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Oskarshamn site investigation
Groundwater monitoring program
Report for January–August 2007

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Geosigma AB

October 2007

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Keywords: Groundwater, Borehole, Instrumentation, Measurement methods, Monitoring, Oskarshamn.

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

Data in SKB's database can be changed for different reasons. Minor changes in SKB's database will not necessarily result in a revised report. Data revisions may also be presented as supplements, available at www.skb.se.

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

Abstract

This document reports data obtained within the groundwater monitoring program, which is one of the activities performed within the site investigation at Oskarshamn. The objective of the groundwater monitoring is to support the hydrogeological characterization of the area and to document the groundwater conditions before a possible excavation.

Data presented in this report are collected during the period of January until August 2007 and consist of groundwater levels in boreholes. Meteorological and hydrological variables are also monitored within the framework of the site investigations but reported separately.

The data collecting system in HMS (Hydro Monitoring System) consists of two measurement stations (computers) which communicate with and collect data from a number of dataloggers. The computers are connected to the SKB Ethernet LAN. All data are collected by means of different transducers connected to different types of data loggers: Minitroll, LevelTroll, Mitec and Datataker.

In order to calibrate registrations from the data loggers, manual levelling of all sections is made, normally once every month. The logger data are converted to water levels using calibration constants. All collected data are subjected to a quality check, during which obviously erroneous data are removed and calibration constants are corrected so that the monitored data are consistent with the manual levelling. The status of the equipment is also controlled and service might be initiated.

Diagrams of groundwater levels for the period of January–August 2007 (daily values for each section) are presented in Appendix 1. The original results are stored in the primary data base Sicada. The data in this data base may then be used for further analysis.

There are no nonconformities with respect to the activity plan or the method description.

Sammanfattning

Denna rapport redovisar data erhållna inom grundvattenmonitoreringsprogrammet, vilket är en av aktiviteterna inom platsundersökningen i Oskarshamn. Syftet med grundvattenmonitoreringen är att stödja den hydrogeologiska karakteriseringen av platsen och att dokumentera grundvattenförhållanden före en eventuell byggnation.

Data presenterade i rapporten är insamlade under perioden januari till och med augusti 2007 och består av grundvattennivå i borrhål. Inom ramen för platsundersökningarna monitoreras även meteorologiska och ythydrologiska variabler, men dessa presenteras i en annan rapport.

Datainsamlingsystemet i HMS (Hydro Monitoring System) består av två mätstationer (datorer) vilka kommunicerar med och samlar in data från ett antal dataloggers. Datorn är förbunden med SKB:s nätverk. Alla data samlas in med hjälp av olika givare förbundna med olika typer av dataloggrar: Minitroll, LevelTroll, Mitec och Datataker.

För att kunna kalibrera registreringarna från dataloggrarna utförs, vanligtvis en gång i månaden, manuell nivåregistrering (lodning) i alla sektioner. Loggerdata omvandlas till vattennivåer genom användande av kalibreringskonstanter. Alla insamlade data kvalitetskontrolleras. Under detta arbete tas uppenbart felaktiga data bort och kalibreringskonstanterna korrigeras så att automatiskt registrerade data överensstämmer med manuella nivåregistreringar. Vid dessa tillfällen kontrolleras utrustningens status och service kan initieras.

Diagram över grundvattennivåerna för perioden januari till augusti 2007 (en datapunkt per sektion och 24 timmar redovisas) visas i Appendix 1. Ursprungsresultatet lagras i primär databasen Sicada. Data från denna databas kan användas för vidare analyser.

Aktiviteten har utförts i överensstämmelse med aktivitetsplanen och metodbeskrivningen.

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1 Introduction

This document reports data collected within the groundwater monitoring program, which is one of the activities performed within the site investigation at Oskarshamn. The work was carried out in accordance with activity plans SKB AP PS 400-06-159. In Table 1-1, controlling documents for this activity are listed. The activity plans and the method descriptions are SKB's internal controlling documents. The site investigation internal report, Table 1-2, presents the results from the quality check performed once every three months, see Chapter 4.4.

Data presented in this report include groundwater levels collected during January–August 2007.

The HMS (Hydro Monitoring System) is used to collect and store all data.

Table 1-1. Controlling documents.

Activity Plans	Number	Version
Platsundersökning i Oskarshamn – Grundvattenmonitoring 2007.	AP PS 400-06-159	1.0
Method Descriptions	Number	Version
Metodbeskrivning för grundvattenmonitoring vid SKB:s platsundersökningar.	SKB MD 360.002	1.0

Table 1-2. Monitoring reports.

Site investigation Internal Reports (in Swedish)	Number
Platsundersökning i Oskarshamn – Kvalitetskontroll av grundvattenmonitoring Period: oktober 2006–januari 2007.	PIR-07-06
Platsundersökning i Oskarshamn – Kvalitetskontroll av grundvattenmonitoring Period: januari–maj 2007.	PIR-07-30
Platsundersökning i Oskarshamn – Kvalitetskontroll av grundvattenmonitoring Period: maj–september 2007.	PIR-07-40

2 Objective and scope

The objective of the groundwater monitoring program during the site investigation is to determine baseline conditions of the natural variations of the groundwater levels prior to the potential excavation for a nuclear waste repository and to support the hydrogeological site characterization.

