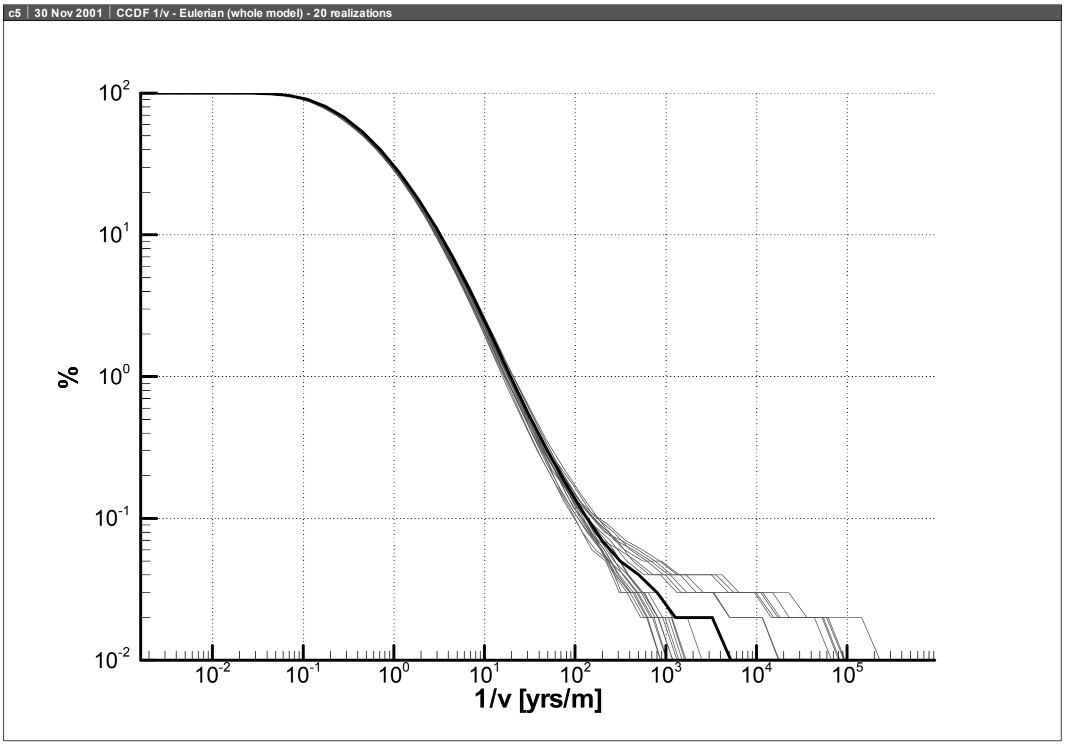

Figure 5.6-1 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/v from Lagrangian and Eulerian results shows that the Eulerian velocity can be slower than the Lagrangian velocity by several order of magnitude.

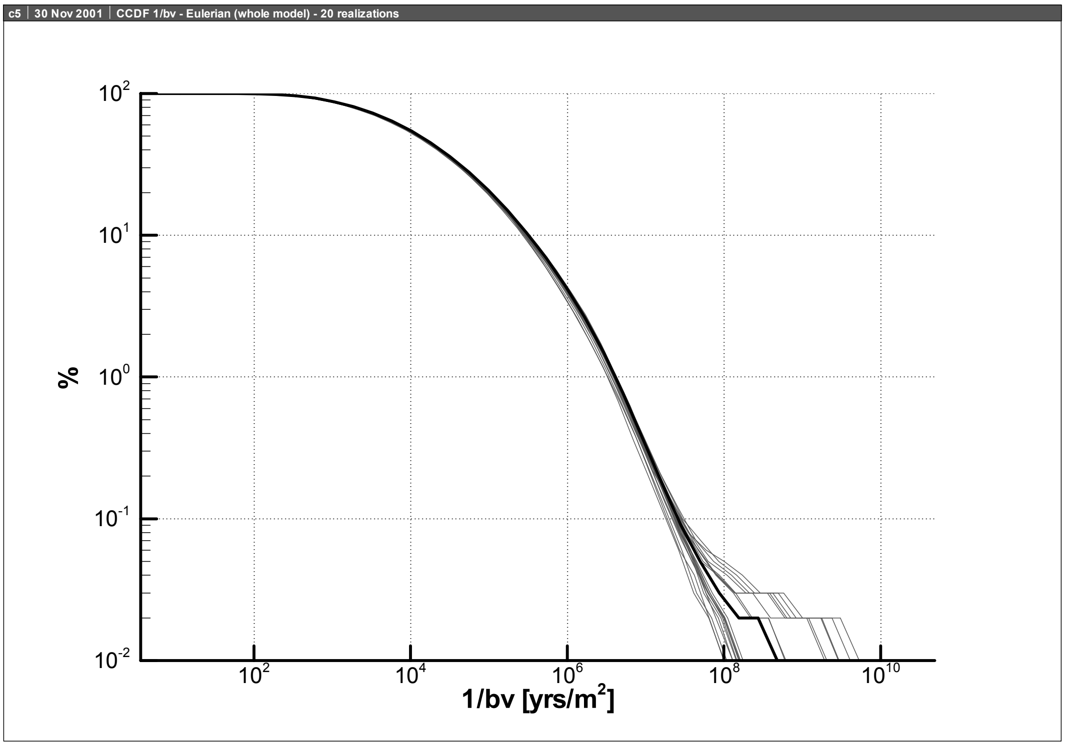

Figure 5.6-2 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/bv from Lagrangian and Eulerian results shows that the Eulerian 1/bv ratio can be higher than the Lagrangian 1/bv ratio by several order of magnitude.

5.7 Case 7a: Cubic Law

5.7.1 Introduction

A total of 20 realisations were carried out. A target number of particles to be released in each model is set to 1000 but varies from realisation to realisation depending on the total inflow through the boundary.

The time conditions are set up so that even slow particles can reach the downstream boundary and exit the system.

5.7.2 Lagrangian results

The Lagrangian (local co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

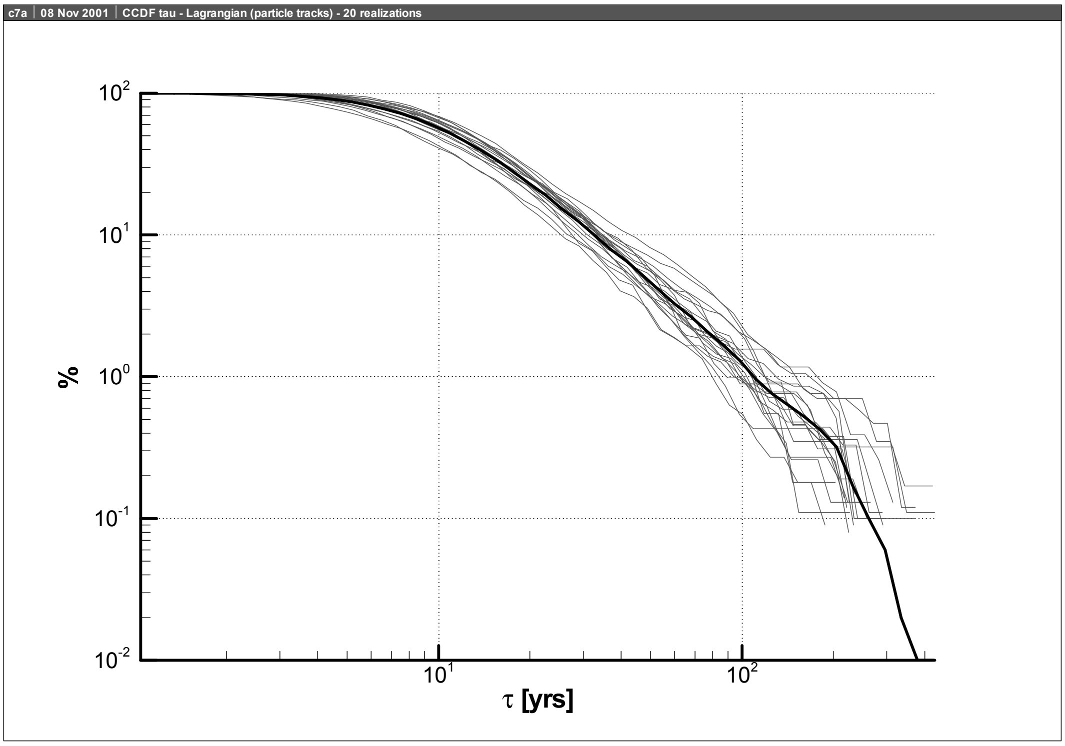

Figure 5.7-1 *CCDFs of* τ *in years for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

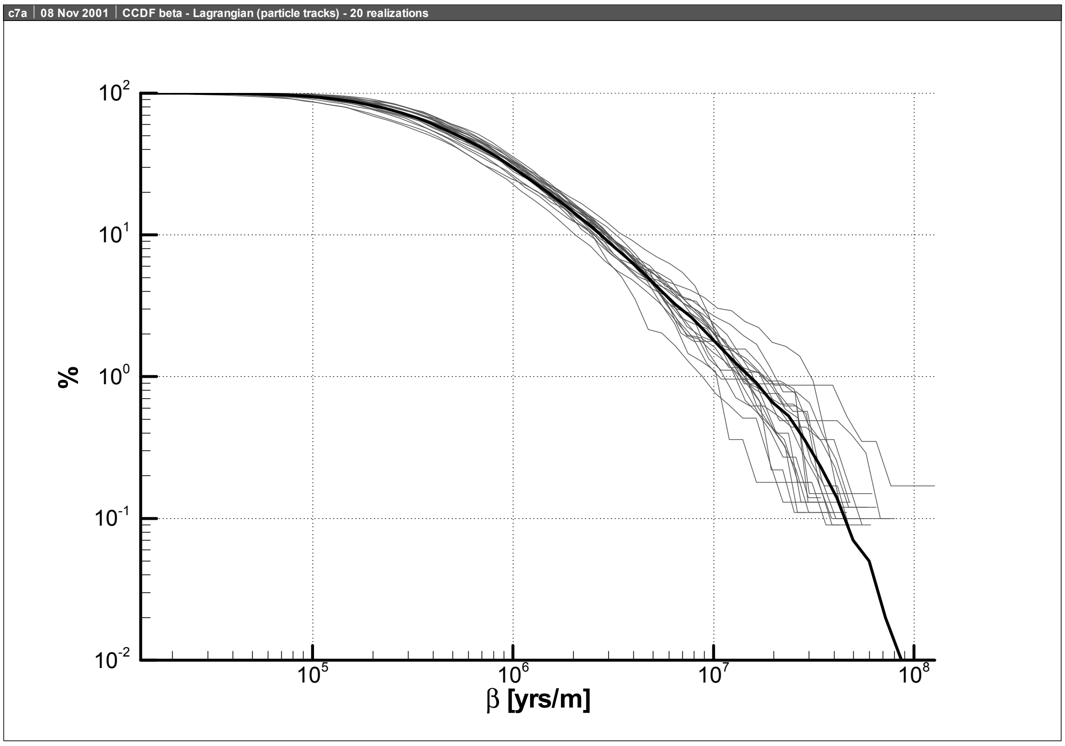

Figure 5.7-2 *CCDFs of β in years/m for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

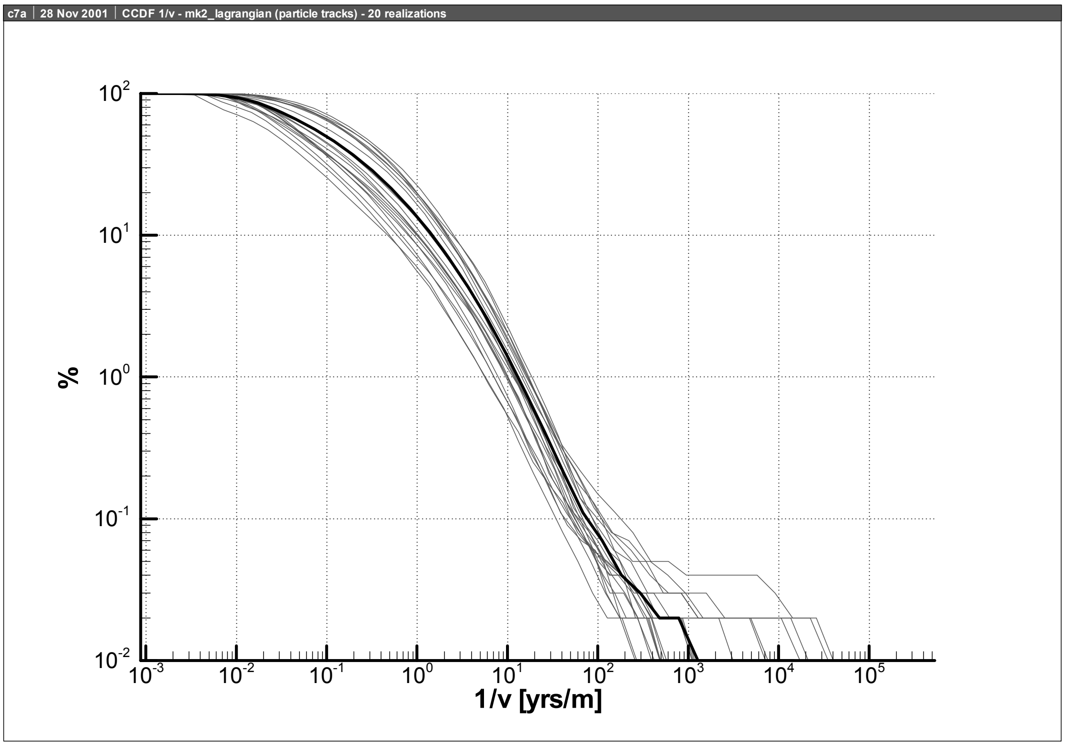

Figure 5.7-3 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

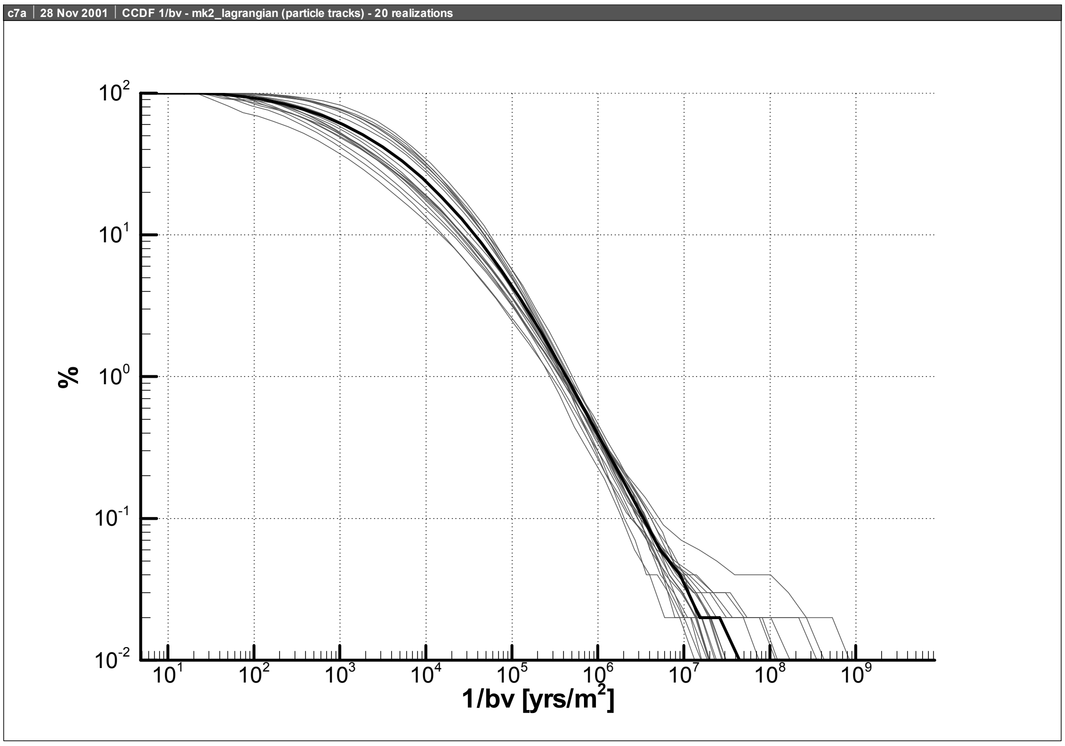

Figure 5.7-4 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

The CCDFs of the Lagrangian 1/v and 1/bv of Case 7a show a variation between realisations for low values of the parameters. This represents a variation between the realisations in the higher velocity domain.

One can observe that there exists also some very slow particles in some realisations.

5.7.3 Eulerian results

The Eulerian (world co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

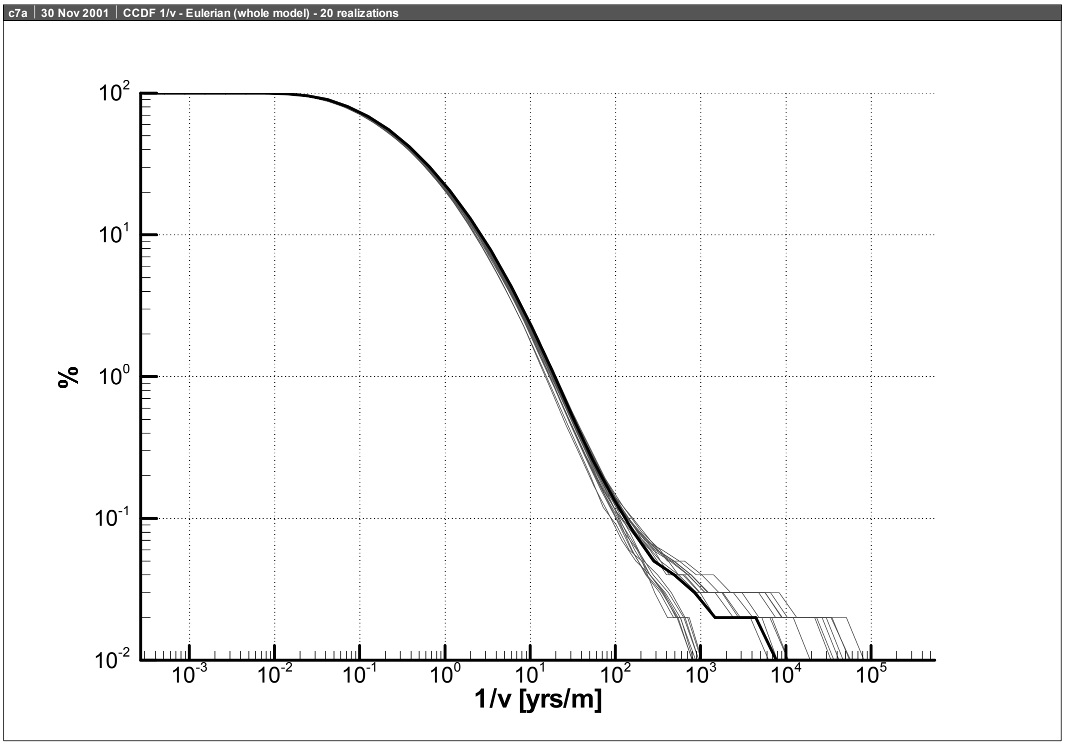

Figure 5.7-1 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/v from Lagrangian and Eulerian results shows that in both cases there exists some very slow particles in some realisations.

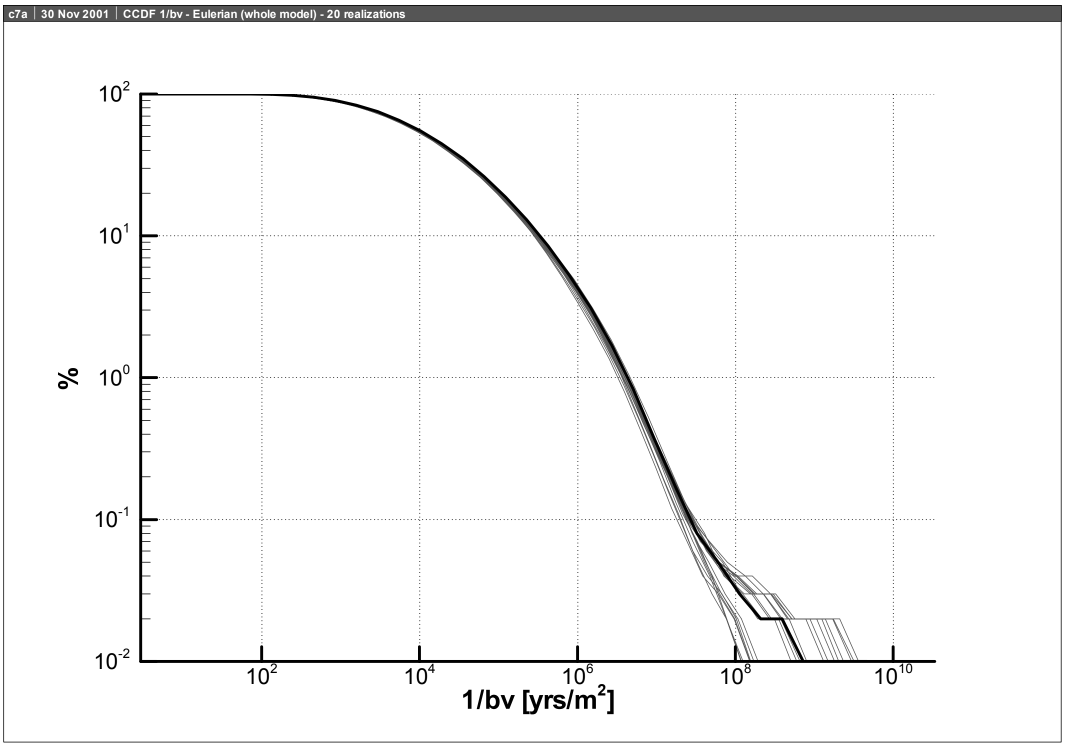

Figure 5.7-2 *CCDFs of 1/bv in years/m² for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/v from Lagrangian and Eulerian results shows that in both cases there exists few very slow particles in some realisations.

5.8 Case 7b: Linear Aperture vs. Transmissivity

5.8.1 Introduction

A total of 20 different realisations are run. A target number of particles to be released in each model is set to 1000 but varies from realisation to realisation depending on the total inflow through the boundary.

The time conditions are set up so that even slow particles can reach the downstream boundary and exit the system.

5.8.2 Lagrangian results

The Lagrangian (local co-ordinates system) results of the computations are presented below. The thin lines on the diagrams represent single realisation data. There is one per realisation. The thick curve represent the data from all realisations pooled together.

In some cases, the pooled data curve is defined for probability values lower than single realisation data. This is an effect of a larger sampling population of the pooled data.

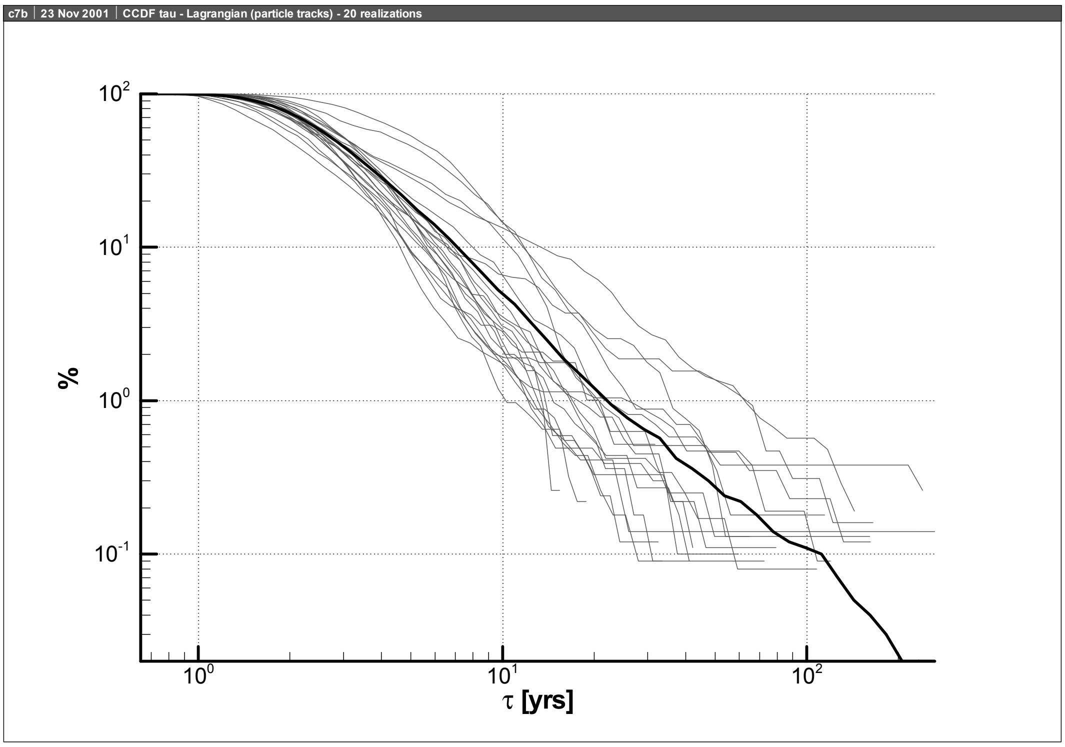

Figure 5.8-1 *CCDFs of τ in years for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

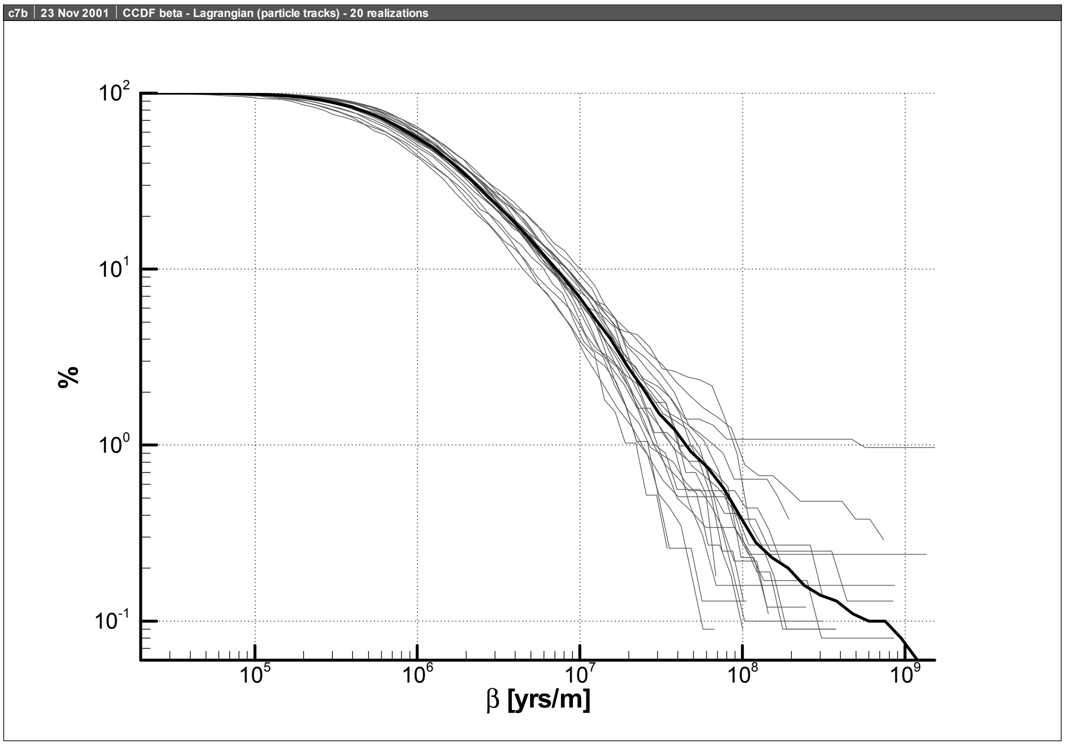

Figure 5.8-2 *CCDFs of β in years/m for exited particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

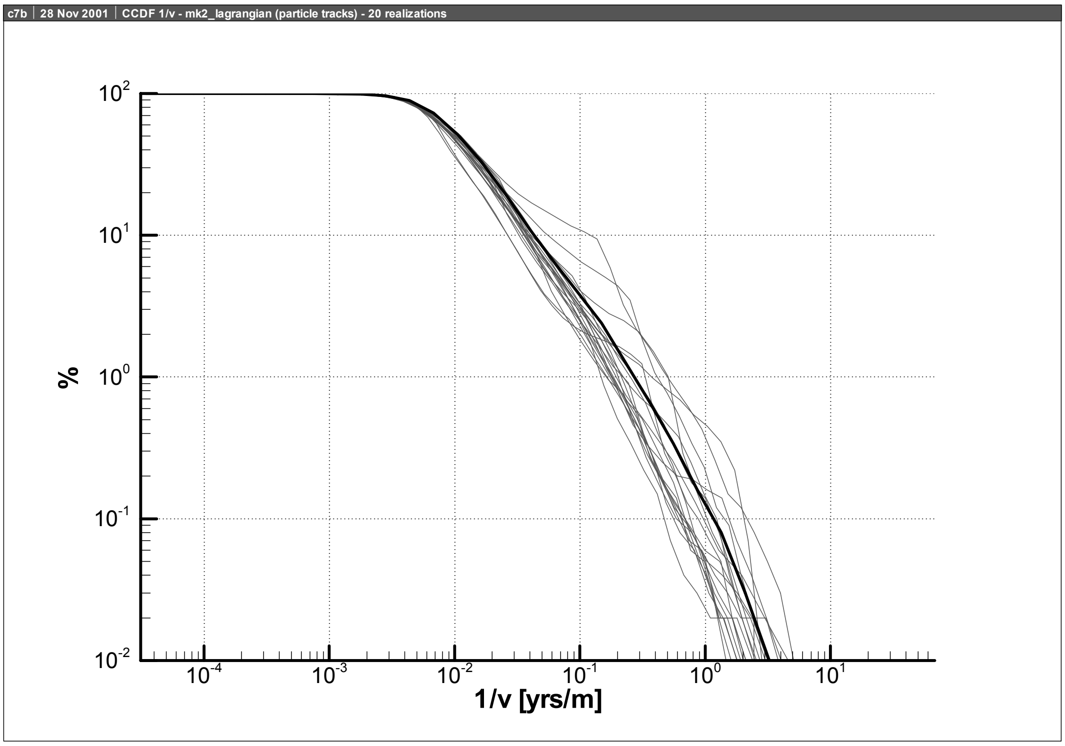

Figure 5.8-3 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

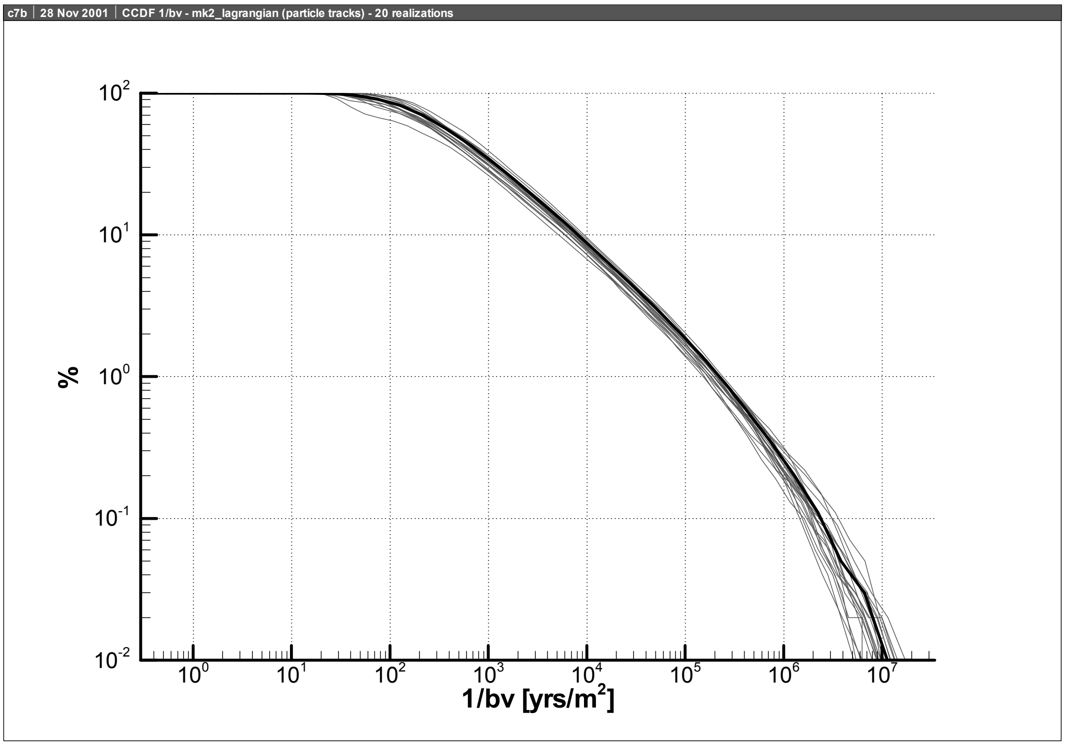

Figure 5.8-4 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

5.8.2.e Eulerian results

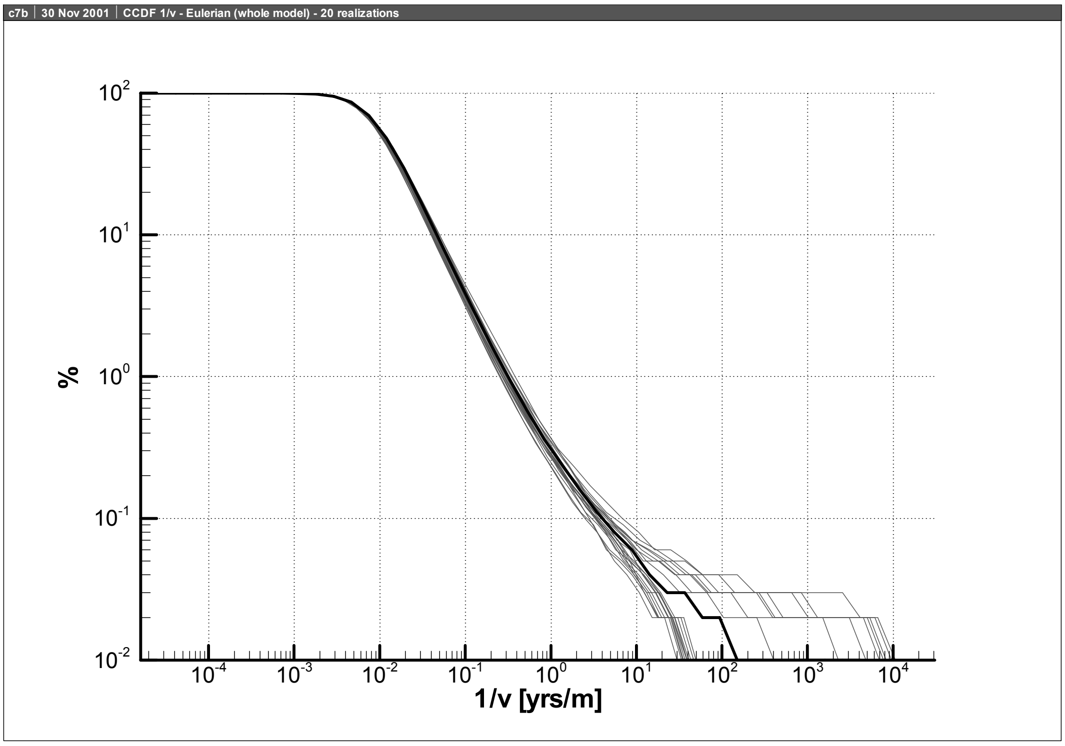

Figure 5.8-6 *CCDFs of 1/v in years/m for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/v from Lagrangian and Eulerian results shows that the Eulerian velocity can be slower than the Lagrangian velocity by several order of magnitude.

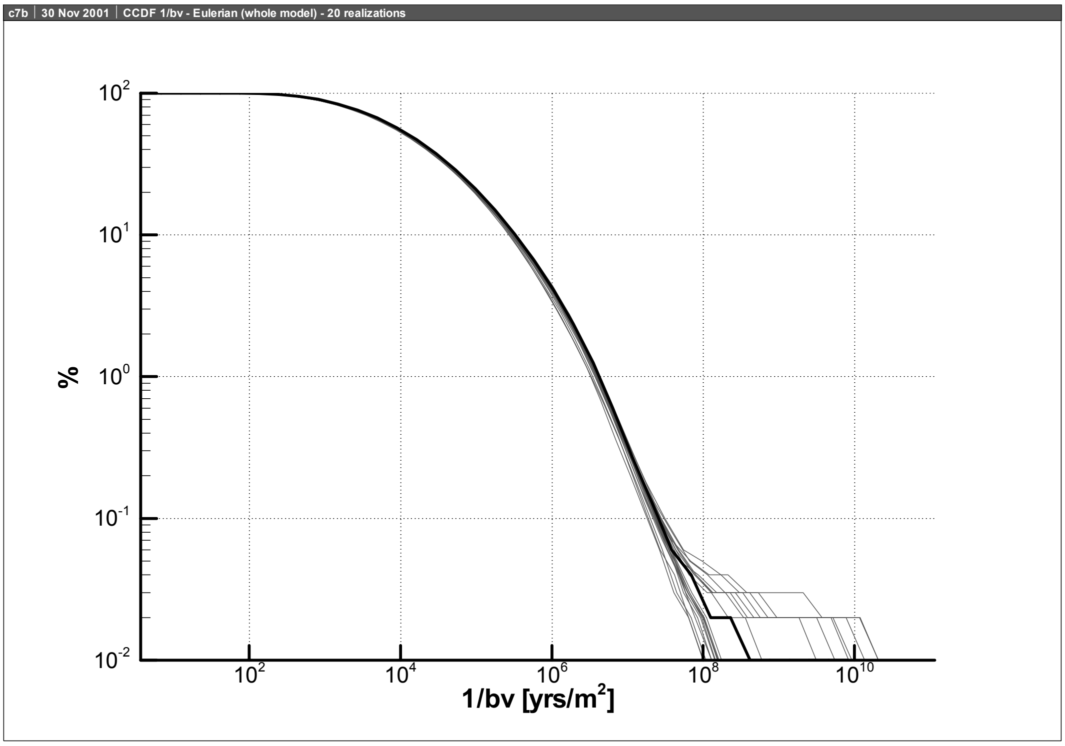

Figure 5.8-7 *CCDFs of 1/bv in years/m^2 for all particles. The 20 realisations are represented with thin lines. The thick line represents the CCDF based on all data.*

A comparison between the CCDFs of 1/bv from Lagrangian and Eulerian results shows that the Eulerian 1/bv ratio can be higher than the Lagrangian 1/bv ratio by several order of magnitude.

6 Comparison between cases

6.1 Scatter Plots

Scatter plots of the following parameters are presented below:

- β vs. τ
- τ vs. v1
- β vs. b1.v1

where:

b1 is the aperture of the first fracture element of a particle pathway

v1 is the velocity of the particle in this element

6.1.1 Scatter plots β vs. τ

One of the aims of this project is to focus on the compatibility of the present results and the results from the previous flow and transport study presented in the PAWorks 3 project (Outters et al., 2001).

The PAWorks 3 project presented sensitivity analysis of channel network pathway simulations in a DFN model. The DFN model consisted of two sets of stochastic fractures at different scales and the canister locations of a hypothetical repository layout. The hydrogeological base case model is defined by constant head boundary conditions on the edges of a 2000 x 2000 x 1000 m^3 block.

The pathway analysis carried out by the program PAWorks provided pathway parameters (pathway length, pathway width, transport aperture, reactive surface area, pathway transmissivity), canister statistics (average number of pathways per canister, percentage of canister locations with pathways) and visualisation of pathways. The DFN model was based mainly on data from the TBM tunnel area (Follin and Hermanson, 1996) and Uchida et al., 1995.

Figure 6.1-1 below shows a comparison of results for the current Base Case and Case 1a against scatter plot of β vs. τ in log-log scale from Outters et al., 2001.

The PAWorks solution presents a correlation between the two parameters. The MAFIC solution also presents a correlation between the two parameters. The MAFIC solution shows greater scattering than the PAWorks solution.

The travel time of the three solutions are of the same order of magnitude. However, the similarity of the travel time of the PAWorks 3 project and the present project is a coincidence since the pathway lengths are not the same. The average pathway length in the present project is about 110m. In the PAWorks 3 project, it was about 1000m.

The MAFIC transport computations produce in general higher retention factors β than PAWorks does. The reason is the flux weighted pathway search in the PAWorks solution. The flow velocities are higher in the PAWorks solutions than in the MAFIC solutions, hence a lower β in the PAWorks solutions (see Eq 2-1).

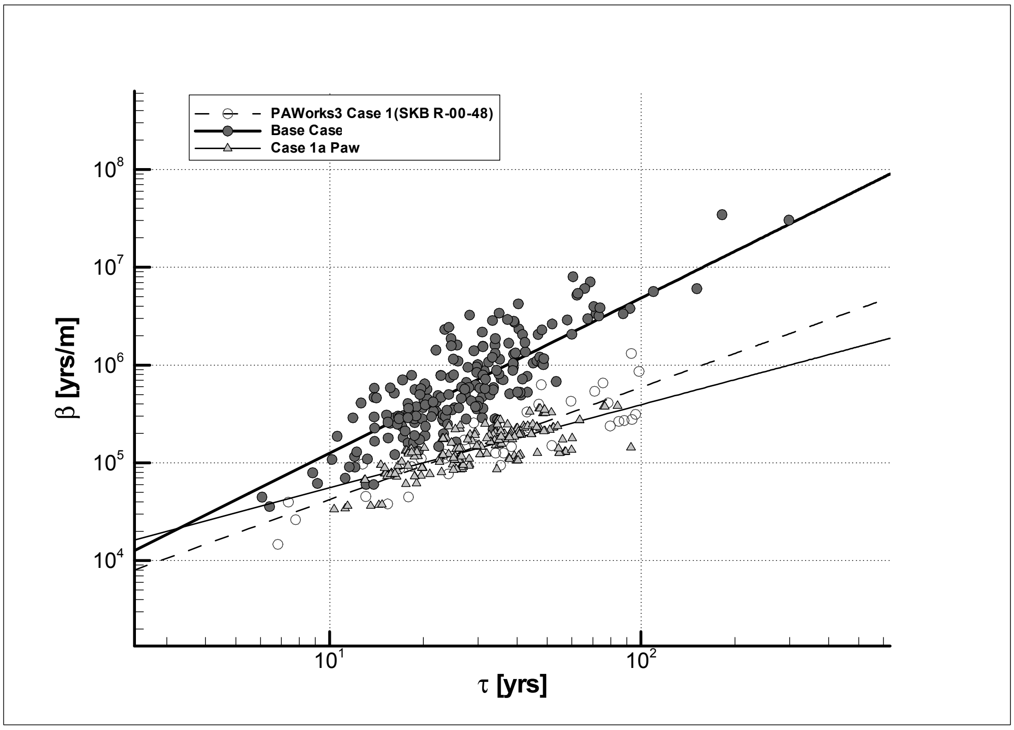

Figure 6.1-1 *β vs. τ. Comparison between Base Case, Case 1a and PAWorks 3 data.*

The scatter plot below (Figure 6.1-2) shows the results from MAFIC for the Base Case, Case 2 and Case 5.

The correlation of the three cases is about the same.

The results from the Base Case and Case 5 (streamline routing) are very similar. The alternative streamline routing algorithm implemented in MAFIC does not affect the results in a significant way.

One notices that the travel time from Case 2 is larger by almost one order of magnitude. This is explained by the more complex flow pattern that exists within the fractures of Case 2. The overall transmissivity is the same as in the Base Case but the channelling reduces the flow velocity.

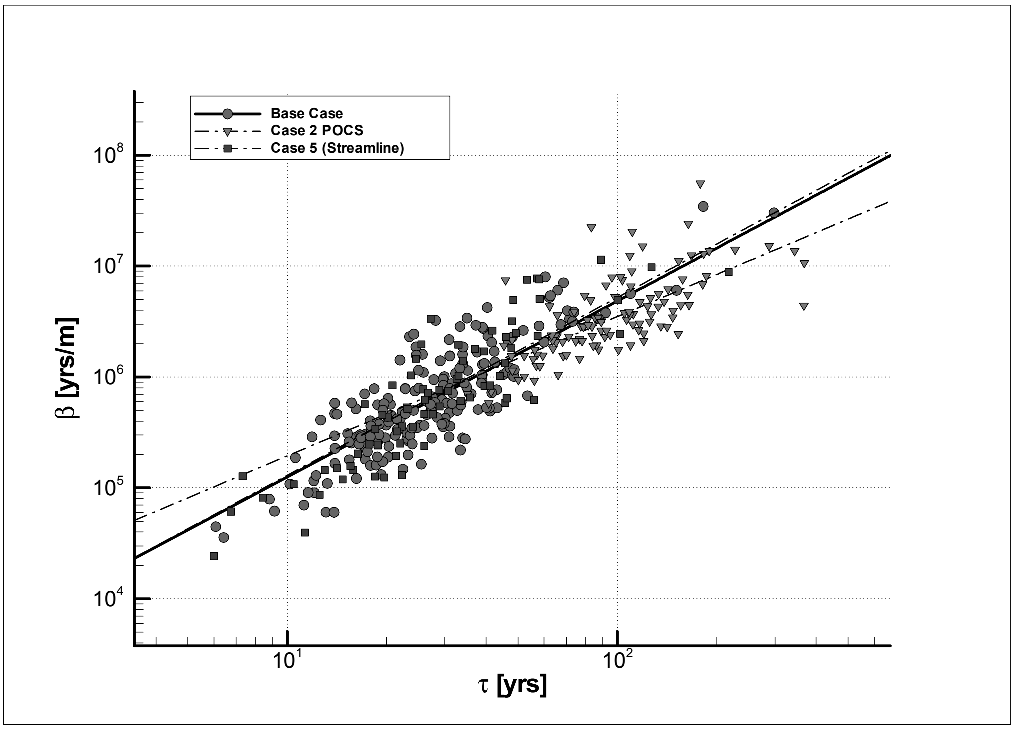

Figure 6.1-2 *β vs. τ. Comparison between Base Case, Case 2 and Case 5 data.*

The scatter plot below (Figure 6.1-3) shows the solution from MAFIC for the Base Case, Case 4a and Case 4b where different fracture densities are used.

The scatter plot shows that a reduction of 50% (Case 4a) of the fracture intensity does not affect the results significantly. However, a reduction of 90% (Case 4b) of the fracture intensity affects the transport properties in increasing the travel time and the retention factor. This is due to a lower velocity of the particles caused by a reduced number of possible pathways in the model.

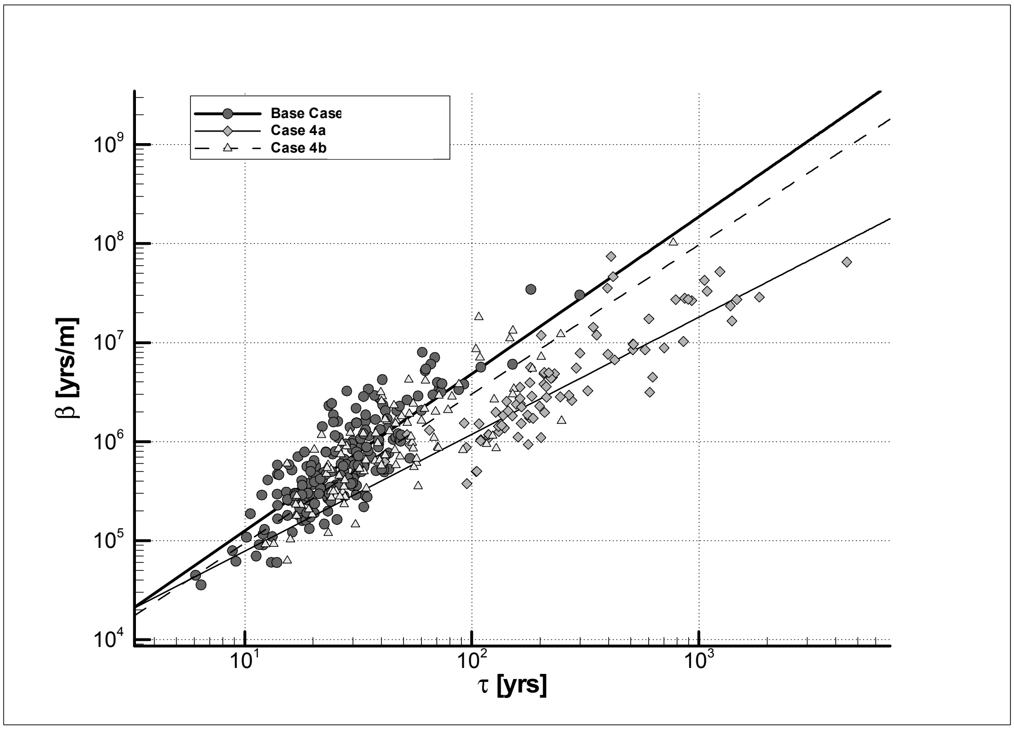

Figure 6.1-3 *β vs. τ. Comparison between Base Case, Case 4a and Case 4b data.*

The scatter plot below (Figure 6.1-4) shows the solution from MAFIC for the Base Case, Case 7a and Case 7b where different relationships for transmissivity-aperture are tested. The scatter plot shows that the three models present a retention factor of the same order of magnitude.