Data collected within this activity are:

- groundwater level in boreholes,
- surface water level in streams.

There are also some parameters that are used for monitoring of the function of the measurement system itself. However, these are not reported herein.

The following numbers of boreholes and probing points were monitored during the reporting period within the Oskarshamn site investigation:

- 35 core-drilled boreholes,
- 43 percussion-drilled boreholes,
- 70 soil wells,
- 2 probing points monitoring surface water level in streams.

The locations of the boreholes and probing points monitored during the reporting period are shown in Figure 2-1. A list of the boreholes along with some basic information is compiled in Table 2-1 and in Table 5-1.

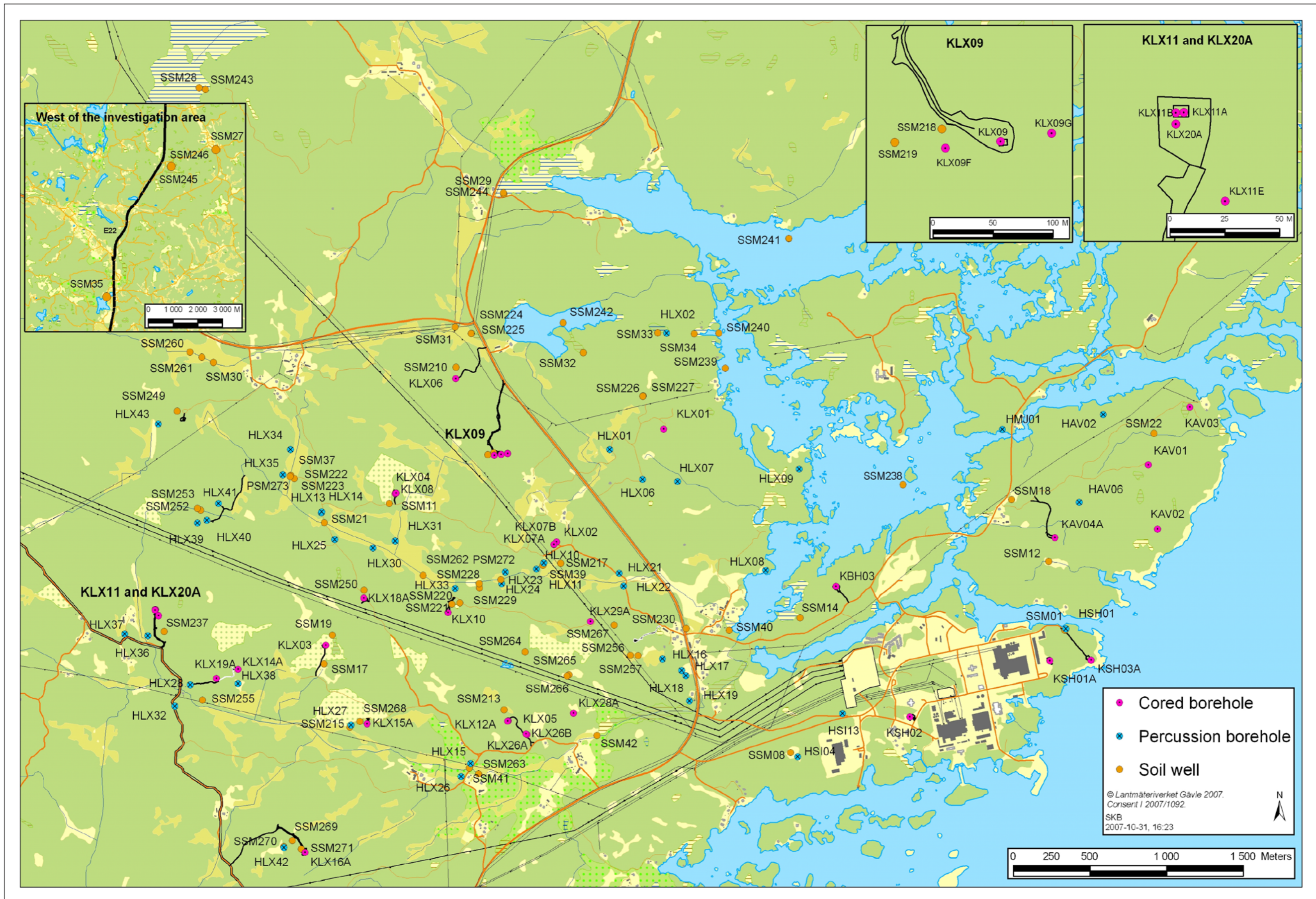


Figure 2-1. Overview of the Oskarshamn site investigation area showing the locations of monitored boreholes.