The Base Case and Case 7a show similar correlations. Case 7a shows a travel time slightly shorter than the Base Case. This indicates that the particle velocity is higher in Case 7a than in the Base Case. This result was expected since for the same transmissivity, the aperture will be higher calculated with the Doe law than with the cubic law. For a given discharge, a higher aperture gives a slower velocity.

Case 7b, where a linear relationship between transmissivity and aperture is used, shows a poor correlation between travel time and retention factor. The travel time of Case 7b is lower than the travel time of the Base Case by several orders of magnitude. This result was expected since for the same transmissivity, the aperture will be higher calculated with the linear relationship (see Eq. 4-2) than with the Doe law.

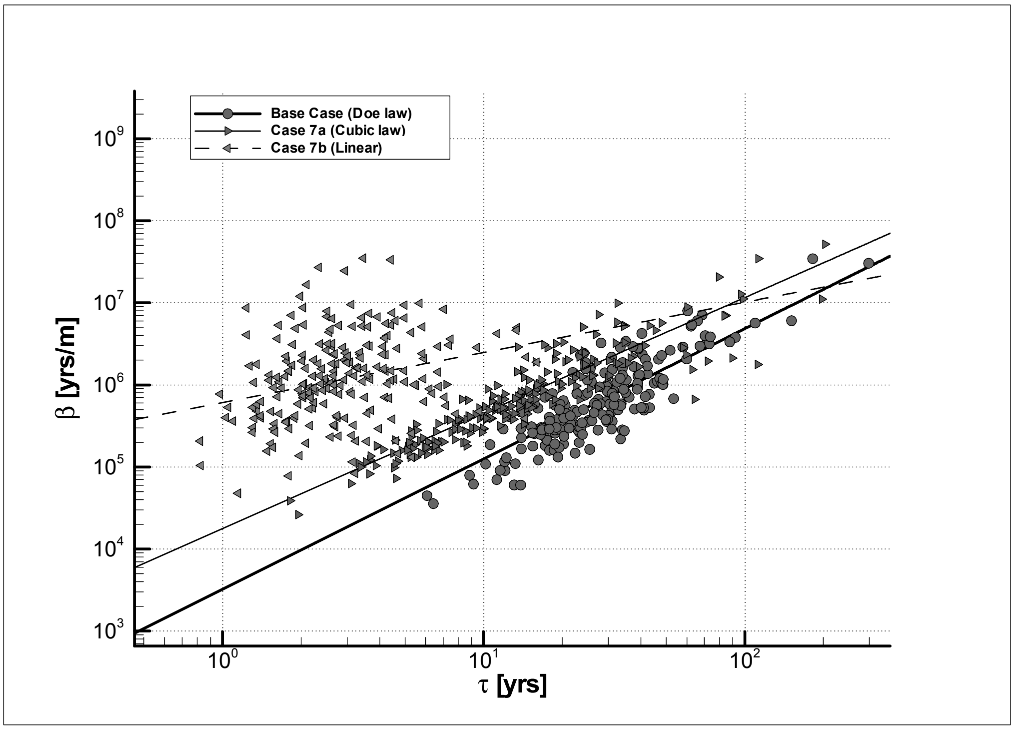

Figure 6.1-4 *β vs. τ. Comparison between Base Case, Case 7a and Case 7b data.*

6.2 Scatter plots τ vs. v1

The study of the correlation between the travel time and the velocity in the first element of a pathway is carried out to test the possibility of characterising the transport time within a DFN with the data obtained in the close neighbourhood of a test borehole. The velocity v1 in the first element should reflect directly the flow rate within a given pump section.

The Base Case and Case 1a both do not show a significant correlation between τ and v1 (Figure 6.2-1) since the data points are located on an almost horizontal line. The velocity within the first FE element is lower by about one order of magnitude in Case 1a than in the Base Case. This might be due to the fact that the models are very different in their approach. The Base Case uses 3D FE while Case 1a uses one-dimensional pipe elements.

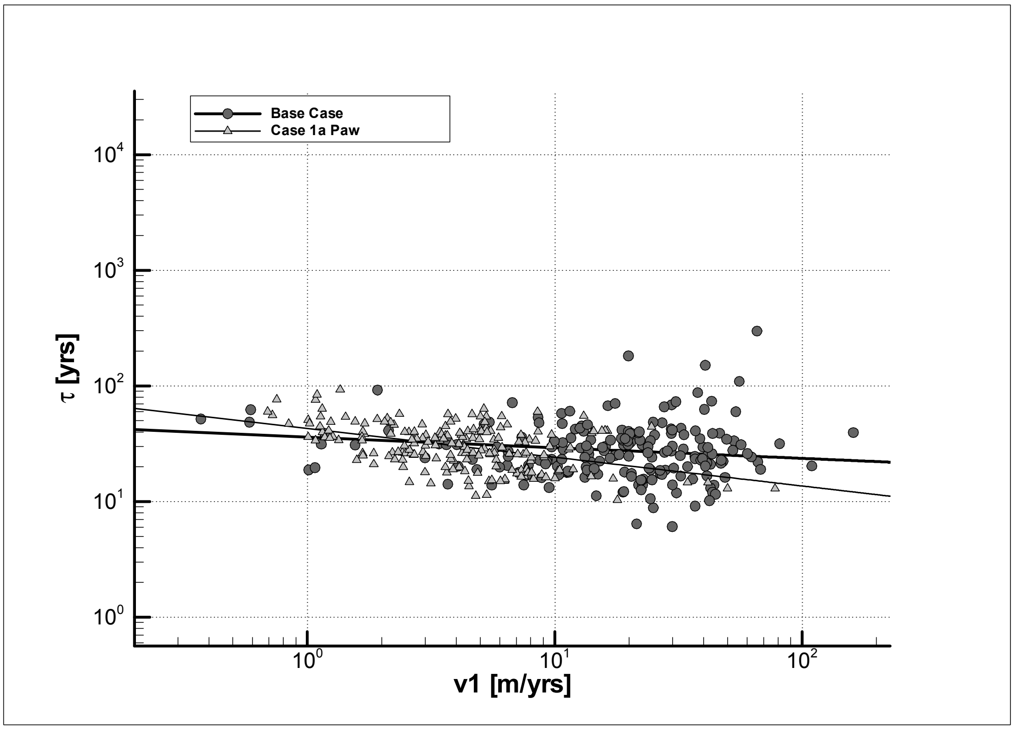

Figure 6.2-1 *τ vs. v1. Comparison between Base Case and Case 1a data*

Case 2 and Case 5 do not show a significant correlation between τ and v1 (Figure 6.2-2) since the data points are located on an almost horizontal line. The velocity within the first FE element is lower by about one order of magnitude in Case 2 than in the Base Case and Case 5.

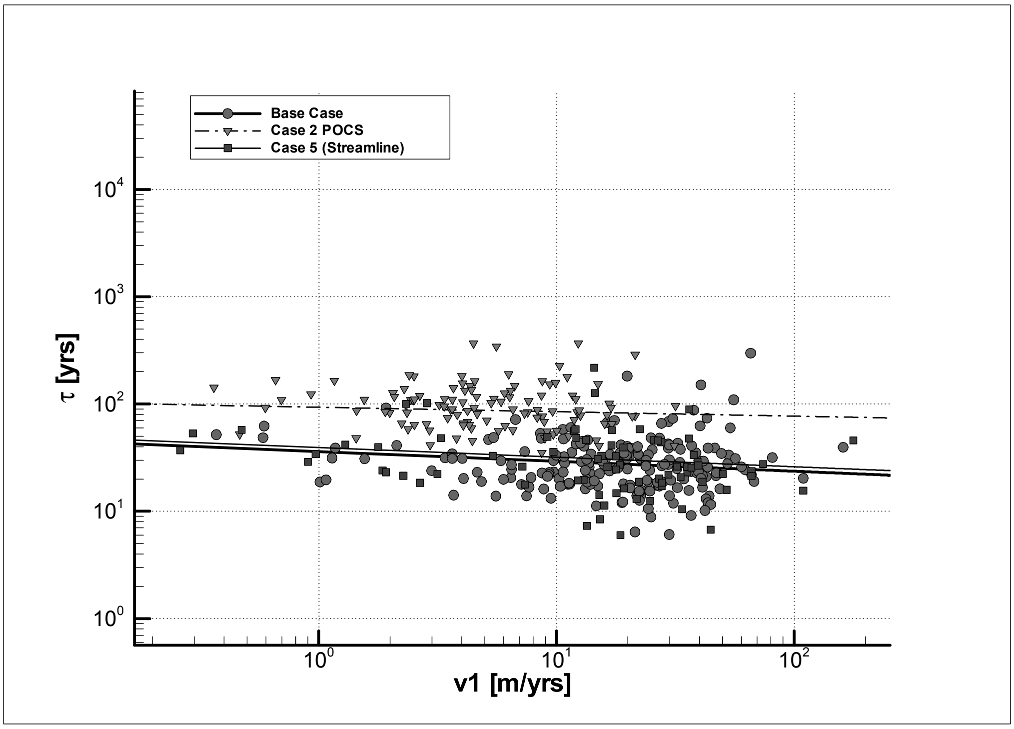

Figure 6.2-2 *τ vs. v1. Comparison between Base Case, Case 2 and Case 5 data.*

Case 4b does not show a significant correlation between τ and v1 (Figure 6.2-3) since the data points are located on an almost horizontal line.
On the contrary, Case 4a shows a more significant correlation due to the fact that in Case 4a, the fracture intensity is low, hence a pathway is made of fewer fractures than in the Base Case. The effect of the velocity in the first fracture element is therefore more important.

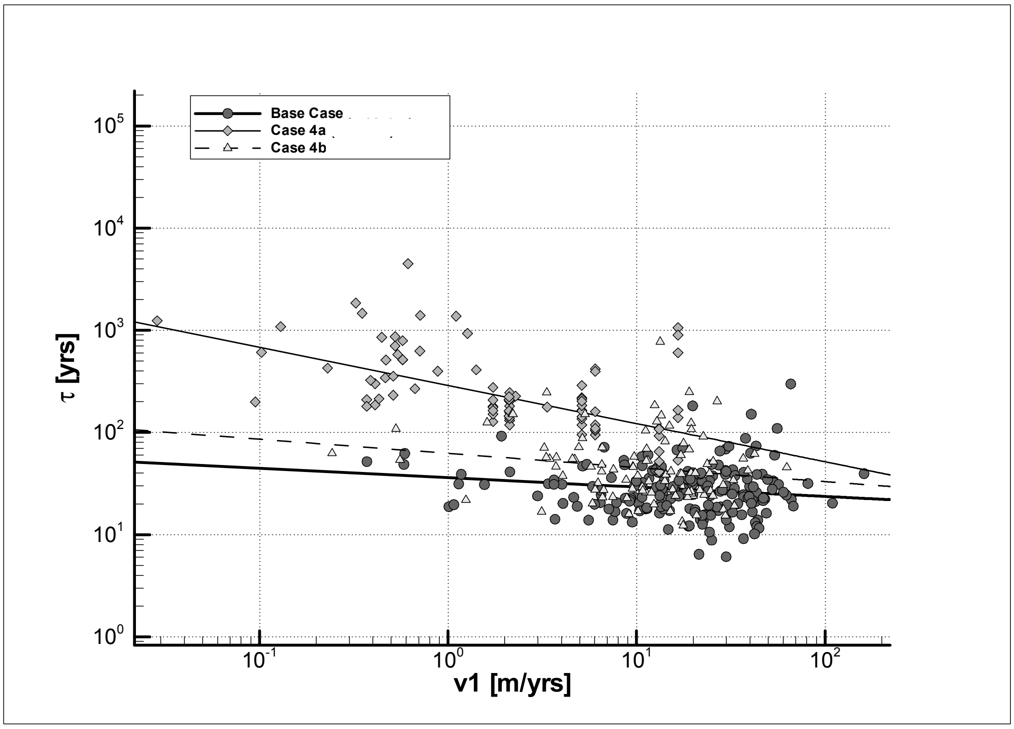

Figure 6.2-3 *τ vs. v1. Comparison between Base Case, Case 4a and Case 4b data.*

Case 7a and Case 7b do not show a significant correlation between τ and v1 (Figure 6.2-4) since the data points are located on an almost horizontal line. The velocity within the first FE element is higher by about one order of magnitude in Case 7b than in the Base Case and Case 7a.

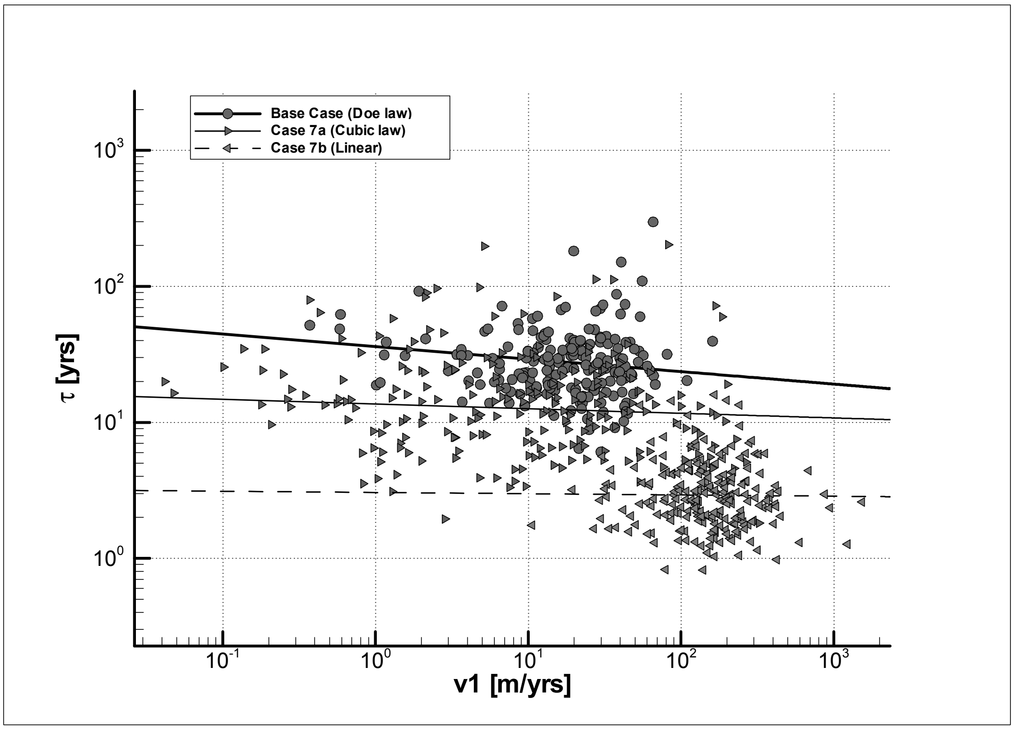

Figure 6.2-4 τ *vs. v1. Comparison between Base Case, Case 7a and Case 7b data.*

6.3 Scatter plots β vs. b1v1

The study of the correlation between the retention factor β and the velocity time aperture in the first element of a pathway is carried out to test the possibility of characterising the retention factor within a DFN with the data obtained in the close neighbourhood of a test borehole. The product b1*v1 in the first element should reflect directly the flow rate within a given pump section.

The Base Case and Case 1a both do not show a significant correlation between β and b1*v1 (Figure 6.3-1) since the data points are located on an almost horizontal line. The range of β and b1*v1 of Case 1a is smaller than in the Base Case. This might be due to the fact that the models are very different in their approach. The Base Case uses 3D FE while Case 1a uses one-dimensional pipe elements.

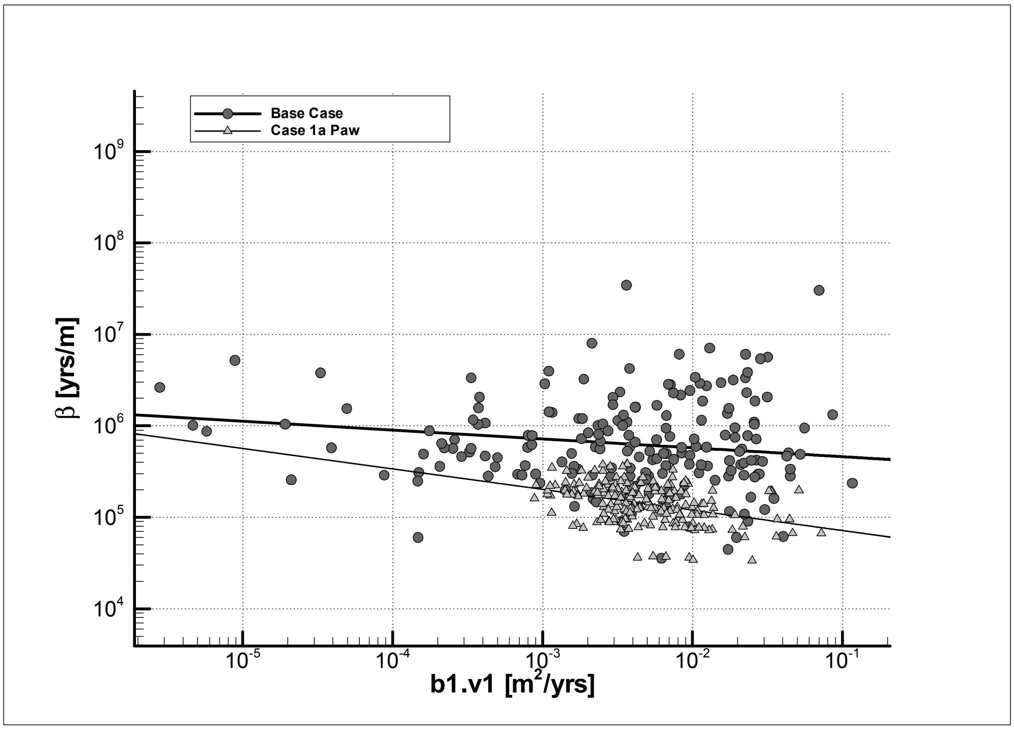

Figure 6.3-1 β *vs. b1v1. Comparison between Base Case and Case 1a data*

Case 2 and Case 6 do not show a significant correlation between β and b1*v1 (Figure 6.3-2) since the data points are located on an almost horizontal line. The product b1*v1 within the first FE element is lower by about one order of magnitude in Case 2 than in the Base Case and Case 6.

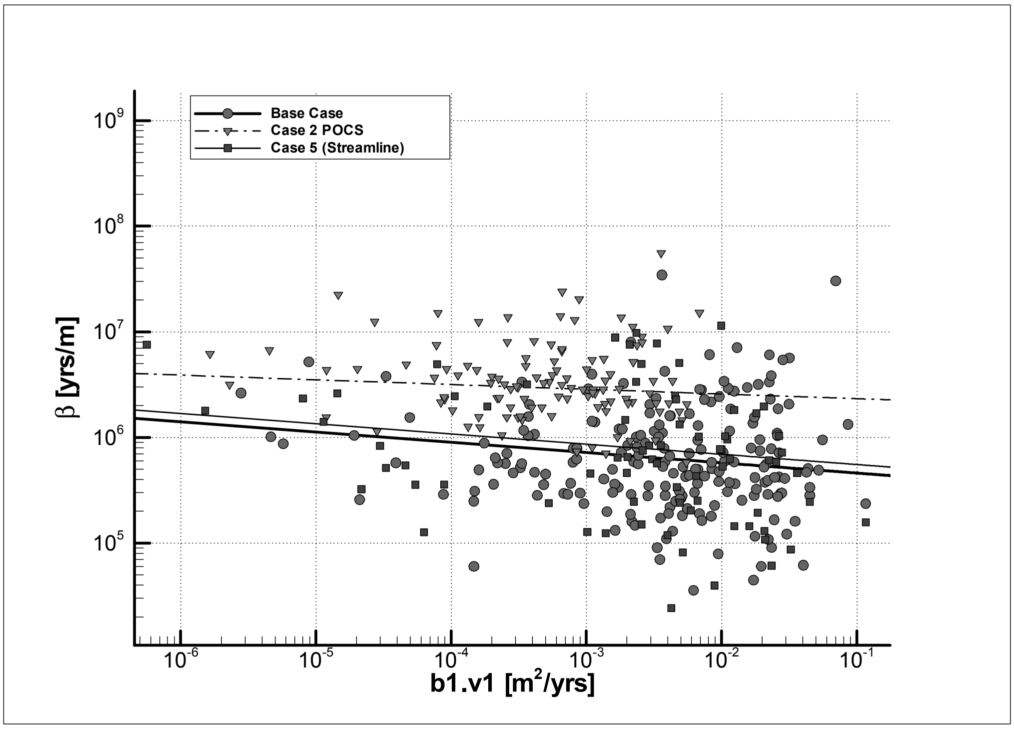

Figure 6.3-2 β *vs. b1v1. Comparison between Base Case, Case 2 and Case 5 data.*

Case 4b does not show a significant correlation between β and b1*v1 (Figure 6.3-3) since the data points are located on an almost horizontal line.

On the contrary, Case 4a shows a more significant correlation due to the fact that in Case 4a, the fracture intensity is low, hence a pathway is made of fewer fractures than in the Base Case. The effect of the product b1*v1 in the first fracture element is therefore more important.

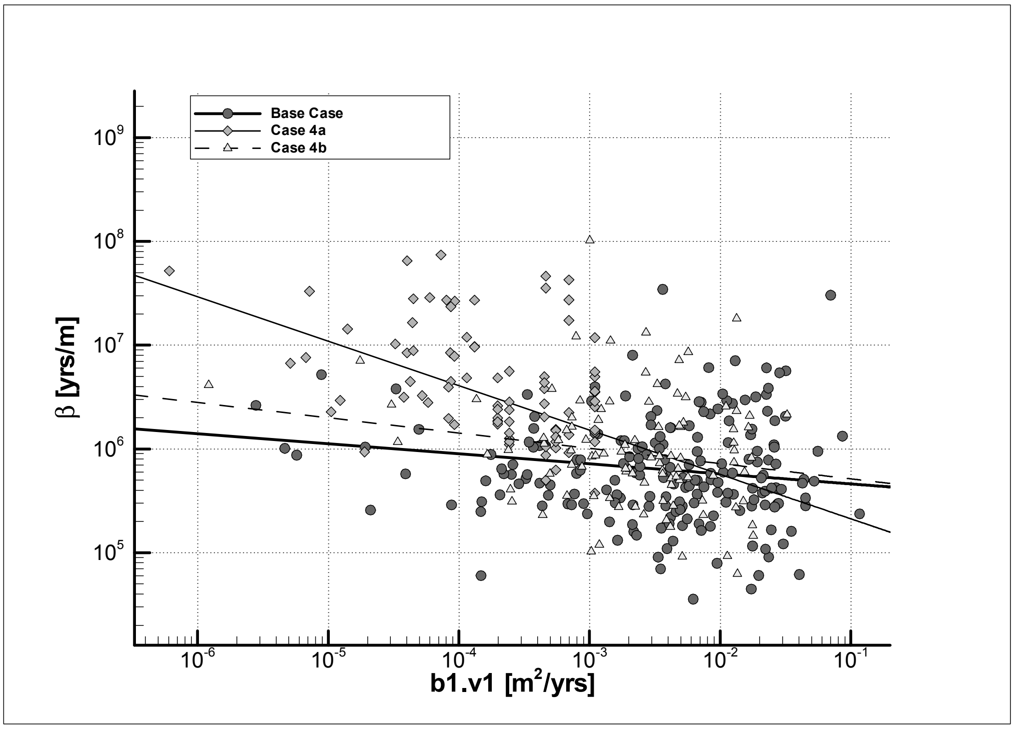

Figure 6.3-3 *β vs. b1v1. Comparison between Base Case, Case 4a and Case 4b data.*

Case 7a and Case 7b do not show a significant correlation between β and b1*v1 (Figure 6.3-4) since the data points are located on an almost horizontal line. The velocity within the first FE element is higher by about one order of magnitude in Case 7b than in the Base Case and Case 7a.

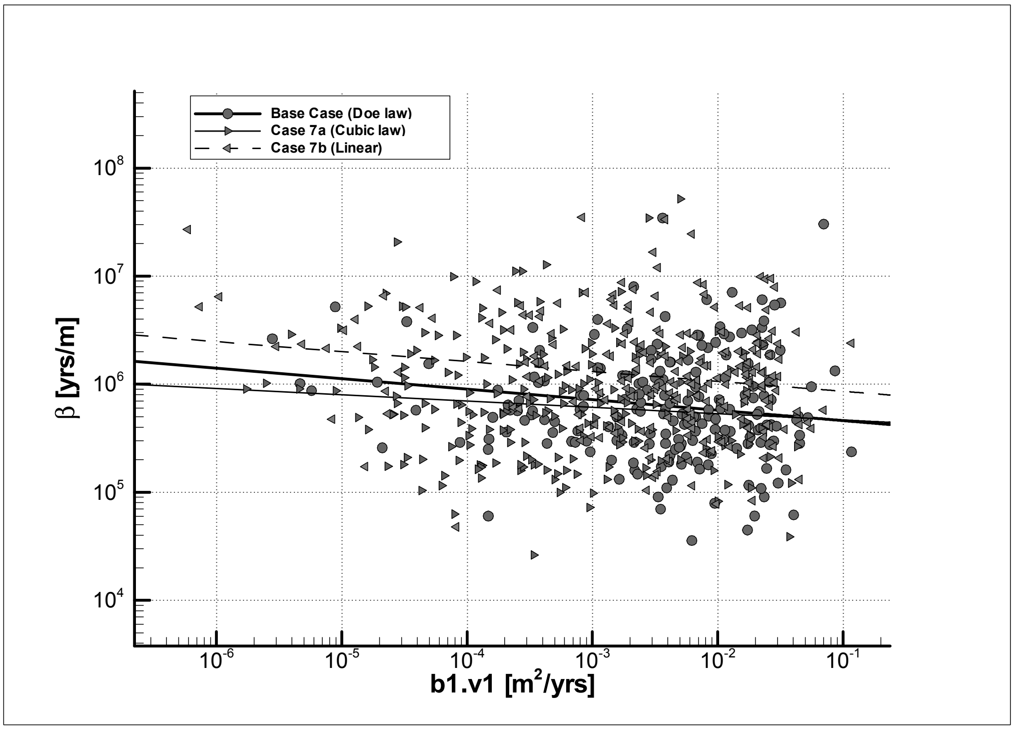

Figure 6.3-4 β *vs. b1v1. Comparison between Base Case, Case 7a and Case 7b data.*

Table 6.3-1 Summary tables of the power law fit data of the scatter plots.

Power fit of beta vs. tau scatterplots
beta=exp(A * ln(tau) + B)

Case	A	B
Base	1.587	8.08
Paworks 3	1.148	8.00
Case 1a	0.850	8.97
Case 2	1.257	9.28
Case 4a	1.182	8.55
Case 4b	1.507	7.98
Case 5	1.604	8.08
Case 7a	1.408	9.78
Case 7b	0.611	13.32

Power fit of tau vs. v1 scatterplots
tau=exp(A * ln(v1) + B)

Case	A	B
Base	-0.092	3.59
Case 1a	-0.248	3.76
Case 2	-0.041	4.54
Case 4a	-0.374	5.67
Case 4b	-0.138	4.13
Case 5	-0.089	3.67
Case 7a	-0.034	2.61
Case 7b	-0.009	1.12

Power fit of beta vs. b1v1 scatterplots
beta=exp(A * ln(b1v1) + B)

Case	A	B
Base	-0.097	12.82
Case 1a	-0.224	10.66
Case 2	-0.045	14.56
Case 4a	-0.428	11.28
Case 4b	-0.147	12.81
Case 5	-0.097	13.00
Case 7a	-0.058	12.92

6.4 CCDFs of pooled Lagrangian data

CCDFs of pooled data are built upon data from all realisations grouped together.

Figure 6.4-1 below shows the CCDFs of the travel time τ in the different cases. There are no major variation in the distribution of the travel times between cases, except in their order of magnitude. This has been discussed in the section 6.1.1.

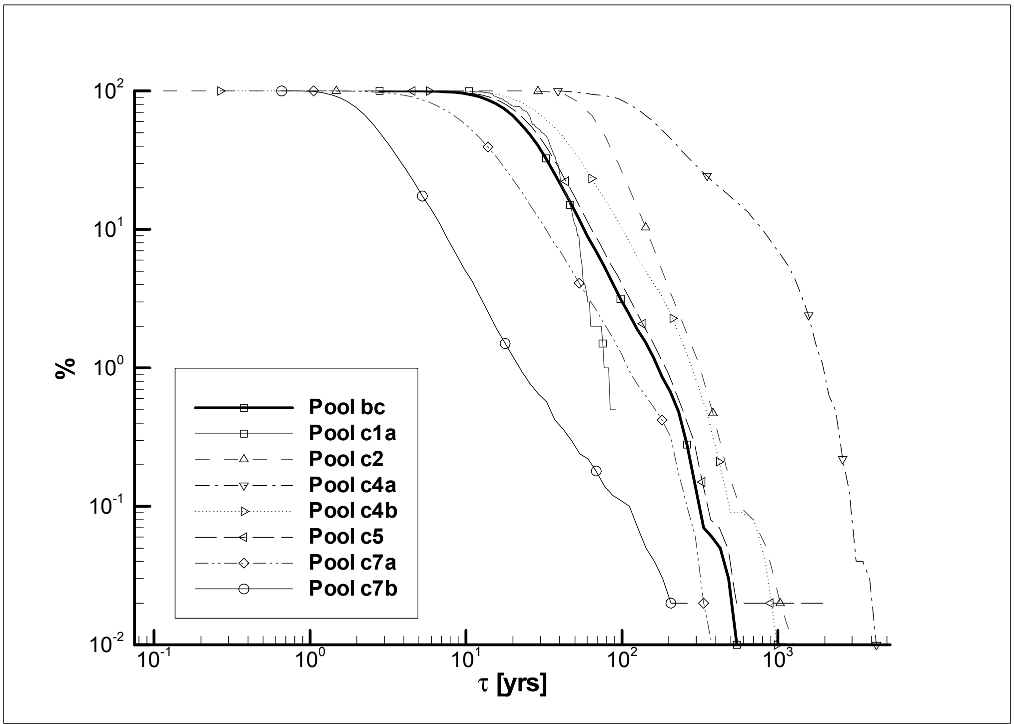

Figure 6.4-1 *CCDFs of τ in years for exited particles for all cases and all realisations (pooled data)*

Figure 6.4-2 below shows the CCDFs of the retention factor β in the different cases. There are no major variation in the distribution of the travel times between cases, except in their order of magnitude and except for Case 1a. The probability of higher values of β in Case 1a is several orders of magnitude lower that for the rest of the cases. The computed retention factor β range is relatively small in Case 1a.

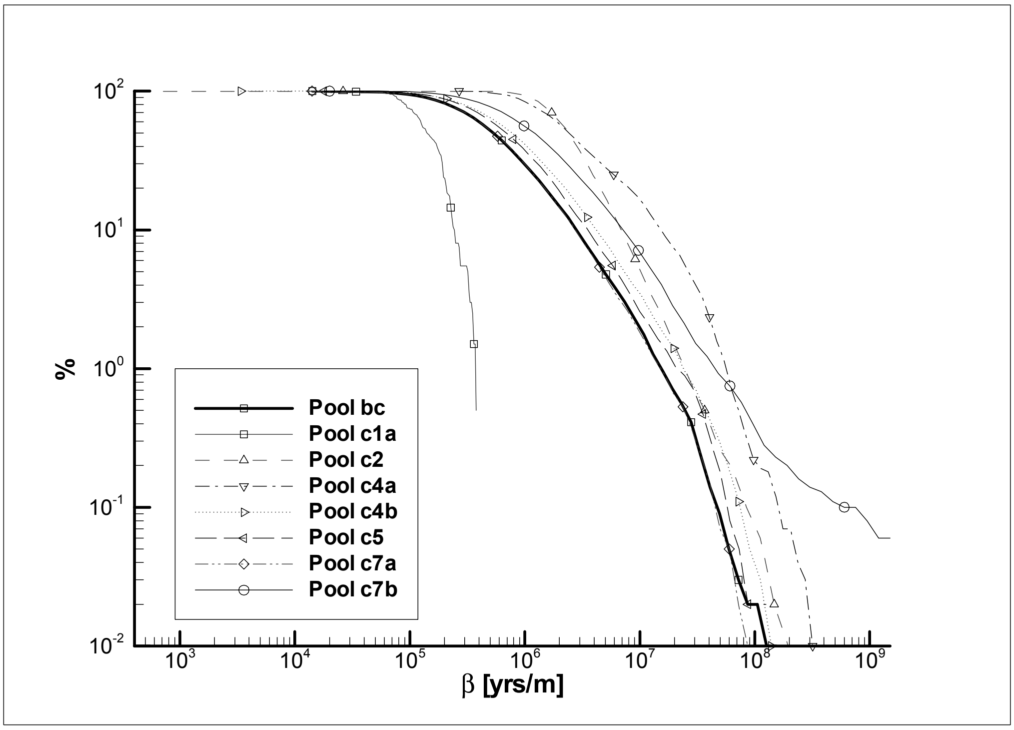

Figure 6.4-2 *CCDFs of β in years/m for exited particles for all cases and all realisations (pooled data)*

Figure 6.4-3 below shows the CCDFs of the ratio 1/v in the different cases. There are no major variation in the distribution of the travel times between cases, except in their order of magnitude. This has been discussed in section 6.1.1.

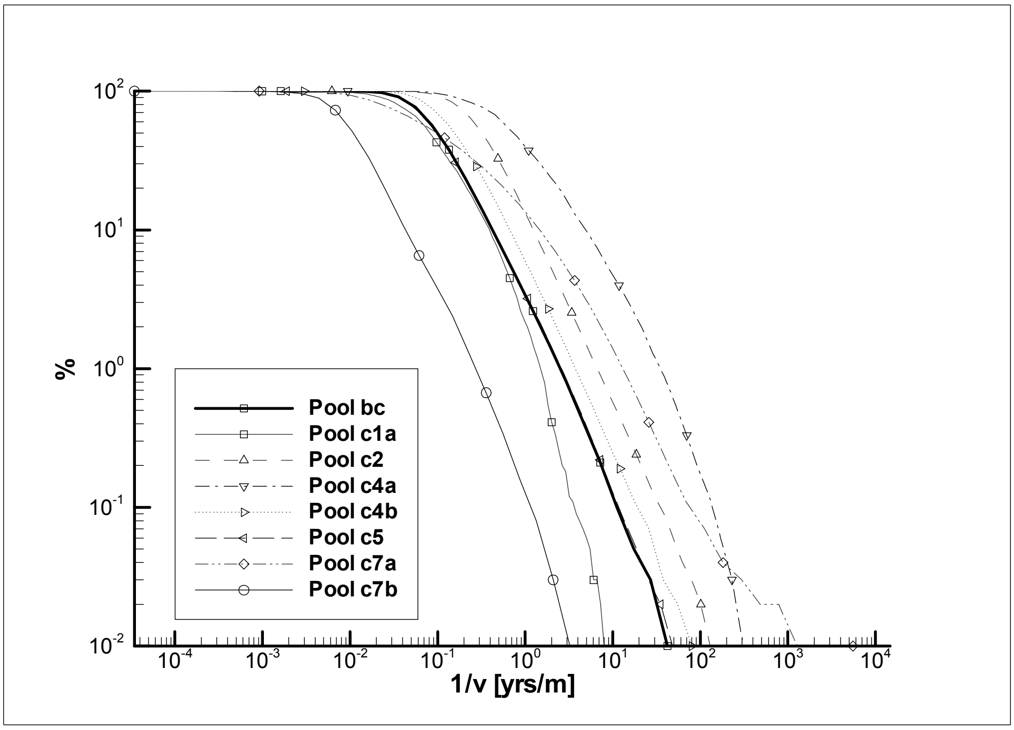

Figure 6.4-3 *CCDFs of 1/v in years/m for all particles for all cases and all realisations (pooled data)*

Figure 6.4-4 below shows the CCDFs of the ratio 1/bv in the different cases. There are no major variation in the distribution of 1/bv between cases, except in their order of magnitude and except for Case 1a. The probability of higher values of 1/bv in Case 1a is several orders of magnitude lower that for the rest of the cases. The computed ratio 1/bv range is relatively small in Case 1a.

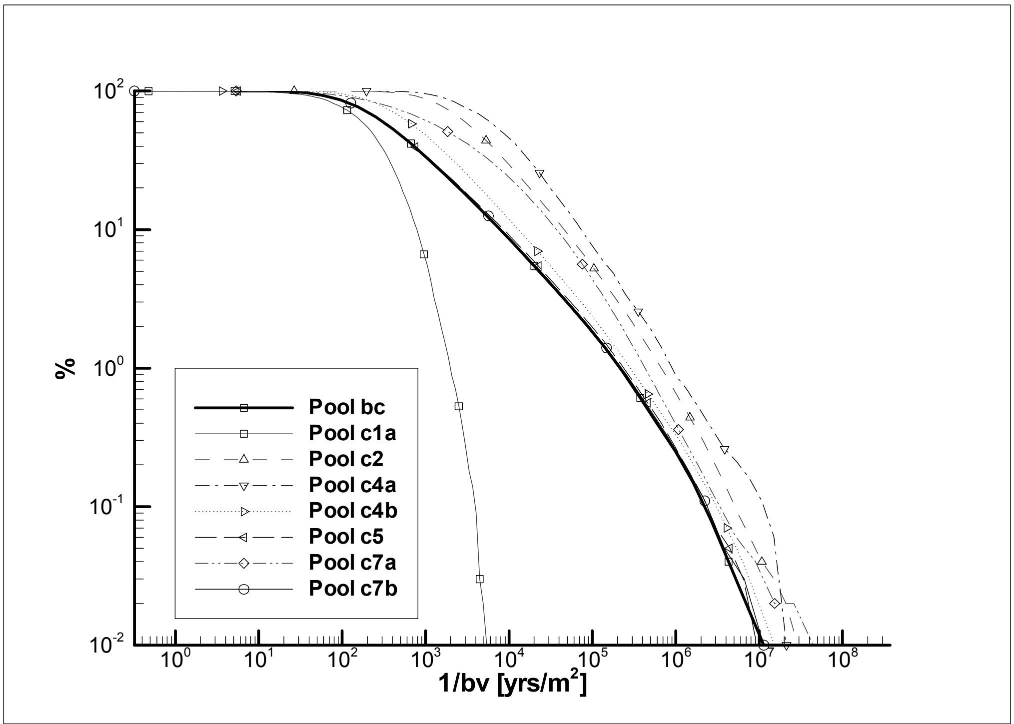

Figure 6.4-4 *CCDFs of 1/bv in years/m^2 for all particles for all cases and all realisations (pooled data).*

6.5 CCDFs of pooled Eulerian results

CCDFs of pooled data are built upon data from all realisations and all pathways grouped together. The CCDF are based on a total of about 30 million data (20 x 1.5 million) for DFN models with non-reduced P_{32}.

Figure 6.5-1 below shows the CCDFs of the ratio 1/v in the different cases.

One can see that there are no major differences between the flow velocity distributions of the Base Case, Case 2, Case 4b, Case 5 and Case 7a.

Case 4a which has a low fracture intensity presents a range of velocities that is larger than for the Base Case. There exists in Case 4a parts of the model with very low velocity.

On the contrary, in Case 7b, where the fracture aperture is based on a linear relationship between transmissivity and aperture, the flow velocity is increased by one order of magnitude.

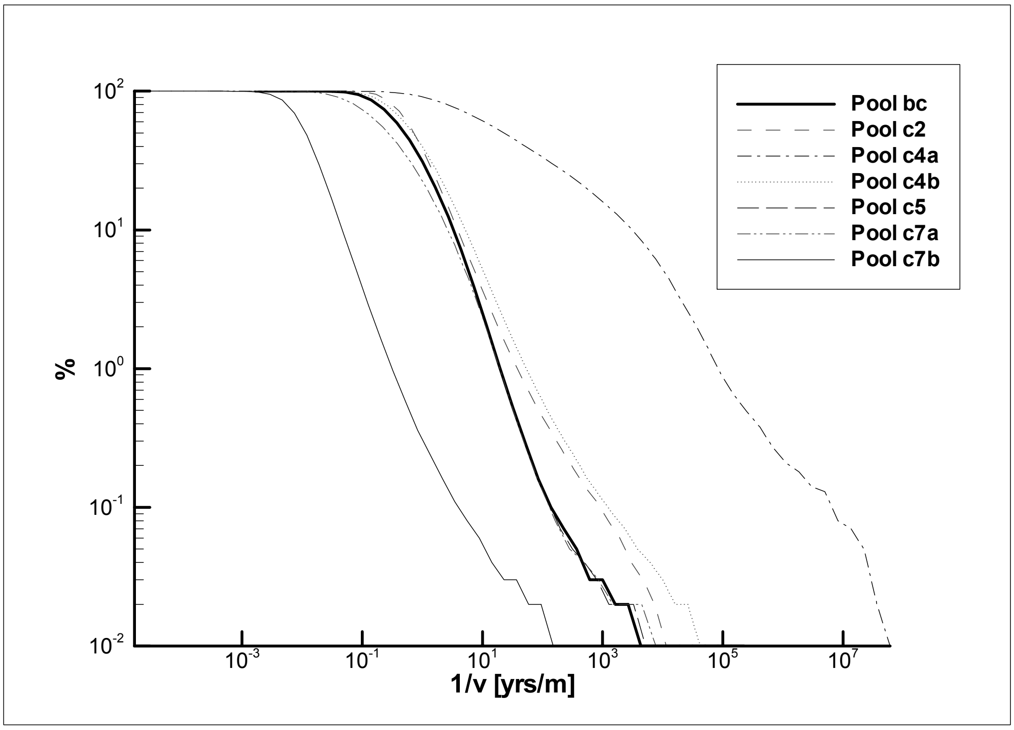

Figure 6.5-1 *CCDFs of 1/v in years/m for all particles for all cases and all realisations (pooled data)*

Figure 6.5-2 below shows the CCDFs of the ratio 1/bv in the different cases.

One can see that there are no major differences between the flow velocity distributions of the Base Case, Case 2, Case 4b, Case 5, Case 7a and Case 7b.

Note that there are no major differences between the Base Case and Case 7b for 1/bv. In fact, 1/bv reflects the discharge through the DFN. The results confirm the discharge is not affected by the fracture aperture but the fracture transmissivity.

Case 4a which has a low fracture intensity presents a range of discharge that is larger than for the Base Case. There exists in Case 4a parts of the model with very low discharge.

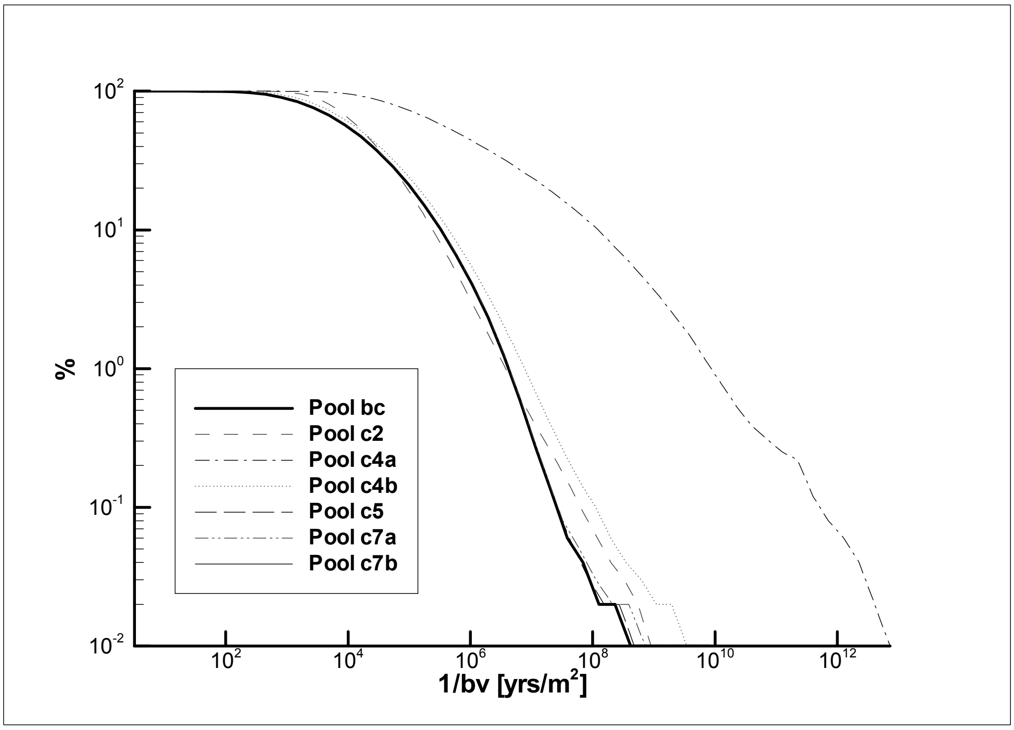

Figure 6.5-2 *CCDFs of 1/bv in years/m^2 for all particles for all cases and all realisations (pooled data).*

7 Conclusions

This report presents a sensitivity analysis of pathway simulations in a DFN model. The sensitivity analysis is based on several alternative cases. These cases consider changing of parameters in a base case.

The project provided the following results:

- The alternative streamline routing algorithm implemented in MAFIC (Case 5) provides results that are very similar to the Base Case
- Case 4b where an alternative fracture intensity P_{32} is set to 50% of the original fracture intensity produces results very similar to the Base Case. A high level of confidence in the evaluation of P_{32} from field data is therefore not required as long as the fracture intensity is sufficient.
- Case 4a where an alternative fracture intensity P_{32} is set to 10% of the original fracture intensity produces results that are different from the Base Case. A fracture intensity too low can greatly affect the connectivity of the DFN.
- The use of the Doe law and the cubic law as a relationship between the fracture aperture and the transmissivity presents significant but not large differences.
- The use of a linear relationship between the fracture aperture and the transmissivity was found difficult to calibrate and is inappropriate for the wide range of transmissivities used in the study.
- A correlation between the velocity or discharge in the vicinity of the upstream boundaries and the general characteristics of the pathways could not be observed
- The CCDFs of the travel time of the particles show similar results. The results can still change by some orders of magnitude depending on the boundary conditions.
- The CCDFs of the retention factor are similar for cases using the MAFIC transport solutions. The PAWorks solution is rather different and presents lower retention factors within a smaller range.
- The CCDFs of the ratio 1/bv of the Lagrangian data are similar for cases using the MAFIC transport solutions. The PAWorks solution is rather different and presents lower ratio 1/bv within a smaller range.
- The Eulerian CCDFs of 1/v and 1/bv show that all cases except Case 4a behave in a similar way. Some differences in scale can still be seen in some cases. Case 4a behaves differently due to the low fracture intensity that has been used.

8 References

Cvetkovic, V., Painter, S., and Selroos, J.-O., Geosphere Performance Analysis (GEPS) for site selection and safety assessment: Theory and application examples, SKB Report in prep.

Outters, N., and D. Shuttle. Sensitivity analysis of a discrete fracture network model for performance assessment of Aberg, SKB R-00-48.

Painter, S., Cvetkovic, V., and Selroos, J.-O. Transport and retention in fractured rock: Consequences of a power-law distribution for fracture lengths, Physical Review E 57(1998):6, pp. 6917-6922

Stigsson, M., Outters, N. and J. Hermanson. Prototype Repository Hydraulic DFN Model no.2. SKB IPR-01-39.

Appendix A

1 Base Case

1.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 1-1 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-1.06	0.43	-1.51	-0.96	-0.23	1.28
2	-1.01	0.41	-1.53	-1.01	-0.17	1.37
3	-1.03	0.43	-1.54	-1.08	-0.15	1.39
4	-0.99	0.43	-1.57	-1.02	-0.11	1.46
5	-1.06	0.43	-1.56	-1.11	-0.22	1.34
6	-0.99	0.43	-1.56	-0.97	-0.19	1.36
7	-1.06	0.44	-1.63	-1.11	-0.20	1.43
8	-0.99	0.41	-1.49	-1.05	-0.16	1.33
9	-1.09	0.43	-1.63	-1.13	-0.24	1.39
10	-1.03	0.42	-1.49	-1.02	-0.18	1.31
11	-0.99	0.43	-1.54	-1.04	-0.14	1.41
12	-0.93	0.42	-1.50	-0.90	-0.11	1.39
13	-1.05	0.43	-1.56	-1.04	-0.22	1.34
14	-1.08	0.43	-1.61	-1.13	-0.26	1.35
15	-1.13	0.45	-1.69	-1.09	-0.24	1.45
16	-1.11	0.43	-1.59	-1.07	-0.24	1.35
17	-1.00	0.42	-1.49	-1.03	-0.19	1.30
18	-1.02	0.43	-1.51	-1.02	-0.14	1.38
19	-1.21	0.49	-1.81	-1.20	-0.25	1.56
20	-0.97	0.43	-1.50	-0.98	-0.16	1.33
Mean	**-1.04**	**0.43**	**-1.57**	**-1.05**	**-0.19**	**1.38**
Pooled	***-1.04***	***0.44***	***-1.55***	***-0.98***	***-0.21***	***1.34***

Table 1-2 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	2.69	0.77	1.80	2.61	4.24	2.44
2	2.77	0.75	1.89	2.72	4.25	2.36
3	2.68	0.82	1.72	2.61	4.38	2.66
4	2.75	0.82	1.69	2.65	4.42	2.73
5	2.66	0.81	1.71	2.64	4.25	2.54
6	2.79	0.79	1.90	2.68	4.35	2.44
7	2.66	0.82	1.69	2.53	4.38	2.69
8	2.81	0.75	1.96	2.73	4.39	2.43
9	2.58	0.81	1.78	2.49	4.17	2.39
10	2.73	0.80	1.69	2.64	4.27	2.58
11	2.76	0.81	1.77	2.73	4.37	2.59
12	2.86	0.77	1.95	2.85	4.38	2.43
13	2.65	0.84	1.50	2.59	4.37	2.87
14	2.60	0.83	1.58	2.56	4.24	2.65
15	2.58	0.83	1.64	2.53	4.18	2.54
16	2.57	0.84	1.51	2.57	4.25	2.74
17	2.76	0.79	1.83	2.63	4.38	2.55
18	2.74	0.80	1.75	2.74	4.29	2.54
19	2.42	0.90	1.46	2.37	4.20	2.74
20	2.73	0.84	1.62	2.73	4.38	2.76
Mean	**2.69**	**0.81**	**1.72**	**2.63**	**4.31**	**2.58**
Pooled	***2.68***	***0.82***	***1.65***	***2.71***	***4.40***	***2.75***

X5, X50 and X95 represent respectively the 5%, 50% and 95% percentiles of the studied variables.

Table 1-3 Summary table of τ [yrs]

Real	mean	stdev	X5	X50	X95	X95-X5
1	31.70	35.64	10.89	24.71	72.44	61.55
2	36.98	38.76	13.37	27.48	88.33	74.95
3	36.12	37.78	12.63	27.71	82.39	69.76
4	42.78	45.52	13.43	31.29	110.41	96.98
5	34.36	25.70	12.24	28.05	79.61	67.37
6	37.42	28.06	13.83	30.07	93.08	79.25
7	33.48	28.57	12.42	26.43	82.49	70.08
8	34.59	27.02	11.68	27.82	81.41	69.73
9	34.07	35.71	10.28	24.20	99.39	89.12
10	32.15	26.54	12.79	24.94	78.63	65.84
11	41.65	38.88	15.06	31.13	106.45	91.39
12	42.34	34.71	15.36	33.81	95.86	80.50
13	35.09	36.70	11.57	26.62	86.81	75.24
14	32.14	29.67	10.92	24.29	81.51	70.59
15	28.44	25.57	8.84	22.25	74.84	66.00
16	28.84	27.87	8.95	21.81	65.12	56.17
17	36.66	31.02	13.06	30.64	80.70	67.64
18	41.38	53.55	13.92	29.00	110.43	96.51
19	25.56	20.75	7.76	19.91	63.35	55.59
20	40.19	31.53	15.27	32.25	84.96	69.70
Mean	**35.04**	**33.05**	**12.05**	**26.96**	**85.96**	**73.91**
Pooled	***35.07***	***34.31***	***11.71***	***26.85***	***87.43***	***75.72***

Table 1-4 Summary table of β [yrs/m2]

Real	mean	stdev	X5	X50	X95	X95-X5
1	1.21E+06	2.84E+06	1.41E+05	5.04E+05	4.13E+06	3.99E+06
2	1.69E+06	6.19E+06	4.62E+05	8.83E+05	5.51E+06	5.05E+06
3	1.65E+06	3.51E+06	2.12E+05	6.88E+05	5.83E+06	5.62E+06
4	2.02E+06	4.80E+06	1.79E+05	8.78E+05	6.61E+06	6.43E+06
5	1.40E+06	3.05E+06	1.92E+05	6.75E+05	4.70E+06	4.51E+06
6	2.11E+06	5.79E+06	2.15E+05	7.31E+05	8.12E+06	7.91E+06
7	1.69E+06	3.48E+06	1.36E+05	6.69E+05	8.01E+06	7.88E+06
8	1.31E+06	2.54E+06	1.16E+05	6.42E+05	4.41E+06	4.29E+06
9	1.62E+06	4.25E+06	1.85E+05	5.12E+05	6.57E+06	6.38E+06
10	1.32E+06	3.09E+06	1.94E+05	6.56E+05	4.50E+06	4.31E+06
11	1.48E+06	2.69E+06	2.46E+05	8.01E+05	5.46E+06	5.22E+06
12	1.94E+06	6.69E+06	4.03E+05	7.39E+05	6.45E+06	6.04E+06
13	1.76E+06	6.22E+06	3.33E+05	6.43E+05	6.21E+06	5.88E+06
14	1.72E+06	5.18E+06	2.21E+05	5.99E+05	6.28E+06	6.06E+06
15	1.25E+06	2.68E+06	9.79E+04	4.90E+05	5.27E+06	5.17E+06
16	1.08E+06	2.71E+06	1.32E+05	4.91E+05	3.60E+06	3.47E+06
17	1.37E+06	2.49E+06	2.07E+05	6.57E+05	5.16E+06	4.96E+06
18	1.80E+06	6.16E+06	4.00E+05	7.53E+05	6.39E+06	5.99E+06
19	1.11E+06	2.65E+06	1.10E+05	4.89E+05	3.71E+06	3.60E+06
20	1.64E+06	4.06E+06	1.93E+05	7.59E+05	4.30E+06	4.10E+06
Mean	**1.56E+06**	**4.05E+06**	**2.19E+05**	**6.63E+05**	**5.56E+06**	**5.34E+06**
Pooled	***1.55E+06***	***4.28E+06***	***4.34E+05***	***8.55E+05***	***5.48E+06***	***5.05E+06***

1.2 Eulerian results

Table 1-1 Summary table of $\log_{10}$(v [m/yrs])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	0.36	0.58	-0.59	0.43	1.25	1.84
2	0.35	0.59	-0.65	0.45	1.25	1.90
3	0.36	0.58	-0.64	0.45	1.23	1.87
4	0.35	0.59	-0.64	0.45	1.24	1.89
5	0.36	0.58	-0.66	0.42	1.25	1.91
6	0.36	0.56	-0.60	0.41	1.20	1.80
7	0.38	0.58	-0.62	0.44	1.25	1.87
8	0.36	0.57	-0.62	0.41	1.21	1.83
9	0.36	0.59	-0.67	0.45	1.25	1.92
10	0.38	0.57	-0.58	0.47	1.22	1.81
11	0.37	0.57	-0.62	0.45	1.26	1.87
12	0.35	0.58	-0.67	0.42	1.21	1.88
13	0.37	0.59	-0.61	0.48	1.25	1.86
14	0.37	0.57	-0.63	0.45	1.23	1.85
15	0.38	0.58	-0.58	0.43	1.25	1.83
16	0.38	0.59	-0.65	0.45	1.27	1.92
17	0.35	0.58	-0.62	0.42	1.22	1.84
18	0.36	0.58	-0.63	0.42	1.24	1.86
19	0.38	0.57	-0.59	0.43	1.26	1.85
20	0.34	0.58	-0.68	0.41	1.20	1.88
Mean	**0.36**	**0.58**	**-0.62**	**0.44**	**1.24**	**1.86**
Pooled	***0.36***	***0.58***	***-0.63***	***0.44***	***1.24***	***1.87***

Table 1-2 Summary table of $\log_{10}$(b [m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-4.41	0.51	-5.23	-4.39	-3.55	1.68
2	-4.39	0.51	-5.24	-4.38	-3.55	1.69
3	-4.40	0.52	-5.27	-4.41	-3.50	1.77
4	-4.40	0.52	-5.27	-4.39	-3.51	1.76
5	-4.40	0.52	-5.24	-4.40	-3.52	1.72
6	-4.41	0.51	-5.24	-4.40	-3.55	1.69
7	-4.40	0.53	-5.26	-4.39	-3.51	1.75
8	-4.41	0.51	-5.26	-4.40	-3.56	1.70
9	-4.39	0.53	-5.25	-4.39	-3.51	1.74
10	-4.40	0.51	-5.25	-4.39	-3.55	1.70
11	-4.39	0.51	-5.21	-4.39	-3.50	1.71
12	-4.40	0.52	-5.24	-4.38	-3.53	1.71
13	-4.41	0.52	-5.27	-4.40	-3.53	1.74
14	-4.39	0.51	-5.23	-4.38	-3.56	1.68
15	-4.39	0.52	-5.24	-4.40	-3.52	1.72
16	-4.39	0.52	-5.25	-4.39	-3.55	1.70
17	-4.39	0.51	-5.24	-4.39	-3.54	1.70
18	-4.40	0.51	-5.22	-4.41	-3.56	1.66
19	-4.40	0.52	-5.20	-4.40	-3.52	1.69
20	-4.40	0.53	-5.25	-4.41	-3.51	1.74
Mean	**-4.40**	**0.52**	**-5.24**	**-4.39**	**-3.53**	**1.71**
Pooled	***-4.40***	***0.52***	***-5.24***	***-4.39***	***-3.54***	***1.70***

Table 1-3 **Summary table of $\log_{10}$(1/v [yrs/m])**

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.36	0.58	-1.19	-0.38	0.64	1.84
2	-0.35	0.59	-1.20	-0.40	0.71	1.90
3	-0.36	0.58	-1.19	-0.41	0.69	1.87
4	-0.35	0.59	-1.19	-0.40	0.69	1.89
5	-0.36	0.58	-1.21	-0.38	0.70	1.91
6	-0.36	0.56	-1.16	-0.37	0.64	1.80
7	-0.38	0.58	-1.21	-0.39	0.67	1.87
8	-0.36	0.57	-1.16	-0.37	0.66	1.83
9	-0.36	0.59	-1.20	-0.40	0.72	1.92
10	-0.38	0.57	-1.17	-0.42	0.63	1.81
11	-0.37	0.57	-1.22	-0.41	0.66	1.87
12	-0.35	0.58	-1.17	-0.38	0.72	1.88
13	-0.37	0.59	-1.20	-0.42	0.66	1.86
14	-0.37	0.57	-1.19	-0.41	0.63	1.82
15	-0.38	0.58	-1.20	-0.43	0.63	1.83
16	-0.38	0.59	-1.23	-0.41	0.69	1.92
17	-0.35	0.58	-1.17	-0.37	0.67	1.85
18	-0.36	0.58	-1.19	-0.37	0.67	1.86
19	-0.38	0.57	-1.22	-0.39	0.63	1.85
20	-0.34	0.58	-1.19	-0.37	0.73	1.92
Mean	**-0.36**	**0.58**	**-1.19**	**-0.40**	**0.67**	**1.86**
Pooled	***-0.36***	***0.58***	***-1.19***	***-0.38***	***0.69***	***1.87***

Table 1-4 **Summary table of $\log_{10}$(1/bv [yrs/m2])**

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	4.04	0.99	2.54	4.03	5.77	3.23
2	4.04	0.99	2.55	4.01	5.82	3.27
3	4.05	1.01	2.50	4.02	5.83	3.33
4	4.04	1.01	2.53	4.01	5.81	3.28
5	4.04	1.01	2.51	4.03	5.82	3.31
6	4.05	0.98	2.57	4.03	5.78	3.20
7	4.02	1.01	2.47	4.00	5.82	3.35
8	4.05	0.99	2.52	4.02	5.79	3.27
9	4.04	1.02	2.50	4.01	5.84	3.35
10	4.02	0.99	2.54	4.01	5.78	3.24
11	4.02	0.99	2.49	4.02	5.73	3.25
12	4.05	1.00	2.55	3.99	5.83	3.28
13	4.04	1.00	2.51	4.03	5.80	3.29
14	4.02	0.99	2.53	4.01	5.79	3.26
15	4.01	1.01	2.48	3.99	5.80	3.32
16	4.02	1.01	2.48	3.98	5.82	3.35
17	4.04	0.99	2.54	4.02	5.78	3.24
18	4.04	0.99	2.52	4.03	5.75	3.23
19	4.02	0.99	2.49	3.98	5.72	3.24
20	4.07	1.00	2.53	4.06	5.83	3.30
Mean	**4.04**	**1.00**	**2.52**	**4.01**	**5.80**	**3.28**
Pooled	***4.04***	***1.00***	***2.50***	***4.00***	***5.81***	***3.31***

2 Case 1a

2.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 2-1 Summary table of $\log_{10}(1/v$ [yrs/m]$)$

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.95	0.44	-1.61	-1.01	-0.16	1.46
2	-0.92	0.52	-1.85	-0.94	-0.02	1.83
3	-1.19	0.54	-2.06	-1.13	-0.27	1.79
4	-1.12	0.50	-1.81	-1.14	-0.23	1.58
5	-1.07	0.39	-1.70	-1.07	-0.36	1.34
6	-0.92	0.52	-1.76	-0.98	0.12	1.88
7	-1.14	0.51	-1.91	-1.13	-0.15	1.75
8	-0.96	0.49	-1.68	-0.99	-0.06	1.62
9	-1.00	0.49	-1.65	-0.97	-0.21	1.44
10	-1.21	0.48	-1.96	-1.21	-0.37	1.59
11	-1.25	0.46	-1.92	-1.25	-0.45	1.47
12	-0.98	0.44	-1.61	-0.99	-0.21	1.41
13	-0.95	0.51	-1.68	-0.96	-0.14	1.54
14	-1.09	0.47	-1.75	-1.14	-0.23	1.51
15	-1.03	0.50	-1.69	-1.10	-0.08	1.61
16	-0.85	0.49	-1.53	-0.87	0.01	1.54
17	-1.02	0.47	-1.72	-1.06	-0.15	1.57
18	-1.03	0.52	-1.96	-1.06	-0.11	1.85
19	-0.98	0.45	-1.70	-1.10	-0.23	1.47
20	-1.10	0.38	-1.70	-1.09	-0.43	1.27
Mean	**-1.04**	**0.48**	**-1.77**	**-1.06**	**-0.17**	**1.59**
Pooled	***-1.04***	***0.49***	***-1.77***	***-1.05***	***-0.17***	***1.59***

Table 2-2 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	2.51	0.38	1.85	2.57	3.06	1.21
2	2.59	0.38	1.89	2.62	3.10	1.21
3	2.10	0.58	1.11	2.18	2.92	1.81
4	2.11	0.52	1.21	2.19	2.82	1.61
5	2.44	0.40	1.73	2.47	3.09	1.36
6	2.30	0.40	1.62	2.31	2.96	1.33
7	2.13	0.49	1.17	2.15	2.88	1.71
8	2.51	0.45	1.66	2.51	3.20	1.54
9	2.27	0.51	1.47	2.38	2.93	1.46
10	2.08	0.46	1.29	2.10	2.84	1.55
11	2.09	0.53	1.15	2.19	2.80	1.65
12	2.48	0.38	1.78	2.49	3.05	1.27
13	2.42	0.47	1.57	2.48	3.09	1.52
14	2.24	0.39	1.57	2.28	2.85	1.28
15	2.39	0.47	1.66	2.40	3.19	1.53
16	2.68	0.43	1.98	2.66	3.38	1.40
17	2.32	0.44	1.59	2.40	2.99	1.40
18	2.39	0.50	1.53	2.46	3.16	1.62
19	2.45	0.36	1.91	2.46	3.05	1.14
20	2.23	0.41	1.54	2.31	2.84	1.30
Mean	**2.34**	**0.45**	**1.56**	**2.38**	**3.01**	**1.45**
Pooled	***2.34***	***0.48***	***1.50***	***2.40***	***3.07***	***1.57***

Table 2-3 Summary table of τ [yrs]

Real	mean	stdev
1	41.15	8.50
2	42.20	11.06
3	24.72	6.23
4	22.87	4.46
5	23.78	6.60
6	44.83	8.99
7	23.24	13.98
8	44.32	11.41
9	29.92	3.69
10	26.55	7.67
11	19.61	12.09
12	37.66	5.76
13	36.75	6.65
14	37.46	19.71
15	39.57	22.96
16	43.66	26.60
17	21.99	8.90
18	33.84	11.07
19	36.04	8.89
20	27.58	3.46
Mean	**33.17**	**10.80**
Pooled	***32.89***	***14.17***

Table 2-4 Summary table of β [yrs/m2]

Real	mean	stdev
1	2.07E+05	2.18E+04
2	2.29E+05	3.45E+04
3	1.04E+05	2.75E+04
4	8.92E+04	4.21E+04
5	1.71E+05	3.97E+04
6	1.18E+05	1.34E+04
7	9.83E+04	8.07E+04
8	2.60E+05	7.45E+04
9	1.46E+05	5.52E+03
10	9.99E+04	1.26E+04
11	9.66E+04	5.04E+04
12	2.03E+05	7.63E+03
13	1.74E+05	4.37E+04
14	1.23E+05	2.03E+04
15	1.87E+05	7.48E+04
16	2.72E+05	1.13E+05
17	1.04E+05	4.42E+04
18	1.73E+05	8.56E+04
19	1.82E+05	1.70E+04
20	1.24E+05	3.11E+04
Mean	**1.58E+05**	**4.20E+04**
Pooled	***1.58E+05***	***7.33E+04***

3 Case 2

3.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 3-1 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.49	0.43	-1.08	-0.53	0.28	1.35
2	-0.52	0.42	-1.12	-0.56	0.24	1.35
3	-0.51	0.43	-1.11	-0.53	0.27	1.38
4	-0.49	0.43	-1.08	-0.53	0.29	1.37
5	-0.48	0.43	-1.07	-0.51	0.29	1.36
6	-0.49	0.43	-1.11	-0.52	0.28	1.39
7	-0.48	0.43	-1.09	-0.52	0.30	1.38
8	-0.50	0.42	-1.07	-0.53	0.27	1.34
9	-0.54	0.42	-1.12	-0.57	0.21	1.33
10	-0.51	0.43	-1.11	-0.55	0.26	1.36
11	-0.51	0.42	-1.10	-0.54	0.28	1.38
12	-0.48	0.44	-1.08	-0.52	0.32	1.41
13	-0.52	0.42	-1.10	-0.55	0.23	1.32
14	-0.50	0.43	-1.11	-0.53	0.28	1.39
15	-0.46	0.44	-1.06	-0.50	0.32	1.38
16	-0.54	0.43	-1.13	-0.57	0.23	1.36
17	-0.52	0.43	-1.11	-0.56	0.26	1.37
18	-0.51	0.43	-1.11	-0.55	0.27	1.37
19	-0.50	0.43	-1.12	-0.53	0.28	1.40
20	-0.49	0.43	-1.09	-0.52	0.28	1.37
Mean	**-0.50**	**0.43**	**-1.10**	**-0.54**	**0.27**	**1.37**
Pooled	***-0.50***	***0.43***	***-1.10***	***-0.52***	***0.27***	***1.37***

Table 3-2 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	3.67	0.70	2.71	3.58	4.99	2.28
2	3.62	0.70	2.67	3.56	4.94	2.26
3	3.64	0.70	2.71	3.57	4.96	2.26
4	3.67	0.69	2.74	3.59	4.99	2.25
5	3.69	0.70	2.77	3.59	5.04	2.27
6	3.67	0.70	2.71	3.59	4.99	2.29
7	3.69	0.70	2.75	3.60	5.04	2.28
8	3.67	0.69	2.75	3.56	4.98	2.23
9	3.61	0.69	2.71	3.53	4.93	2.22
10	3.65	0.70	2.72	3.57	4.96	2.25
11	3.63	0.70	2.68	3.54	4.98	2.30
12	3.67	0.71	2.72	3.59	5.02	2.30
13	3.62	0.70	2.72	3.53	4.95	2.24
14	3.67	0.69	2.72	3.59	4.97	2.25
15	3.68	0.69	2.76	3.59	4.98	2.22
16	3.61	0.71	2.67	3.51	4.94	2.27
17	3.63	0.70	2.70	3.54	4.98	2.28
18	3.64	0.71	2.70	3.56	5.01	2.31
19	3.65	0.71	2.68	3.57	5.00	2.32
20	3.66	0.71	2.71	3.57	5.00	2.29
Mean	**3.65**	**0.70**	**2.71**	**3.57**	**4.98**	**2.27**
Pooled	***3.65***	***0.70***	***2.71***	***3.58***	***4.98***	***2.26***

X5, X50 and X95 represent respectively the 5%, 50% and 95% percentiles of the studied variables.

Table 3-3 Summary table of τ [yrs]

Real	mean	stdev	X5	X50	X95	X95-X5
1	101.57	60.13	48.89	87.04	198.79	149.90
2	93.26	49.10	44.25	80.07	191.53	147.28
3	93.56	53.16	42.31	82.54	189.14	146.83
4	96.98	51.23	47.07	86.27	184.26	137.20
5	108.25	59.05	53.86	93.51	210.14	156.29
6	95.81	43.99	51.04	85.46	178.60	127.56
7	109.43	77.50	54.36	91.02	269.08	214.72
8	95.91	48.63	53.21	85.73	191.40	138.19
9	87.78	49.30	42.52	74.43	180.82	138.30
10	101.13	90.29	46.45	83.38	204.71	158.25
11	96.11	53.59	46.01	81.82	205.52	159.51
12	112.26	65.72	51.51	94.36	240.96	189.45
13	86.91	46.05	48.01	76.00	180.98	132.97
14	109.38	112.61	55.44	89.49	225.71	170.27
15	116.51	89.47	54.12	98.29	243.42	189.30
16	91.49	60.33	44.18	77.43	200.94	156.76
17	97.04	57.22	45.86	83.68	212.74	166.88
18	91.97	47.99	44.92	80.72	176.81	131.89
19	98.70	49.04	46.18	88.02	191.76	145.58
20	99.04	54.33	49.03	85.64	207.04	158.01
Mean	**99.16**	**61.28**	**48.43**	**85.22**	**204.07**	**155.64**
Pooled	***98.68***	***62.83***	***47.34***	***83.49***	***200.27***	***152.94***

Table 3-4 Summary table of β [yrs/m2]

Real	mean	stdev	X5	X50	X95	X95-X5
1	3.90E+06	3.59E+06	1.16E+06	2.96E+06	1.11E+07	9.97E+06
2	4.13E+06	1.06E+07	1.30E+06	3.08E+06	9.32E+06	8.01E+06
3	3.45E+06	3.54E+06	1.15E+06	2.53E+06	9.21E+06	8.05E+06
4	3.99E+06	6.00E+06	1.61E+06	3.12E+06	9.63E+06	8.02E+06
5	4.64E+06	6.45E+06	1.49E+06	3.51E+06	1.16E+07	1.01E+07
6	4.23E+06	4.70E+06	1.25E+06	2.99E+06	1.22E+07	1.09E+07
7	4.32E+06	6.20E+06	1.56E+06	3.40E+06	1.12E+07	9.66E+06
8	4.41E+06	6.50E+06	1.43E+06	2.80E+06	1.28E+07	1.14E+07
9	3.51E+06	4.81E+06	1.23E+06	2.47E+06	9.89E+06	8.66E+06
10	4.55E+06	9.39E+06	1.19E+06	3.35E+06	1.13E+07	1.01E+07
11	3.93E+06	4.31E+06	1.24E+06	2.69E+06	1.19E+07	1.06E+07
12	5.35E+06	8.52E+06	1.53E+06	3.42E+06	1.57E+07	1.41E+07
13	4.15E+06	6.93E+06	1.13E+06	2.57E+06	1.22E+07	1.10E+07
14	4.41E+06	7.04E+06	1.56E+06	3.02E+06	1.23E+07	1.08E+07
15	4.98E+06	6.65E+06	1.25E+06	3.17E+06	1.72E+07	1.59E+07
16	4.02E+06	5.84E+06	1.07E+06	2.84E+06	1.05E+07	9.43E+06
17	4.37E+06	6.36E+06	1.31E+06	2.97E+06	1.21E+07	1.08E+07
18	4.43E+06	6.52E+06	9.14E+05	3.06E+06	1.27E+07	1.18E+07
19	4.32E+06	4.80E+06	1.18E+06	2.88E+06	1.39E+07	1.27E+07
20	5.93E+06	2.52E+07	2.82E+06	4.75E+06	1.44E+07	1.16E+07
Mean	**4.35E+06**	**7.20E+06**	**1.37E+06**	**3.08E+06**	**1.21E+07**	**1.07E+07**
Pooled	***4.32E+06***	***7.72E+06***	***1.55E+06***	***3.10E+06***	***1.16E+07***	***1.01E+07***

3.2 Eulerian results

Table 3-1 Summary table of $\log_{10}$(v [m/yrs])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	0.16	0.53	-0.76	0.26	0.88	1.65
2	0.20	0.53	-0.73	0.28	0.92	1.65
3	0.20	0.52	-0.71	0.28	0.93	1.64
4	0.16	0.53	-0.78	0.24	0.90	1.68
5	0.17	0.52	-0.73	0.27	0.89	1.61
6	0.16	0.53	-0.75	0.26	0.90	1.65
7	0.17	0.52	-0.75	0.24	0.89	1.65
8	0.17	0.52	-0.73	0.26	0.90	1.63
9	0.19	0.53	-0.75	0.26	0.90	1.65
10	0.18	0.53	-0.73	0.28	0.92	1.65
11	0.20	0.52	-0.72	0.29	0.92	1.64
12	0.17	0.52	-0.75	0.25	0.90	1.65
13	0.19	0.52	-0.73	0.28	0.91	1.63
14	0.16	0.53	-0.76	0.23	0.90	1.66
15	0.15	0.52	-0.75	0.24	0.87	1.62
16	0.20	0.52	-0.72	0.30	0.94	1.66
17	0.20	0.52	-0.73	0.27	0.93	1.66
18	0.18	0.53	-0.74	0.26	0.92	1.66
19	0.18	0.53	-0.74	0.29	0.90	1.64
20	0.17	0.52	-0.74	0.24	0.91	1.64
Mean	**0.18**	**0.53**	**-0.74**	**0.27**	**0.91**	**1.65**
Pooled	***0.18***	***0.53***	***-0.76***	***0.25***	***0.93***	***1.69***

Table 3-2 Summary table of $\log_{10}$(b [m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-4.41	0.45	-5.16	-4.40	-3.65	1.51
2	-4.41	0.45	-5.12	-4.41	-3.65	1.47
3	-4.41	0.45	-5.15	-4.39	-3.65	1.50
4	-4.41	0.45	-5.14	-4.41	-3.65	1.49
5	-4.41	0.45	-5.14	-4.40	-3.65	1.49
6	-4.41	0.45	-5.14	-4.41	-3.65	1.49
7	-4.41	0.45	-5.14	-4.40	-3.65	1.49
8	-4.41	0.45	-5.14	-4.40	-3.67	1.47
9	-4.41	0.45	-5.14	-4.40	-3.65	1.49
10	-4.42	0.46	-5.14	-4.41	-3.65	1.49
11	-4.40	0.45	-5.14	-4.40	-3.65	1.49
12	-4.41	0.45	-5.14	-4.40	-3.65	1.49
13	-4.41	0.45	-5.14	-4.40	-3.65	1.49
14	-4.41	0.45	-5.14	-4.40	-3.66	1.48
15	-4.41	0.46	-5.14	-4.41	-3.65	1.49
16	-4.41	0.45	-5.14	-4.40	-3.65	1.49
17	-4.41	0.45	-5.14	-4.40	-3.65	1.49
18	-4.41	0.46	-5.14	-4.40	-3.65	1.49
19	-4.41	0.46	-5.14	-4.41	-3.65	1.49
20	-4.41	0.46	-5.14	-4.41	-3.63	1.51
Mean	**-4.41**	**0.45**	**-5.14**	**-4.40**	**-3.65**	**1.49**
Pooled	***-4.41***	***0.45***	***-5.14***	***-4.40***	***-3.65***	***1.49***

Table 3-3 Summary table of $\log_{10}(1/v$ [yrs/m]$)$

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.16	0.53	-0.84	-0.21	0.81	1.65
2	-0.20	0.53	-0.87	-0.24	0.78	1.65
3	-0.20	0.52	-0.89	-0.24	0.75	1.64
4	-0.16	0.53	-0.86	-0.20	0.79	1.65
5	-0.17	0.52	-0.84	-0.23	0.77	1.61
6	-0.16	0.53	-0.85	-0.22	0.80	1.66
7	-0.17	0.52	-0.85	-0.20	0.79	1.65
8	-0.17	0.52	-0.86	-0.22	0.77	1.63
9	-0.19	0.53	-0.86	-0.22	0.79	1.66
10	-0.18	0.53	-0.87	-0.24	0.78	1.65
11	-0.20	0.52	-0.88	-0.25	0.76	1.64
12	-0.17	0.52	-0.86	-0.21	0.79	1.66
13	-0.19	0.52	-0.87	-0.24	0.77	1.64
14	-0.16	0.53	-0.86	-0.19	0.80	1.66
15	-0.15	0.52	-0.83	-0.20	0.79	1.62
16	-0.20	0.52	-0.89	-0.25	0.77	1.66
17	-0.20	0.52	-0.88	-0.27	0.78	1.67
18	-0.18	0.53	-0.88	-0.22	0.78	1.66
19	-0.18	0.53	-0.86	-0.25	0.79	1.64
20	-0.17	0.52	-0.87	-0.24	0.78	1.65
Mean	**-0.18**	**0.53**	**-0.86**	**-0.23**	**0.78**	**1.65**
Pooled	***-0.18***	***0.53***	***-0.88***	***-0.20***	***0.76***	***1.64***

Table 3-4 Summary table of $\log_{10}(1/bv$ [yrs/m2]$)$

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	4.25	0.78	3.17	4.20	5.69	2.51
2	4.21	0.78	3.12	4.16	5.62	2.51
3	4.21	0.78	3.16	4.12	5.64	2.48
4	4.25	0.78	3.18	4.17	5.67	2.49
5	4.24	0.77	3.17	4.20	5.64	2.48
6	4.25	0.78	3.16	4.20	5.69	2.52
7	4.24	0.77	3.19	4.18	5.67	2.48
8	4.24	0.77	3.17	4.15	5.66	2.50
9	4.23	0.78	3.17	4.16	5.65	2.49
10	4.24	0.78	3.15	4.18	5.68	2.53
11	4.21	0.77	3.17	4.13	5.63	2.47
12	4.23	0.78	3.16	4.17	5.66	2.50
13	4.22	0.77	3.14	4.17	5.64	2.50
14	4.25	0.78	3.15	4.18	5.69	2.54
15	4.25	0.78	3.20	4.20	5.70	2.49
16	4.22	0.78	3.13	4.17	5.64	2.51
17	4.21	0.78	3.11	4.17	5.65	2.54
18	4.23	0.78	3.16	4.18	5.64	2.49
19	4.23	0.78	3.17	4.15	5.63	2.46
20	4.24	0.78	3.15	4.18	5.67	2.53
Mean	**4.23**	**0.78**	**3.16**	**4.17**	**5.66**	**2.50**
Pooled	***4.23***	***0.78***	***3.17***	***4.16***	***5.64***	***2.47***

4 Case 4a

4.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 4-1 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	0.34	0.61	-0.43	0.20	1.47	1.90
2	0.35	0.48	-0.36	0.33	1.18	1.54
3	0.16	0.65	-0.99	0.15	1.24	2.23
4	0.39	0.92	-0.83	0.25	1.92	2.75
5	0.00	0.64	-0.93	0.02	1.01	1.95
6	0.15	0.58	-0.75	0.16	1.16	1.91
7	0.18	0.53	-0.65	0.18	1.00	1.66
8	0.20	0.56	-0.64	0.15	1.20	1.85
9	-0.33	0.56	-1.10	-0.37	0.65	1.74
10	-0.23	0.48	-0.95	-0.24	0.62	1.57
11	0.17	0.65	-0.91	0.17	1.24	2.15
12	-0.04	0.55	-0.85	-0.08	1.01	1.86
13	0.24	0.58	-0.64	0.26	1.24	1.88
14	-0.10	0.60	-0.91	-0.14	1.00	1.91
15	-0.11	0.58	-0.94	-0.19	0.97	1.92
16	-0.08	0.56	-0.89	-0.17	0.95	1.83
17	-0.34	0.51	-1.14	-0.39	0.59	1.73
18	-0.39	0.45	-1.05	-0.32	0.36	1.41
19	0.44	0.63	-0.69	0.51	1.37	2.06
20	0.23	0.77	-0.75	0.08	1.61	2.36
Mean	**0.06**	**0.60**	**-0.82**	**0.02**	**1.06**	**1.89**
Pooled	***-0.14***	***0.58***	***-1.00***	***-0.19***	***0.94***	***1.94***

Table 4-2 **Summary table of $\log_{10}$(1/bv [yrs/m2])**

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	4.61	0.64	3.86	4.42	5.79	1.92
2	4.45	0.42	3.91	4.37	5.25	1.33
3	4.41	0.77	3.25	4.38	5.77	2.51
4	4.65	1.05	3.28	4.51	6.47	3.19
5	4.12	0.57	3.39	4.00	5.20	1.81
6	4.39	0.63	3.48	4.31	5.46	1.98
7	4.39	0.51	3.70	4.32	5.31	1.61
8	4.39	0.55	3.65	4.34	5.38	1.74
9	3.57	0.66	2.82	3.38	4.65	1.83
10	3.83	0.44	3.23	3.80	4.65	1.42
11	4.34	0.61	3.61	4.18	5.48	1.87
12	4.11	0.63	3.21	4.07	5.29	2.08
13	4.46	0.58	3.67	4.43	5.50	1.83
14	4.14	0.64	3.23	4.14	5.32	2.09
15	4.01	0.71	2.82	4.01	5.26	2.44
16	4.10	0.59	3.40	4.03	5.28	1.88
17	3.86	0.55	3.18	3.75	4.84	1.66
18	3.42	0.55	2.73	3.32	4.54	1.81
19	4.62	0.52	3.88	4.51	5.61	1.72
20	4.54	0.83	3.43	4.34	5.96	2.53
Mean	**4.22**	**0.62**	**3.39**	**4.13**	**5.35**	**1.96**
Pooled	***3.92***	***0.67***	***2.95***	***3.88***	***5.17***	***2.22***

X5, X50 and X95 represent respectively the 5%, 50% and 95% percentiles of the studied variables.

Table 4-3 **Summary table of τ [yrs]**

Real	mean	stdev	X5	X50	X95	X95-X5
1	903.75	625.28	350.24	714.56	2255.94	1905.70
2	659.45	284.47	329.29	575.27	1264.03	934.74
3	764.49	270.53		too few data		
4	1555.30	88.53		too few data		
5	595.32	591.28	213.13	387.29	1780.65	1567.53
6	779.93	532.05	232.44	718.78	1934.62	1702.18
7	605.50	249.84	297.30	637.26	965.90	668.60
8	946.63	640.12	278.97	916.15	1978.11	1699.14
9	155.42	131.72	95.98	112.96	384.48	288.50
10	210.49	97.40	113.62	197.05	397.29	283.67
11	511.64	366.50	257.47	327.00	1439.45	1181.97
12	629.74	588.36	188.89	393.71	2006.64	1817.75
13	797.69	284.38	443.97	769.62	1312.36	868.39
14	407.00	444.03	100.98	185.22	1583.57	1482.60
15	561.71	403.12	216.40	484.29	1234.40	1018.00
16	310.11	365.82	184.61	238.98	728.27	543.66
17	170.21	290.03	61.87	111.63	808.28	746.41
18	185.79	115.51	106.94	181.33	300.37	193.43
19	1189.50	488.18	477.61	1159.57	2114.31	1636.70
20	1185.00	284.15		too few data		
Mean	**628.40**	**360.90**	**232.33**	**477.10**	**1322.86**	**1090.53**
Pooled	***350.35***	***416.65***	***91.74***	***201.25***	***1296.35***	***1204.61***

Table 4-4 Summary table of β [yrs/m2]

Real	mean	stdev	X5	X50	X95	X95-X5
1	2.58E+07	4.31E+07	1.22E+07	2.00E+07	7.49E+07	6.27E+07
2	1.06E+07	8.78E+06	4.64E+06	9.14E+06	2.71E+07	2.25E+07
3	2.42E+07	1.66E+07		too few data		
4	6.54E+07	1.52E+07		too few data		
5	7.36E+06	1.23E+07	3.46E+06	5.50E+06	2.59E+07	2.24E+07
6	2.17E+07	2.18E+07	3.81E+06	1.66E+07	7.88E+07	7.50E+07
7	1.11E+07	7.58E+06	4.39E+06	1.09E+07	2.11E+07	1.67E+07
8	1.96E+07	2.49E+07	9.84E+06	1.62E+07	5.45E+07	4.46E+07
9	2.84E+06	1.20E+07		too few data		
10	3.02E+06	5.47E+06		too few data		
11	8.13E+06	4.89E+06	4.22E+06	6.77E+06	2.13E+07	1.71E+07
12	1.97E+07	3.04E+07	5.86E+06	9.52E+06	7.17E+07	6.58E+07
13	2.10E+07	1.39E+07	7.25E+06	1.73E+07	5.29E+07	4.56E+07
14	8.41E+06	1.04E+07	1.87E+06	3.46E+06	3.53E+07	3.34E+07
15	1.26E+07	1.72E+07	5.66E+06	9.22E+06	4.12E+07	3.56E+07
16	5.68E+06	8.10E+06	2.77E+06	4.58E+06	1.55E+07	1.27E+07
17	4.52E+06	1.15E+07		too few data		
18	3.16E+06	5.28E+06		too few data		
19	1.88E+07	1.05E+07	7.18E+06	1.58E+07	3.84E+07	3.12E+07
20	3.19E+07	1.92E+07		too few data		
Mean	**1.63E+07**	**1.50E+07**	**5.62E+06**	**1.11E+07**	**4.30E+07**	**3.73E+07**
Pooled	***6.98E+06***	***1.45E+07***		too few data		

4.2 Eulerian results

Table 4-1 Summary table of $\log_{10}$(v [m/yrs])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-1.14	1.06	-3.27	-0.90	0.23	3.50
2	-1.33	1.26	-3.71	-1.07	0.40	4.10
3	-1.28	1.20	-3.50	-1.11	0.42	3.92
4	-1.69	1.29	-4.12	-1.49	0.13	4.25
5	-1.66	1.42	-4.25	-1.41	0.28	4.53
6	-1.31	1.21	-3.51	-1.05	0.35	3.86
7	-1.61	1.29	-3.97	-1.41	0.18	4.15
8	-1.37	1.06	-3.23	-1.25	0.18	3.41
9	-1.03	1.20	-3.40	-0.82	0.59	4.00
10	-1.04	1.19	-3.51	-0.77	0.51	4.02
11	-1.94	1.42	-4.40	-1.69	0.03	4.43
12	-1.13	1.08	-3.05	-1.00	0.39	3.43
13	-1.26	1.07	-3.25	-1.12	0.24	3.49
14	-1.63	1.37	-4.03	-1.47	0.34	4.37
15	-1.14	1.22	-3.61	-1.00	0.57	4.18
16	-1.44	1.15	-3.36	-1.32	0.30	3.65
17	-0.92	1.23	-3.49	-0.62	0.62	4.10
18	-1.22	1.15	-3.14	-1.14	0.55	3.69
19	-1.98	1.32	-4.33	-1.77	-0.21	4.12
20	-2.84	2.34	-6.67	-2.53	0.35	7.02
Mean	**-1.38**	**1.22**	**-3.64**	**-1.18**	**0.32**	**3.96**
Pooled	***-1.44***	***1.37***	***-3.92***	***-1.15***	***0.36***	***4.28***

Table 4-2 Summary table of $\log_{10}$(b [m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-4.41	0.52	-5.26	-4.41	-3.52	1.74
2	-4.36	0.52	-5.19	-4.34	-3.45	1.74
3	-4.41	0.52	-5.31	-4.44	-3.55	1.76
4	-4.39	0.57	-5.31	-4.38	-3.42	1.89
5	-4.41	0.52	-5.32	-4.40	-3.50	1.82
6	-4.41	0.49	-5.22	-4.41	-3.57	1.66
7	-4.45	0.53	-5.34	-4.46	-3.62	1.72
8	-4.40	0.52	-5.25	-4.41	-3.55	1.69
9	-4.37	0.50	-5.20	-4.38	-3.58	1.62
10	-4.43	0.53	-5.25	-4.42	-3.52	1.73
11	-4.36	0.49	-5.15	-4.36	-3.54	1.62
12	-4.43	0.54	-5.36	-4.42	-3.54	1.82
13	-4.42	0.55	-5.36	-4.38	-3.56	1.80
14	-4.42	0.50	-5.25	-4.40	-3.58	1.67
15	-4.42	0.51	-5.28	-4.41	-3.57	1.71
16	-4.46	0.51	-5.33	-4.47	-3.61	1.72
17	-4.38	0.52	-5.27	-4.38	-3.49	1.78
18	-4.33	0.54	-5.17	-4.34	-3.37	1.80
19	-4.37	0.50	-5.23	-4.37	-3.56	1.68
20	-4.43	0.53	-5.30	-4.43	-3.55	1.75
Mean	**-4.40**	**0.52**	**-5.27**	**-4.40**	**-3.53**	**1.74**
Pooled	***-4.40***	***0.52***	***-5.27***	***-4.40***	***-3.53***	***1.74***

Table 4-3 Summary table of $\log_{10}(1/v$ [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	1.14	1.06	-0.19	0.94	3.32	3.50
2	1.33	1.26	-0.36	1.11	3.75	4.11
3	1.28	1.20	-0.37	1.16	3.55	3.92
4	1.69	1.29	-0.08	1.55	4.18	4.26
5	1.66	1.42	-0.22	1.46	4.30	4.53
6	1.31	1.21	-0.31	1.06	3.55	3.86
7	1.61	1.29	-0.14	1.46	3.97	4.12
8	1.37	1.06	-0.14	1.29	3.27	3.41
9	1.03	1.20	-0.55	0.86	3.45	4.00
10	1.04	1.19	-0.47	0.78	3.56	4.02
11	1.94	1.42	0.02	1.73	4.45	4.43
12	1.13	1.08	-0.39	1.00	3.09	3.47
13	1.26	1.07	-0.19	1.16	3.30	3.49
14	1.63	1.37	-0.29	1.53	4.08	4.37
15	1.14	1.22	-0.53	1.04	3.65	4.18
16	1.44	1.15	-0.25	1.37	3.40	3.65
17	0.92	1.23	-0.58	0.67	3.53	4.11
18	1.22	1.15	-0.51	1.14	3.18	3.69
19	1.98	1.32	0.25	1.82	4.38	4.12
20	2.84	2.34	-0.30	2.58	6.72	7.02
Mean	**1.38**	**1.22**	**-0.28**	**1.22**	**3.68**	**3.96**
Pooled	***1.44***	***1.37***	***-0.31***	***1.21***	***3.98***	***4.28***

Table 4-4 Summary table of $\log_{10}(1/bv$ [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	5.58	1.15	4.14	5.41	7.89	3.75
2	5.70	1.35	4.02	5.42	8.38	4.37
3	5.71	1.37	3.84	5.60	8.27	4.43
4	6.10	1.46	4.09	5.92	8.79	4.70
5	6.09	1.55	4.02	5.87	9.00	4.98
6	5.75	1.34	3.95	5.56	8.21	4.27
7	6.07	1.42	4.05	5.96	8.62	4.57
8	5.79	1.21	4.18	5.63	8.11	3.93
9	5.41	1.38	3.49	5.22	8.19	4.70
10	5.47	1.34	3.82	5.20	8.29	4.47
11	6.30	1.56	4.29	6.00	9.25	4.96
12	5.58	1.26	3.87	5.45	7.87	4.01
13	5.70	1.29	4.02	5.56	8.16	4.14
14	6.08	1.48	3.98	5.93	8.72	4.74
15	5.57	1.41	3.50	5.52	8.30	4.80
16	5.91	1.30	4.06	5.82	8.20	4.14
17	5.33	1.40	3.60	5.09	8.20	4.60
18	5.55	1.34	3.48	5.44	7.91	4.43
19	6.39	1.47	4.44	6.18	9.16	4.72
20	7.31	2.44	3.96	7.08	11.42	7.46
Mean	**5.87**	**1.43**	**3.94**	**5.69**	**8.55**	**4.61**
Pooled	***5.86***	***1.51***	***3.91***	***5.67***	***8.69***	***4.78***

5 Case 4b

5.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 5-1 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.77	0.42	-1.31	-0.79	0.02	1.33
2	-0.80	0.46	-1.39	-0.85	0.07	1.47
3	-0.74	0.42	-1.33	-0.79	0.06	1.39
4	-0.82	0.45	-1.40	-0.90	0.06	1.46
5	-0.84	0.45	-1.41	-0.90	0.02	1.43
6	-0.79	0.46	-1.40	-0.84	0.04	1.44
7	-0.83	0.43	-1.39	-0.87	-0.02	1.36
8	-0.91	0.44	-1.50	-0.96	-0.09	1.41
9	-0.96	0.42	-1.55	-0.99	-0.16	1.39
10	-0.85	0.44	-1.45	-0.90	-0.04	1.41
11	-0.82	0.45	-1.41	-0.84	0.00	1.41
12	-0.88	0.43	-1.46	-0.92	-0.07	1.38
13	-0.89	0.45	-1.47	-0.96	-0.05	1.42
14	-0.82	0.46	-1.40	-0.88	0.05	1.44
15	-0.80	0.45	-1.38	-0.83	0.02	1.40
16	-0.78	0.44	-1.38	-0.84	0.02	1.40
17	-0.83	0.42	-1.36	-0.87	-0.04	1.33
18	-0.87	0.44	-1.44	-0.91	-0.07	1.37
19	-0.83	0.46	-1.43	-0.88	-0.01	1.43
20	-0.80	0.44	-1.43	-0.84	-0.01	1.42
Mean	**-0.83**	**0.44**	**-1.41**	**-0.88**	**-0.01**	**1.40**
Pooled	***-0.84***	***0.44***	***-1.43***	***-0.89***	***0.01***	***1.43***

Table 5-2 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	3.12	0.71	2.27	3.01	4.56	2.28
2	3.05	0.76	2.11	2.94	4.55	2.44
3	3.13	0.75	2.27	2.99	4.64	2.38
4	3.02	0.78	2.06	2.88	4.56	2.50
5	2.96	0.80	1.94	2.90	4.47	2.53
6	3.09	0.77	2.19	2.93	4.57	2.38
7	3.05	0.75	2.09	2.93	4.53	2.44
8	2.84	0.80	1.82	2.74	4.38	2.56
9	2.75	0.77	1.77	2.65	4.24	2.47
10	2.99	0.77	1.86	2.88	4.49	2.63
11	3.01	0.83	1.73	2.98	4.44	2.71
12	2.96	0.74	1.96	2.89	4.39	2.43
13	2.87	0.86	1.69	2.81	4.48	2.78
14	3.02	0.78	1.99	2.89	4.51	2.51
15	3.08	0.73	2.21	2.96	4.47	2.26
16	3.08	0.74	2.15	2.95	4.52	2.36
17	3.02	0.78	1.92	2.94	4.45	2.53
18	2.90	0.76	1.92	2.79	4.39	2.47
19	3.00	0.76	2.11	2.88	4.48	2.37
20	3.01	0.74	2.11	2.91	4.42	2.31
Mean	**3.00**	**0.77**	**2.01**	**2.89**	**4.48**	**2.47**
Pooled	***2.98***	***0.78***	***1.92***	***2.87***	***4.47***	***2.55***

X5, X50 and X95 represent respectively the 5%, 50% and 95% percentiles of the studied variables.

Table 5-3 Summary table of τ [yrs]

Real	mean	stdev	X5	X50	X95	X95-X5
1	64.96	53.11	22.70	51.28	169.68	146.98
2	65.43	59.75	21.14	47.24	203.86	182.72
3	76.63	65.64	22.59	56.58	226.53	203.94
4	66.27	64.29	17.91	46.84	182.54	164.63
5	70.32	61.51	19.76	52.12	207.84	188.08
6	67.52	59.18	20.84	51.40	161.90	141.06
7	57.04	50.49	20.25	45.87	129.72	109.47
8	53.24	58.89	16.33	39.22	149.82	133.49
9	38.61	32.47	15.37	30.60	89.60	74.23
10	65.66	93.75	23.48	48.70	181.11	157.62
11	55.98	49.37	17.48	44.84	142.55	125.07
12	48.08	40.63	16.13	40.14	106.64	90.51
13	45.32	47.98	15.62	35.84	109.98	94.36
14	68.88	67.12	17.25	49.77	212.35	195.09
15	71.09	86.08	21.92	53.74	167.39	145.47
16	64.54	60.01	25.33	51.17	147.14	121.80
17	61.49	48.75	21.10	49.30	152.71	131.61
18	45.27	34.91	14.38	36.42	107.62	93.24
19	60.35	53.37	18.10	48.08	149.56	131.47
20	63.94	51.29	22.16	49.55	147.11	124.94
Mean	**60.35**	**57.23**	**19.35**	**46.27**	**157.82**	**138.46**
Pooled	***58.97***	***58.86***	***19.32***	***44.75***	***159.20***	***139.88***

Table 5-4 Summary table of β [yrs/m2]

Real	mean	stdev	X5	X50	X95	X95-X5
1	2.53E+06	5.56E+06	3.22E+05	1.28E+06	7.99E+06	7.67E+06
2	2.51E+06	5.67E+06	4.28E+05	1.12E+06	9.46E+06	9.03E+06
3	3.87E+06	8.66E+06	4.53E+05	1.20E+06	1.72E+07	1.68E+07
4	2.21E+06	4.04E+06	3.08E+05	1.26E+06	7.20E+06	6.89E+06
5	3.75E+06	8.75E+06	5.54E+05	1.49E+06	2.39E+07	2.34E+07
6	3.44E+06	6.98E+06	4.19E+05	1.48E+06	1.63E+07	1.59E+07
7	1.90E+06	2.91E+06	2.57E+05	9.36E+05	7.21E+06	6.96E+06
8	1.78E+06	5.36E+06	5.56E+05	1.07E+06	7.20E+06	6.65E+06
9	1.03E+06	1.56E+06	1.43E+05	5.46E+05	3.77E+06	3.63E+06
10	2.96E+06	9.70E+06	7.64E+05	1.48E+06	9.32E+06	8.56E+06
11	2.63E+06	8.98E+06	6.33E+05	1.23E+06	9.05E+06	8.42E+06
12	1.32E+06	2.08E+06	1.40E+05	7.46E+05	4.56E+06	4.42E+06
13	1.84E+06	6.36E+06	4.86E+05	9.34E+05	6.75E+06	6.26E+06
14	2.72E+06	6.14E+06	4.02E+05	1.14E+06	1.14E+07	1.10E+07
15	3.13E+06	1.11E+07	8.53E+05	1.62E+06	9.29E+06	8.43E+06
16	2.26E+06	4.71E+06	2.82E+05	1.10E+06	7.82E+06	7.53E+06
17	2.83E+06	7.14E+06	5.51E+05	1.02E+06	1.17E+07	1.12E+07
18	1.37E+06	2.34E+06	1.55E+05	6.29E+05	4.90E+06	4.75E+06
19	2.65E+06	5.52E+06	3.50E+05	9.64E+05	1.17E+07	1.14E+07
20	1.79E+06	4.47E+06	4.58E+05	1.19E+06	5.57E+06	5.11E+06
Mean	**2.43E+06**	**5.90E+06**	**4.26E+05**	**1.12E+06**	**9.62E+06**	**9.19E+06**
Pooled	***2.32E+06***	***6.22E+06***	***7.70E+05***	1.54E+06	***8.44E+06***	***7.67E+06***

5.2 Eulerian results

Table 5-1 Summary table of $\log_{10}$(v [m/yrs])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	0.15	0.62	-0.93	0.24	1.01	1.95
2	0.19	0.63	-0.89	0.27	1.09	1.97
3	0.17	0.60	-0.89	0.26	1.04	1.93
4	0.17	0.63	-0.91	0.24	1.11	2.02
5	0.19	0.64	-0.91	0.26	1.13	2.03
6	0.22	0.62	-0.88	0.30	1.10	1.99
7	0.21	0.62	-0.85	0.30	1.14	1.99
8	0.23	0.62	-0.83	0.32	1.10	1.93
9	0.27	0.62	-0.82	0.39	1.15	1.97
10	0.23	0.61	-0.81	0.34	1.11	1.92
11	0.23	0.64	-0.86	0.32	1.15	2.02
12	0.21	0.61	-0.84	0.32	1.07	1.91
13	0.20	0.63	-0.90	0.30	1.13	2.03
14	0.14	0.63	-0.94	0.24	1.07	2.01
15	0.19	0.60	-0.85	0.28	1.05	1.90
16	0.20	0.61	-0.85	0.29	1.06	1.91
17	0.23	0.64	-0.87	0.32	1.11	1.98
18	0.22	0.63	-0.88	0.30	1.10	1.98
19	0.22	0.62	-0.86	0.32	1.12	1.98
20	0.19	0.64	-0.86	0.29	1.09	1.95
Mean	**0.20**	**0.62**	**-0.87**	**0.30**	**1.10**	**1.97**
Pooled	***0.20***	***0.62***	***-0.85***	***0.29***	***1.13***	***1.98***

Table 5-2 Summary table of $\log_{10}$(b [m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-4.40	0.51	-5.21	-4.39	-3.53	1.68
2	-4.39	0.51	-5.21	-4.37	-3.53	1.67
3	-4.44	0.53	-5.30	-4.42	-3.54	1.77
4	-4.41	0.52	-5.27	-4.40	-3.51	1.76
5	-4.39	0.53	-5.29	-4.38	-3.51	1.78
6	-4.40	0.52	-5.24	-4.40	-3.52	1.71
7	-4.40	0.51	-5.22	-4.42	-3.56	1.66
8	-4.38	0.52	-5.23	-4.39	-3.49	1.73
9	-4.37	0.52	-5.20	-4.38	-3.51	1.69
10	-4.39	0.51	-5.22	-4.38	-3.53	1.68
11	-4.38	0.52	-5.20	-4.37	-3.53	1.66
12	-4.40	0.50	-5.23	-4.38	-3.58	1.65
13	-4.41	0.52	-5.22	-4.40	-3.56	1.66
14	-4.41	0.51	-5.23	-4.40	-3.55	1.68
15	-4.39	0.51	-5.24	-4.39	-3.53	1.70
16	-4.41	0.51	-5.27	-4.41	-3.56	1.71
17	-4.38	0.51	-5.20	-4.37	-3.52	1.68
18	-4.40	0.52	-5.22	-4.41	-3.52	1.69
19	-4.38	0.51	-5.21	-4.37	-3.53	1.68
20	-4.38	0.52	-5.25	-4.39	-3.49	1.75
Mean	**-4.40**	**0.52**	**-5.23**	**-4.39**	**-3.53**	**1.70**
Pooled	***-4.39***	***0.52***	***-5.24***	***-4.39***	***-3.52***	***1.72***

Table 5-3 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.15	0.62	-0.97	-0.20	0.97	1.95
2	-0.19	0.63	-1.04	-0.23	0.93	1.97
3	-0.17	0.60	-1.00	-0.22	0.93	1.93
4	-0.17	0.63	-1.07	-0.20	0.95	2.02
5	-0.19	0.64	-1.08	-0.22	0.95	2.04
6	-0.22	0.62	-1.07	-0.27	0.88	1.95
7	-0.21	0.62	-1.09	-0.25	0.90	1.99
8	-0.23	0.62	-1.06	-0.28	0.87	1.93
9	-0.27	0.62	-1.11	-0.34	0.83	1.93
10	-0.23	0.61	-1.06	-0.29	0.86	1.92
11	-0.23	0.64	-1.10	-0.26	0.87	1.97
12	-0.21	0.61	-1.03	-0.28	0.88	1.91
13	-0.20	0.63	-1.08	-0.26	0.95	2.03
14	-0.14	0.63	-1.02	-0.19	0.99	2.02
15	-0.19	0.60	-1.02	-0.24	0.89	1.90
16	-0.20	0.61	-1.02	-0.25	0.89	1.91
17	-0.23	0.64	-1.06	-0.31	0.92	1.98
18	-0.22	0.63	-1.06	-0.30	0.93	1.99
19	-0.22	0.62	-1.08	-0.27	0.90	1.98
20	-0.19	0.64	-1.04	-0.23	0.92	1.95
Mean	**-0.20**	**0.62**	**-1.05**	**-0.26**	**0.91**	**1.96**
Pooled	***-0.20***	***0.62***	***-1.07***	***-0.24***	***0.91***	***1.98***

Table 5-4 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	4.24	0.97	2.88	4.16	5.98	3.10
2	4.20	0.98	2.77	4.14	5.96	3.19
3	4.26	0.97	2.86	4.19	6.04	3.18
4	4.23	0.99	2.75	4.17	5.97	3.22
5	4.20	1.01	2.75	4.12	6.02	3.27
6	4.18	0.99	2.71	4.12	5.96	3.25
7	4.19	0.98	2.73	4.14	5.97	3.24
8	4.15	0.98	2.70	4.12	5.89	3.19
9	4.10	0.98	2.62	4.06	5.87	3.25
10	4.15	0.97	2.73	4.09	5.88	3.15
11	4.15	0.99	2.68	4.10	5.88	3.20
12	4.19	0.96	2.81	4.13	5.90	3.09
13	4.20	0.98	2.79	4.15	5.94	3.15
14	4.27	0.98	2.83	4.21	6.01	3.19
15	4.20	0.96	2.80	4.14	5.92	3.13
16	4.21	0.96	2.80	4.14	5.95	3.16
17	4.15	0.98	2.72	4.05	5.90	3.18
18	4.17	0.99	2.71	4.14	5.95	3.24
19	4.16	0.98	2.70	4.07	5.91	3.21
20	4.18	0.99	2.74	4.12	5.96	3.21
Mean	**4.19**	**0.98**	**2.75**	**4.13**	**5.94**	**3.19**
Pooled	***4.19***	***0.98***	***2.75***	***4.12***	***5.98***	***3.23***

6 Case 5

6.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 6-1 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-1.04	0.44	-1.62	-1.10	-0.20	1.43
2	-0.99	0.42	-1.53	-1.05	-0.20	1.33
3	-1.01	0.43	-1.57	-1.08	-0.18	1.39
4	-0.98	0.43	-1.56	-1.04	-0.17	1.39
5	-1.04	0.44	-1.60	-1.11	-0.20	1.40
6	-0.96	0.43	-1.55	-1.00	-0.16	1.39
7	-1.06	0.46	-1.62	-1.11	-0.20	1.43
8	-0.97	0.42	-1.49	-1.02	-0.17	1.32
9	-1.06	0.44	-1.62	-1.13	-0.21	1.40
10	-1.01	0.43	-1.57	-1.06	-0.20	1.37
11	-0.98	0.44	-1.56	-1.03	-0.15	1.41
12	-0.91	0.44	-1.51	-0.98	-0.11	1.39
13	-1.04	0.43	-1.56	-1.11	-0.22	1.34
14	-1.06	0.45	-1.60	-1.13	-0.18	1.42
15	-1.11	0.46	-1.75	-1.14	-0.26	1.49
16	-1.09	0.45	-1.65	-1.13	-0.23	1.43
17	-0.98	0.42	-1.52	-1.03	-0.18	1.34
18	-0.99	0.44	-1.56	-1.06	-0.16	1.40
19	-1.19	0.51	-1.81	-1.24	-0.25	1.56
20	-0.96	0.44	-1.55	-1.01	-0.14	1.41
Mean	**-1.02**	**0.44**	**-1.59**	**-1.08**	**-0.19**	**1.40**
Pooled	***-1.03***	***0.45***	***-1.63***	***-1.08***	***-0.18***	***1.45***

Table 6-2 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	2.73	0.80	1.77	2.58	4.30	2.53
2	2.79	0.77	1.86	2.62	4.33	2.46
3	2.70	0.84	1.72	2.52	4.36	2.64
4	2.77	0.83	1.70	2.66	4.36	2.66
5	2.70	0.82	1.66	2.59	4.31	2.65
6	2.84	0.81	1.86	2.69	4.43	2.57
7	2.67	0.84	1.73	2.53	4.37	2.64
8	2.84	0.77	1.93	2.68	4.35	2.42
9	2.64	0.84	1.66	2.49	4.28	2.62
10	2.77	0.82	1.68	2.67	4.37	2.69
11	2.79	0.82	1.71	2.70	4.38	2.67
12	2.89	0.79	1.93	2.75	4.44	2.52
13	2.67	0.86	1.49	2.57	4.32	2.83
14	2.65	0.86	1.53	2.49	4.31	2.78
15	2.61	0.85	1.54	2.53	4.24	2.70
16	2.60	0.87	1.38	2.52	4.27	2.90
17	2.79	0.80	1.75	2.70	4.35	2.60
18	2.79	0.83	1.67	2.68	4.39	2.72
19	2.44	0.94	1.34	2.37	4.24	2.91
20	2.74	0.86	1.55	2.62	4.42	2.86
Mean	**2.72**	**0.83**	**1.67**	**2.60**	**4.34**	**2.67**
Pooled	***2.71***	***0.84***	***1.60***	***2.59***	***4.35***	***2.74***

X5, X50 and X95 represent respectively the 5%, 50% and 95% percentiles of the studied variables.

Table 6-3 Summary table of τ [yrs]

Real	mean	stdev	X5	X50	X95	X95-X5
1	38.63	41.83	11.82	28.21	92.15	80.33
2	45.99	125.14	19.39	30.88	99.83	80.43
3	38.36	34.39	13.27	31.00	84.17	70.90
4	42.15	38.88	16.93	33.06	102.21	85.28
5	41.87	42.44	15.10	31.73	101.93	86.83
6	45.68	43.71	15.22	34.06	125.58	110.36
7	38.21	35.72	11.15	28.84	107.74	96.59
8	39.60	35.53	12.65	30.40	103.18	90.53
9	37.25	37.87	12.58	27.95	94.52	81.93
10	33.67	20.64	14.48	28.65	77.35	62.87
11	44.49	39.97	15.33	35.64	107.63	92.30
12	48.95	41.59	20.85	37.45	120.48	99.64
13	40.79	40.65	12.67	30.15	134.99	122.32
14	37.02	29.00	13.36	28.75	109.35	95.99
15	31.64	33.50	10.12	26.67	73.00	62.87
16	35.17	36.03	9.15	28.71	82.51	73.36
17	40.62	31.34	16.27	33.91	89.34	73.07
18	42.91	35.95	15.86	33.70	108.59	92.73
19	28.84	23.65	9.09	22.83	71.90	62.81
20	45.54	39.06	17.60	36.50	104.53	86.93
Mean	**39.57**	**40.41**	**13.96**	**30.66**	**99.29**	**85.32**
Pooled	***39.67***	***46.61***	***15.77***	***38.78***	***96.33***	***80.56***

Table 6-4 Summary table of β [yrs/m2]

Real	mean	stdev	X5	X50	X95	X95-X5
1	1.78E+06	4.86E+06	3.36E+05	9.48E+05	5.23E+06	4.90E+06
2	2.82E+06	7.48E+06	4.97E+05	9.42E+05	1.39E+07	1.34E+07
3	1.97E+06	3.92E+06	2.37E+05	8.62E+05	7.53E+06	7.30E+06
4	1.97E+06	5.79E+06	4.65E+05	8.70E+05	6.94E+06	6.47E+06
5	2.08E+06	4.86E+06	3.08E+05	8.75E+05	9.38E+06	9.07E+06
6	2.44E+06	5.81E+06	3.40E+05	9.33E+05	1.01E+07	9.78E+06
7	2.31E+06	5.68E+06	2.84E+05	7.76E+05	9.87E+06	9.59E+06
8	1.77E+06	3.93E+06	2.78E+05	9.40E+05	6.24E+06	5.96E+06
9	1.43E+06	2.07E+06	1.11E+05	7.03E+05	5.00E+06	4.89E+06
10	1.48E+06	2.76E+06	2.30E+05	7.64E+05	4.85E+06	4.62E+06
11	1.84E+06	3.49E+06	1.92E+05	9.52E+05	6.12E+06	5.93E+06
12	2.90E+06	1.04E+07	7.65E+05	1.45E+06	9.65E+06	8.89E+06
13	2.15E+06	5.40E+06	2.99E+05	8.44E+05	7.92E+06	7.62E+06
14	2.57E+06	7.78E+06	4.08E+05	7.71E+05	9.14E+06	8.73E+06
15	1.77E+06	6.07E+06	3.73E+05	7.25E+05	6.35E+06	5.98E+06
16	1.72E+06	4.27E+06	2.81E+05	8.12E+05	7.18E+06	6.89E+06
17	1.76E+06	3.32E+06	2.55E+05	7.94E+05	6.01E+06	5.75E+06
18	1.75E+06	3.17E+06	1.99E+05	8.58E+05	6.62E+06	6.42E+06
19	1.48E+06	4.06E+06	3.03E+05	5.78E+05	5.25E+06	4.95E+06
20	1.81E+06	4.12E+06	3.36E+05	1.07E+06	5.00E+06	4.67E+06
Mean	**1.99E+06**	**4.96E+06**	**3.25E+05**	**8.73E+05**	**7.41E+06**	**7.09E+06**
Pooled	***1.97E+06***	***5.14E+06***	***7.00E+05***	1.38E+06	***7.54E+06***	***6.84E+06***

6.2 Eulerian results

Table 6-1 Summary table of $\log_{10}$(v [m/yrs])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	0.36	0.58	-0.59	0.43	1.22	1.81
2	0.35	0.59	-0.64	0.43	1.20	1.84
3	0.36	0.58	-0.64	0.45	1.23	1.87
4	0.35	0.59	-0.64	0.45	1.21	1.85
5	0.36	0.58	-0.66	0.42	1.25	1.91
6	0.36	0.56	-0.60	0.41	1.20	1.80
7	0.38	0.58	-0.62	0.44	1.25	1.87
8	0.36	0.57	-0.62	0.41	1.21	1.83
9	0.36	0.59	-0.67	0.45	1.25	1.92
10	0.38	0.57	-0.61	0.45	1.23	1.85
11	0.37	0.57	-0.62	0.45	1.26	1.87
12	0.35	0.58	-0.67	0.42	1.21	1.88
13	0.37	0.59	-0.62	0.44	1.24	1.86
14	0.37	0.57	-0.63	0.45	1.23	1.85
15	0.38	0.58	-0.61	0.46	1.25	1.86
16	0.38	0.59	-0.65	0.45	1.27	1.92
17	0.35	0.58	-0.62	0.41	1.21	1.83
18	0.36	0.58	-0.64	0.41	1.23	1.87
19	0.38	0.57	-0.59	0.43	1.26	1.85
20	0.34	0.58	-0.68	0.41	1.20	1.88
Mean	**0.36**	**0.58**	**-0.63**	**0.43**	**1.23**	**1.86**
Pooled	***0.36***	***0.58***	***-0.65***	***0.41***	***1.23***	***1.88***

Table 6-2 Summary table of $\log_{10}$(b [m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-4.41	0.51	-5.23	-4.39	-3.55	1.68
2	-4.39	0.51	-5.24	-4.38	-3.55	1.69
3	-4.40	0.52	-5.27	-4.41	-3.50	1.77
4	-4.40	0.52	-5.27	-4.39	-3.51	1.76
5	-4.40	0.52	-5.24	-4.40	-3.52	1.72
6	-4.41	0.51	-5.24	-4.40	-3.55	1.69
7	-4.40	0.53	-5.26	-4.39	-3.51	1.75
8	-4.41	0.51	-5.26	-4.40	-3.56	1.70
9	-4.39	0.53	-5.25	-4.39	-3.51	1.74
10	-4.40	0.51	-5.25	-4.39	-3.55	1.70
11	-4.39	0.51	-5.21	-4.39	-3.50	1.71
12	-4.40	0.52	-5.24	-4.38	-3.53	1.71
13	-4.41	0.52	-5.27	-4.40	-3.53	1.74
14	-4.39	0.51	-5.23	-4.38	-3.56	1.68
15	-4.39	0.52	-5.24	-4.40	-3.52	1.72
16	-4.39	0.52	-5.25	-4.39	-3.55	1.70
17	-4.39	0.51	-5.24	-4.39	-3.54	1.70
18	-4.40	0.51	-5.22	-4.41	-3.56	1.66
19	-4.40	0.52	-5.20	-4.40	-3.52	1.69
20	-4.40	0.53	-5.25	-4.41	-3.51	1.74
Mean	**-4.40**	**0.52**	**-5.24**	**-4.39**	**-3.53**	**1.71**
Pooled	***-4.40***	***0.52***	***-5.24***	***-4.39***	***-3.54***	***1.70***

Table 6-3 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.36	0.58	-1.17	-0.38	0.64	1.81
2	-0.35	0.59	-1.20	-0.38	0.69	1.89
3	-0.36	0.58	-1.19	-0.41	0.69	1.87
4	-0.35	0.59	-1.20	-0.40	0.69	1.90
5	-0.36	0.58	-1.21	-0.38	0.70	1.91
6	-0.36	0.56	-1.16	-0.37	0.64	1.80
7	-0.38	0.58	-1.21	-0.39	0.67	1.87
8	-0.36	0.57	-1.16	-0.37	0.66	1.83
9	-0.36	0.59	-1.20	-0.40	0.72	1.92
10	-0.38	0.57	-1.18	-0.40	0.67	1.85
11	-0.37	0.57	-1.22	-0.41	0.66	1.87
12	-0.35	0.58	-1.17	-0.38	0.72	1.88
13	-0.37	0.59	-1.19	-0.38	0.67	1.86
14	-0.37	0.57	-1.19	-0.41	0.63	1.82
15	-0.38	0.58	-1.20	-0.41	0.66	1.86
16	-0.38	0.59	-1.23	-0.41	0.69	1.92
17	-0.35	0.58	-1.16	-0.40	0.67	1.83
18	-0.36	0.58	-1.18	-0.36	0.69	1.87
19	-0.38	0.57	-1.22	-0.39	0.63	1.85
20	-0.34	0.58	-1.19	-0.37	0.73	1.92
Mean	**-0.36**	**0.58**	**-1.19**	**-0.39**	**0.67**	**1.86**
Pooled	***-0.36***	***0.58***	***-1.17***	***-0.41***	***0.66***	***1.83***

Table 6-4 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	4.04	0.99	2.54	4.03	5.81	3.27
2	4.04	0.99	2.56	3.99	5.81	3.24
3	4.05	1.01	2.50	4.02	5.83	3.33
4	4.04	1.00	2.52	4.01	5.85	3.33
5	4.04	1.01	2.51	4.03	5.82	3.31
6	4.05	0.98	2.57	4.03	5.78	3.20
7	4.02	1.01	2.47	4.00	5.82	3.35
8	4.05	0.99	2.52	4.02	5.79	3.27
9	4.04	1.02	2.50	4.01	5.84	3.35
10	4.02	0.98	2.54	3.98	5.80	3.27
11	4.02	0.99	2.49	4.02	5.73	3.25
12	4.05	1.00	2.55	3.99	5.83	3.28
13	4.04	1.00	2.55	3.99	5.80	3.25
14	4.02	0.99	2.53	4.01	5.79	3.26
15	4.01	1.01	2.50	3.99	5.77	3.27
16	4.02	1.01	2.48	3.98	5.82	3.35
17	4.04	0.99	2.55	4.01	5.79	3.24
18	4.04	0.99	2.52	4.03	5.76	3.24
19	4.02	0.99	2.49	3.98	5.72	3.24
20	4.07	1.00	2.53	4.06	5.83	3.30
Mean	**4.04**	**1.00**	**2.52**	**4.01**	**5.80**	**3.28**
Pooled	***4.04***	***1.00***	***2.52***	***3.99***	***5.77***	***3.26***

7 Case 7a

7.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 7-1 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.65	0.72	-1.74	-0.66	0.61	2.35
2	-0.76	0.74	-1.81	-0.80	0.55	2.36
3	-1.10	0.74	-2.07	-1.20	0.29	2.37
4	-1.21	0.69	-2.08	-1.34	0.10	2.18
5	-1.22	0.75	-2.19	-1.34	0.21	2.40
6	-0.99	0.76	-2.06	-1.05	0.42	2.48
7	-1.31	0.72	-2.19	-1.42	0.12	2.31
8	-0.75	0.74	-1.83	-0.79	0.57	2.40
9	-1.17	0.80	-2.15	-1.28	0.31	2.45
10	-1.19	0.73	-2.08	-1.33	0.27	2.35
11	-0.90	0.78	-2.05	-0.96	0.49	2.54
12	-1.16	0.70	-2.00	-1.31	0.25	2.25
13	-1.03	0.81	-2.20	-1.09	0.42	2.63
14	-0.70	0.73	-1.73	-0.78	0.68	2.41
15	-1.41	0.74	-2.37	-1.51	0.00	2.38
16	-1.22	0.80	-2.31	-1.35	0.32	2.63
17	-1.08	0.76	-2.03	-1.19	0.36	2.38
18	-0.74	0.75	-1.94	-0.73	0.53	2.47
19	-1.53	0.78	-2.47	-1.62	0.02	2.49
20	-0.71	0.73	-1.80	-0.73	0.58	2.38
Mean	**-1.04**	**0.75**	**-2.07**	**-1.14**	**0.34**	**2.41**
Pooled	***-1.04***	***0.79***	***-2.15***	***-1.09***	***0.39***	***2.54***

Table 7-2 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	3.60	0.79	2.33	3.57	4.98	2.65
2	3.52	0.81	2.30	3.50	4.94	2.64
3	3.12	0.91	1.85	3.10	4.76	2.91
4	3.03	0.90	1.75	2.95	4.71	2.96
5	3.02	0.93	1.75	2.94	4.71	2.96
6	3.29	0.89	1.98	3.26	4.84	2.86
7	2.93	0.91	1.81	2.81	4.69	2.88
8	3.53	0.83	2.25	3.49	5.00	2.75
9	3.03	0.97	1.70	2.97	4.75	3.06
10	3.07	0.91	1.80	2.98	4.76	2.97
11	3.35	0.89	1.92	3.37	4.87	2.96
12	3.12	0.88	1.96	3.02	4.78	2.82
13	3.19	0.98	1.51	3.19	4.82	3.32
14	3.51	0.81	2.31	3.47	4.95	2.64
15	2.81	0.93	1.59	2.72	4.52	2.93
16	2.98	0.98	1.43	2.90	4.73	3.30
17	3.18	0.91	1.87	3.11	4.84	2.97
18	3.53	0.82	2.13	3.57	4.90	2.77
19	2.65	1.02	1.38	2.57	4.54	3.15
20	3.50	0.85	2.11	3.54	4.92	2.82
Mean	**3.20**	**0.90**	**1.89**	**3.15**	**4.80**	**2.92**
Pooled	***3.20***	***0.94***	***1.75***	***3.19***	***4.86***	***3.11***

X5, X50 and X95 represent respectively the 5%, 50% and 95% percentiles of the studied variables.

Table 7-3 Summary table of τ[yrs]

Real	mean	stdev	X5	X50	X95	X95-X5
1	16.34	21.05	4.17	11.90	41.55	37.38
2	17.53	23.49	5.40	12.99	46.37	40.97
3	18.93	26.40	5.17	12.99	48.17	43.01
4	21.12	30.47	4.90	14.78	60.92	56.02
5	18.63	24.04	5.13	12.69	50.46	45.32
6	21.02	24.78	4.97	14.21	70.86	65.90
7	18.15	20.48	4.75	12.70	54.74	49.99
8	19.15	21.97	4.67	12.95	57.15	52.48
9	17.81	22.78	3.90	12.11	56.68	52.78
10	17.87	25.75	6.81	13.59	45.23	38.42
11	23.40	33.47	5.85	15.62	74.21	68.35
12	21.05	32.36	6.58	15.51	51.25	44.67
13	18.66	24.00	4.86	12.14	53.37	48.51
14	17.07	23.18	4.47	10.49	49.65	45.18
15	14.68	19.71	3.12	9.50	44.61	41.49
16	16.15	21.42	3.67	11.00	46.40	42.73
17	18.42	19.17	4.25	13.68	47.87	43.62
18	19.50	22.99	6.18	13.99	54.59	48.41
19	13.54	16.37	3.07	9.95	39.41	36.33
20	19.67	23.08	5.88	13.64	51.18	45.30
Mean	**18.37**	**23.89**	**4.84**	**12.78**	**52.29**	**47.45**
Pooled	***18.31***	***24.06***	***5.52***	***12.32***	***53.12***	***47.60***

Table 7-4 Summary table of β [yrs/m2]

Real	mean	stdev	X5	X50	X95	X95-X5
1	1.16E+06	2.56E+06	1.96E+05	5.42E+05	3.83E+06	3.63E+06
2	1.43E+06	3.72E+06	2.57E+05	6.93E+05	5.05E+06	4.80E+06
3	1.55E+06	3.70E+06	2.21E+05	8.36E+05	5.55E+06	5.33E+06
4	1.74E+06	4.27E+06	1.96E+05	7.09E+05	5.84E+06	5.64E+06
5	1.41E+06	2.82E+06	1.75E+05	6.00E+05	5.28E+06	5.11E+06
6	1.95E+06	5.19E+06	2.37E+05	6.60E+05	5.95E+06	5.71E+06
7	1.63E+06	3.12E+06	1.49E+05	6.41E+05	7.77E+06	7.62E+06
8	1.52E+06	3.10E+06	1.62E+05	6.79E+05	5.72E+06	5.56E+06
9	1.49E+06	3.66E+06	2.02E+05	5.48E+05	5.22E+06	5.02E+06
10	1.38E+06	2.95E+06	2.08E+05	7.02E+05	4.82E+06	4.62E+06
11	1.73E+06	4.31E+06	2.60E+05	9.60E+05	5.63E+06	5.37E+06
12	1.92E+06	7.72E+06	4.90E+05	9.49E+05	5.54E+06	5.05E+06
13	1.59E+06	3.99E+06	2.70E+05	7.13E+05	6.02E+06	5.75E+06
14	1.57E+06	5.18E+06	3.12E+05	6.02E+05	6.11E+06	5.79E+06
15	1.13E+06	2.29E+06	1.23E+05	4.55E+05	4.99E+06	4.87E+06
16	1.33E+06	3.78E+06	2.17E+05	6.15E+05	4.59E+06	4.37E+06
17	1.45E+06	2.77E+06	1.44E+05	6.58E+05	5.28E+06	5.14E+06
18	1.54E+06	3.95E+06	2.93E+05	8.40E+05	5.49E+06	5.20E+06
19	1.15E+06	2.86E+06	1.70E+05	4.77E+05	4.32E+06	4.15E+06
20	1.54E+06	3.28E+06	1.48E+05	7.60E+05	5.05E+06	4.90E+06
Mean	**1.51E+06**	**3.76E+06**	**2.21E+05**	**6.82E+05**	**5.40E+06**	**5.18E+06**
Pooled	***1.50E+06***	***3.87E+06***	***4.72E+05***	9.30E+05	***5.52E+06***	***5.05E+06***

7.2 Eulerian results

Table 7-1 Summary table of $\log_{10}$(v [m/yrs])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	0.64	0.70	-0.56	0.74	1.69	2.26
2	0.65	0.70	-0.58	0.71	1.73	2.31
3	0.64	0.71	-0.58	0.72	1.74	2.31
4	0.64	0.71	-0.58	0.73	1.74	2.32
5	0.64	0.71	-0.56	0.70	1.73	2.29
6	0.64	0.69	-0.53	0.72	1.70	2.23
7	0.66	0.71	-0.57	0.74	1.74	2.31
8	0.63	0.70	-0.56	0.71	1.71	2.27
9	0.65	0.72	-0.59	0.71	1.74	2.33
10	0.66	0.69	-0.51	0.75	1.72	2.22
11	0.66	0.70	-0.50	0.76	1.73	2.23
12	0.64	0.71	-0.59	0.71	1.69	2.28
13	0.66	0.71	-0.57	0.74	1.75	2.32
14	0.65	0.69	-0.55	0.75	1.69	2.25
15	0.67	0.71	-0.55	0.74	1.77	2.32
16	0.67	0.72	-0.56	0.74	1.77	2.33
17	0.64	0.70	-0.59	0.74	1.72	2.30
18	0.64	0.70	-0.56	0.74	1.72	2.28
19	0.67	0.70	-0.54	0.73	1.76	2.31
20	0.63	0.71	-0.59	0.69	1.73	2.33
Mean	**0.65**	**0.70**	**-0.56**	**0.73**	**1.73**	**2.29**
Pooled	***0.65***	***0.70***	***-0.58***	***0.74***	***1.76***	***2.33***

Table 7-2 Summary table of $\log_{10}$(b [m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-4.69	0.34	-5.24	-4.68	-4.12	1.12
2	-4.69	0.34	-5.25	-4.68	-4.12	1.13
3	-4.69	0.35	-5.27	-4.70	-4.09	1.18
4	-4.68	0.35	-5.26	-4.68	-4.09	1.17
5	-4.69	0.35	-5.25	-4.69	-4.10	1.14
6	-4.69	0.34	-5.25	-4.69	-4.12	1.13
7	-4.69	0.35	-5.26	-4.68	-4.10	1.17
8	-4.69	0.35	-5.27	-4.69	-4.12	1.15
9	-4.68	0.35	-5.25	-4.68	-4.10	1.16
10	-4.69	0.34	-5.25	-4.68	-4.12	1.13
11	-4.68	0.34	-5.23	-4.68	-4.08	1.15
12	-4.68	0.34	-5.25	-4.67	-4.11	1.14
13	-4.69	0.35	-5.27	-4.69	-4.11	1.16
14	-4.69	0.34	-5.24	-4.67	-4.13	1.12
15	-4.68	0.35	-5.25	-4.68	-4.10	1.15
16	-4.68	0.35	-5.26	-4.68	-4.12	1.14
17	-4.68	0.34	-5.25	-4.68	-4.11	1.13
18	-4.69	0.34	-5.23	-4.69	-4.12	1.11
19	-4.68	0.34	-5.22	-4.69	-4.10	1.12
20	-4.69	0.35	-5.24	-4.69	-4.08	1.16
Mean	**-4.69**	**0.35**	**-5.25**	**-4.68**	**-4.11**	**1.14**
Pooled	***-4.69***	***0.35***	***-5.25***	***-4.68***	***-4.12***	***1.13***

Table 7-3 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-0.64	0.70	-1.64	-0.69	0.62	2.26
2	-0.65	0.70	-1.67	-0.65	0.63	2.31
3	-0.64	0.71	-1.69	-0.68	0.62	2.31
4	-0.64	0.71	-1.68	-0.68	0.63	2.32
5	-0.64	0.71	-1.69	-0.66	0.60	2.29
6	-0.64	0.69	-1.66	-0.68	0.57	2.23
7	-0.66	0.71	-1.69	-0.69	0.62	2.32
8	-0.63	0.70	-1.65	-0.65	0.62	2.27
9	-0.65	0.72	-1.69	-0.66	0.64	2.33
10	-0.66	0.69	-1.66	-0.70	0.56	2.22
11	-0.66	0.70	-1.67	-0.70	0.56	2.23
12	-0.64	0.71	-1.64	-0.67	0.64	2.28
13	-0.66	0.71	-1.70	-0.69	0.62	2.32
14	-0.65	0.69	-1.69	-0.70	0.60	2.29
15	-0.67	0.71	-1.72	-0.68	0.61	2.32
16	-0.67	0.72	-1.72	-0.69	0.60	2.33
17	-0.64	0.70	-1.66	-0.68	0.64	2.30
18	-0.64	0.70	-1.66	-0.68	0.61	2.28
19	-0.67	0.70	-1.72	-0.69	0.55	2.26
20	-0.63	0.71	-1.68	-0.64	0.65	2.33
Mean	**-0.65**	**0.70**	**-1.68**	**-0.68**	**0.61**	**2.29**
Pooled	***-0.65***	***0.70***	***-1.69***	***-0.68***	***0.64***	***2.33***

Table 7-4 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	4.05	0.99	2.54	4.03	5.80	3.25
2	4.04	0.99	2.52	4.03	5.78	3.26
3	4.05	1.01	2.49	4.04	5.82	3.33
4	4.04	1.00	2.53	4.03	5.83	3.30
5	4.04	1.01	2.51	4.02	5.81	3.30
6	4.05	0.98	2.54	4.03	5.74	3.20
7	4.02	1.02	2.51	3.99	5.84	3.33
8	4.06	1.00	2.53	4.06	5.82	3.30
9	4.04	1.02	2.50	4.01	5.83	3.33
10	4.02	0.98	2.54	4.00	5.78	3.25
11	4.02	0.99	2.52	4.03	5.74	3.22
12	4.05	1.00	2.54	3.98	5.81	3.28
13	4.04	1.00	2.54	3.99	5.79	3.25
14	4.03	0.99	2.58	4.01	5.81	3.23
15	4.01	1.01	2.50	4.00	5.80	3.30
16	4.02	1.01	2.47	4.00	5.78	3.31
17	4.04	0.99	2.57	4.03	5.81	3.24
18	4.04	0.99	2.56	4.00	5.75	3.19
19	4.02	0.99	2.48	4.01	5.74	3.27
20	4.06	1.01	2.51	4.04	5.79	3.28
Mean	**4.04**	**1.00**	**2.52**	**4.02**	**5.79**	**3.27**
Pooled	***4.04***	***1.00***	***2.51***	***3.99***	***5.81***	***3.30***

8 Case 7b

8.1 Lagrangian results

Y5, Y50 and Y95 represent respectively the 5%, 50% and 95% percentiles of the logarithmed values in base 10.

Table 8-1 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-2.06	0.41	-2.54	-2.12	-1.24	1.29
2	-2.03	0.42	-2.59	-2.05	-1.29	1.30
3	-1.98	0.44	-2.62	-2.01	-1.20	1.41
4	-1.99	0.47	-2.60	-2.04	-1.13	1.47
5	-2.02	0.40	-2.57	-2.03	-1.32	1.26
6	-2.01	0.43	-2.59	-2.06	-1.18	1.41
7	-2.03	0.41	-2.60	-2.06	-1.27	1.33
8	-2.03	0.43	-2.59	-2.11	-1.20	1.39
9	-2.01	0.41	-2.59	-1.98	-1.29	1.31
10	-2.03	0.42	-2.60	-2.05	-1.23	1.36
11	-1.99	0.44	-2.62	-2.00	-1.23	1.39
12	-1.97	0.51	-2.60	-2.06	-0.82	1.77
13	-2.00	0.43	-2.62	-2.03	-1.29	1.33
14	-2.01	0.42	-2.62	-2.03	-1.24	1.38
15	-2.08	0.39	-2.55	-2.15	-1.41	1.15
16	-2.02	0.45	-2.62	-2.07	-1.09	1.53
17	-2.01	0.43	-2.60	-2.04	-1.23	1.37
18	-2.02	0.45	-2.60	-2.08	-1.21	1.39
19	-2.08	0.37	-2.58	-2.13	-1.41	1.17
20	-1.91	0.55	-2.62	-2.02	-0.79	1.83
Mean	**-2.01**	**0.43**	**-2.59**	**-2.06**	**-1.23**	**1.37**
Pooled	***-2.01***	***0.44***	***-2.61***	***-2.03***	***-1.17***	***1.43***

Table 8-2 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	2.70	0.78	1.80	2.51	4.24	2.44
2	2.76	0.75	1.85	2.62	4.25	2.40
3	2.67	0.81	1.72	2.49	4.26	2.54
4	2.74	0.83	1.64	2.62	4.32	2.68
5	2.67	0.81	1.63	2.53	4.27	2.63
6	2.80	0.79	1.85	2.68	4.34	2.48
7	2.66	0.82	1.70	2.51	4.29	2.59
8	2.80	0.74	1.92	2.65	4.29	2.37
9	2.59	0.81	1.68	2.47	4.19	2.51
10	2.74	0.81	1.68	2.64	4.29	2.61
11	2.75	0.82	1.69	2.64	4.32	2.63
12	2.86	0.77	1.96	2.74	4.38	2.42
13	2.64	0.84	1.47	2.56	4.23	2.76
14	2.62	0.83	1.53	2.46	4.24	2.71
15	2.58	0.83	1.53	2.48	4.18	2.65
16	2.58	0.85	1.41	2.52	4.19	2.78
17	2.75	0.79	1.73	2.63	4.28	2.55
18	2.74	0.80	1.68	2.65	4.30	2.62
19	2.42	0.91	1.34	2.32	4.15	2.81
20	2.72	0.83	1.57	2.62	4.33	2.76
Mean	**2.69**	**0.81**	**1.67**	**2.57**	**4.27**	**2.60**
Pooled	***2.68***	***0.82***	***1.62***	***2.56***	***4.27***	***2.65***

X5, X50 and X95 represent respectively the 5%, 50% and 95% percentiles of the studied variables.

Table 8-3 Summary table of τ [yrs]

Real	mean	stdev	X5	X50	X95	X95-X5
1	3.01	3.94	1.17	2.50	6.50	5.33
2	3.50	3.03	1.30	2.65	9.05	7.75
3	3.83	6.38	1.52	3.38	7.10	5.58
4	5.41	15.09	2.33	3.58	13.64	11.31
5	3.13	2.77	1.47	2.53	6.79	5.32
6	3.39	2.49	1.38	2.85	7.10	5.73
7	3.38	10.41	2.02	3.41	7.57	5.55
8	3.24	2.30	1.13	2.58	7.66	6.53
9	3.39	4.57	1.33	2.45	8.61	7.28
10	3.09	2.00	1.26	2.66	6.50	5.24
11	4.48	8.29	1.89	3.57	11.16	9.27
12	5.91	6.99	1.93	4.31	15.04	13.11
13	4.71	10.75	1.96	2.82	13.12	11.16
14	2.98	2.94	1.54	2.77	5.24	3.70
15	2.94	3.24	1.17	2.14	5.84	4.67
16	3.55	3.12	1.45	2.71	8.14	6.69
17	3.58	4.13	1.40	3.02	7.50	6.11
18	6.24	12.07	1.66	3.15	21.82	20.16
19	2.62	3.08	1.02	2.15	6.28	5.25
20	6.60	8.05	2.02	5.37	15.40	13.39
Mean	**3.81**	**5.66**	**1.52**	**2.91**	**9.19**	**7.67**
Pooled	***3.89***	***6.76***	***2.00***	***3.39***	***10.33***	***8.32***

Table 8-4 Summary table of β [yrs/m2]

Real	mean	stdev	X5	X50	X95	X95-X5
1	3.77E+06	3.58E+07		too few data		
2	4.56E+06	1.79E+07		too few data		
3	3.77E+06	1.48E+07	1.03E+06	2.01E+06	1.28E+07	1.18E+07
4	4.46E+06	1.59E+07	5.99E+05	1.62E+06	1.49E+07	1.43E+07
5	3.31E+06	1.11E+07	5.09E+05	1.42E+06	9.60E+06	9.09E+06
6	6.71E+06	6.60E+07		too few data		
7	3.78E+06	1.70E+07	8.85E+05	1.71E+06	1.08E+07	9.93E+06
8	2.65E+06	5.80E+06	3.26E+05	1.16E+06	1.15E+07	1.11E+07
9	3.58E+06	2.82E+07		too few data		
10	1.90E+07	1.61E+08		too few data		
11	3.37E+06	1.18E+07	6.86E+05	1.34E+06	9.90E+06	9.22E+06
12	3.74E+06	7.22E+06	2.38E+05	1.50E+06	1.63E+07	1.61E+07
13	4.34E+06	3.68E+07		too few data		
14	3.21E+06	1.24E+07	8.67E+05	1.70E+06	1.17E+07	1.08E+07
15	2.08E+06	3.81E+06	1.14E+05	8.39E+05	8.55E+06	8.43E+06
16	2.20E+06	6.36E+06	2.97E+05	8.30E+05	7.75E+06	7.45E+06
17	2.96E+06	8.53E+06	4.31E+05	1.20E+06	1.15E+07	1.11E+07
18	6.89E+06	4.59E+07		too few data		
19	2.14E+06	4.60E+06	2.05E+05	9.14E+05	8.88E+06	8.68E+06
20	3.77E+06	8.53E+06	3.25E+05	1.39E+06	1.58E+07	1.55E+07
Mean	**4.51E+06**	**2.60E+07**	**5.01E+05**	**1.36E+06**	**1.15E+07**	**1.10E+07**
Pooled	***4.58E+06***	***4.43E+07***		too few data		

8.2 Eulerian results

Table 8-1 Summary table of $\log_{10}$(v [m/yrs])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	2.01	0.46	1.22	2.09	2.66	1.44
2	1.99	0.47	1.20	2.09	2.65	1.45
3	2.00	0.46	1.23	2.06	2.67	1.44
4	1.99	0.48	1.18	2.09	2.67	1.49
5	2.00	0.46	1.24	2.06	2.65	1.42
6	2.01	0.44	1.27	2.09	2.65	1.38
7	2.02	0.45	1.25	2.08	2.66	1.41
8	2.01	0.45	1.22	2.09	2.68	1.46
9	1.99	0.46	1.20	2.05	2.68	1.47
10	2.02	0.45	1.25	2.10	2.67	1.42
11	2.00	0.46	1.22	2.06	2.69	1.47
12	1.99	0.46	1.22	2.04	2.68	1.46
13	2.02	0.47	1.24	2.07	2.71	1.46
14	2.01	0.44	1.25	2.08	2.65	1.40
15	2.02	0.45	1.27	2.11	2.65	1.38
16	2.02	0.46	1.24	2.10	2.69	1.45
17	1.99	0.47	1.20	2.04	2.64	1.44
18	2.00	0.47	1.22	2.10	2.69	1.47
19	2.02	0.44	1.27	2.10	2.68	1.41
20	1.98	0.49	1.15	2.04	2.68	1.53
Mean	**2.01**	**0.46**	**1.23**	**2.08**	**2.67**	**1.44**
Pooled	***2.01***	***0.46***	***1.22***	***2.09***	***2.66***	***1.44***

Table 8-2 Summary table of $\log_{10}$(b [m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-6.06	1.03	-7.71	-6.03	-4.35	3.36
2	-6.03	1.02	-7.72	-5.99	-4.34	3.38
3	-6.05	1.05	-7.79	-6.07	-4.25	3.54
4	-6.04	1.04	-7.78	-6.02	-4.26	3.52
5	-6.05	1.05	-7.72	-6.05	-4.28	3.44
6	-6.06	1.02	-7.72	-6.05	-4.34	3.38
7	-6.04	1.06	-7.77	-6.02	-4.27	3.50
8	-6.06	1.03	-7.77	-6.04	-4.37	3.40
9	-6.03	1.05	-7.75	-6.02	-4.26	3.48
10	-6.05	1.02	-7.74	-6.03	-4.35	3.39
11	-6.02	1.03	-7.67	-6.03	-4.25	3.42
12	-6.04	1.03	-7.73	-6.00	-4.31	3.42
13	-6.06	1.04	-7.79	-6.05	-4.31	3.48
14	-6.04	1.03	-7.71	-6.00	-4.36	3.35
15	-6.03	1.04	-7.73	-6.04	-4.28	3.45
16	-6.03	1.04	-7.75	-6.03	-4.34	3.41
17	-6.03	1.03	-7.72	-6.02	-4.32	3.40
18	-6.04	1.02	-7.68	-6.06	-4.37	3.31
19	-6.04	1.03	-7.65	-6.05	-4.28	3.37
20	-6.05	1.06	-7.74	-6.06	-4.27	3.48
Mean	**-6.04**	**1.03**	**-7.73**	**-6.03**	**-4.31**	**3.42**
Pooled	***-6.04***	***1.04***	***-7.73***	***-6.03***	***-4.32***	***3.40***

Table 8-3 Summary table of $\log_{10}$(1/v [yrs/m])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	-2.01	0.46	-2.60	-2.04	-1.22	1.38
2	-1.99	0.47	-2.60	-2.04	-1.14	1.45
3	-2.00	0.46	-2.63	-2.02	-1.19	1.44
4	-1.99	0.48	-2.62	-2.04	-1.13	1.49
5	-2.00	0.46	-2.65	-2.02	-1.20	1.45
6	-2.01	0.44	-2.61	-2.05	-1.23	1.38
7	-2.02	0.45	-2.62	-2.04	-1.21	1.41
8	-2.01	0.45	-2.63	-2.05	-1.17	1.46
9	-1.99	0.46	-2.63	-2.04	-1.16	1.47
10	-2.02	0.45	-2.62	-2.05	-1.25	1.37
11	-2.00	0.46	-2.65	-2.02	-1.21	1.43
12	-1.99	0.46	-2.64	-2.00	-1.18	1.46
13	-2.02	0.47	-2.65	-2.07	-1.19	1.46
14	-2.01	0.44	-2.61	-2.03	-1.20	1.40
15	-2.02	0.45	-2.60	-2.06	-1.22	1.38
16	-2.02	0.46	-2.65	-2.05	-1.20	1.45
17	-1.99	0.47	-2.59	-1.99	-1.15	1.44
18	-2.00	0.47	-2.63	-2.05	-1.17	1.47
19	-2.02	0.44	-2.64	-2.06	-1.23	1.41
20	-1.98	0.49	-2.64	-2.00	-1.10	1.53
Mean	**-2.01**	**0.46**	**-2.62**	**-2.04**	**-1.19**	**1.43**
Pooled	***-2.01***	***0.46***	***-2.60***	***-2.04***	***-1.16***	***1.44***

Table 8-4 Summary table of $\log_{10}$(1/bv [yrs/m2])

Real	mean	stdev	Y5	Y50	Y95	Y95-Y5
1	4.04	0.99	2.54	4.03	5.77	3.23
2	4.04	0.99	2.55	4.01	5.82	3.27
3	4.05	1.01	2.50	4.02	5.83	3.33
4	4.04	1.01	2.53	4.01	5.81	3.28
5	4.04	1.01	2.51	4.03	5.82	3.31
6	4.05	0.98	2.57	4.03	5.78	3.20
7	4.02	1.01	2.47	4.00	5.82	3.35
8	4.05	0.99	2.52	4.02	5.79	3.27
9	4.04	1.02	2.50	4.01	5.84	3.35
10	4.02	0.99	2.54	4.01	5.78	3.24
11	4.02	0.99	2.49	4.02	5.73	3.25
12	4.05	1.00	2.55	3.99	5.83	3.28
13	4.04	1.00	2.51	4.03	5.80	3.29
14	4.02	0.99	2.53	4.01	5.79	3.26
15	4.01	1.01	2.48	3.99	5.80	3.32
16	4.02	1.01	2.48	3.98	5.82	3.35
17	4.04	0.99	2.54	4.02	5.78	3.24
18	4.04	0.99	2.52	4.03	5.75	3.23
19	4.02	0.99	2.49	3.98	5.72	3.24
20	4.07	1.00	2.53	4.06	5.83	3.30
Mean	**4.04**	**1.00**	**2.52**	**4.01**	**5.80**	**3.28**
Pooled	***4.04***	***1.00***	***2.50***	***4.00***	***5.81***	***3.31***