Table 2-1. Borehole length, inclination, elevation at top of casing (TOC) and date for the completion of drilling.

Borehole	Borehole length (m)	Inclination at ground (°)	Elevation at TOC (m.a.s.l.)	Drilling completed	Length of casing (m)	Comment
HAV02	163.0	-89.1	6.11	1986-08-21	?	
HAV06	100.0	-59.5	12.42	1987-07-30	1.20	
HLX01	100.63	-59.4	8.90	1987-10-21	3.00	
HLX02	132.0	-59.3	9.04	1987-10-27	0.60	
HLX06	100.0	-58.6	15.48	1987-10-30	1.00	
HLX07	100.0	-60.8	8.61	1987-11-03	1.00	
HLX08	40.0	-47.8	2.22	1991-11-14	6.00	
HLX09	151.0	-61.3	3.31	1991-11-21	3.00	
HLX10	85.0	-68.7	11.74	1992-09-30	3.00	
HLX11	70.0	-68.5	13.15	1992-10-01	6.00	
HLX13	200.2	-58.1	17.39	2004-02-26	11.85	
HLX14	115.9	-68.6	17.11	2004-03-11	11.90	
HLX15	151.9	-58.4	4.81	2004-04-29	12.04	
HLX16	202.2	-58.1	3.65	2004-06-24	12.03	
HLX17	202.2	-59.5	3.35	2004-07-01	9.03	
HLX18	181.2	-57.6	4.04	2004-07-06	15.03	
HLX19	202.2	-57.9	5.95	2004-08-12	12.03	
HLX21	150.3	-57.0	10.31	2004-09-02	9.03	
HLX22	163.2	-59.4	10.06	2004-08-26	9.03	
HLX23	160.2	-58.2	14.69	2004-09-16	6.03	
HLX24	175.2	-58.4	12.77	2004-09-09	9.03	
HLX25	202.5	-58.6	20.66	2004-08-19	6.03	
HLX26	151.2	-60.4	6.48	2004-09-28	9.03	
HLX27	164.7	-59.4	8.25	2004-09-22	6.03	
HLX28	154.2	-59.5	13.42	2004-10-02	6.03	
HLX30	163.4	-61.0	12.18	2004-11-30	9.03	
HLX31	133.2	-58.8	12.16	2004-12-03	9.03	
HLX32	162.6	-58.7	10.84	2005-01-11	12.30	
HLX33	202.1	-58.8	12.20	2004-12-20	9.03	
HLX34	151.8	-59.7	14.29	2005-06-14	9.03	
HLX35	151.8	-60.1	14.44	2005-06-02	6.03	
HLX36	199.8	-59.0	15.56	2005-09-22	6.03	
HLX37	199.8	-59.2	15.19	2005-09-28	12.03	
HLX38	199.5	-59.5	11.53	2006-04-24	15.02	
HLX39	199.3	-59.3	27.04	2006-06-14	6.02	
HLX40	199.5	-59.8	25.74	2006-05-09	6.02	
HLX41	199.5	-59.1	21.80	2006-06-01	6.02	
HLX42	152.6	-57.1	12.88	2006-11-16	9.10	
HLX43	170.6	-50.5	24.20	2006-10-26	6.00	
HMJ01	46.0	-60.0	1.41	1991-10-30	6.00	
HSH01	200.0	-70.0	2.86	2002-07-02	12.00	
HSI04	37.0	-58.5	6.63	1995-02-02	?	
HSI13	4.0	-90.0	5.54	1980-02-02	?	
KAV01	502.0			1977-05-16		
	746.6			1986-11-16		

Borehole	Borehole length (m)	Inclination at ground (°)	Elevation at TOC (m.a.s.l.)	Drilling completed	Length of casing (m)	Comment
	757.31	-89.2	14.10	2004-01-10	68.04	
KAV02	97.1	-89.5	7.55	1977-05-31	12.40	
KAV03	248.4	-89.4	8.74	1986-10-05	2.80	
KAV04A	1,004.0	-84.9	10.35	2004-05-03	100.00	
KBH03	100.43	-84.7	7.82	2004-02-13	24.97	
KLX01	702.11			1988-02-05		
	1,077.99	-85.3	16.77	1990-08-04	101.30	
KLX02	1,700.5	-85.0	18.40	1992-11-29	202.95	
KLX03	1,000.42	-74.9	18.49	2004-09-07	100.05	
KLX04	993.49	-84.8	24.09	2004-06-28	12.24	
KLX05	1,000.16	65.2	17.63	2005-01-22	15.00	
KLX06	994.94	-65.2	17.68	2004-11-25	11.88	
KLX07A	844.73	-60.0	18.47	2005-05-04	11.80	
KLX07B	200.13	-85.1	18.38	2005-06-03	9.64	
KLX08	1,000.41	-60.5	24.31	2005-06-13	12.20	
KLX09	880.38	-84.9	23.45	2005-10-15	11.95	
KLX09F	152.3	-59.7	19.57	2006-01-06	9.00	
KLX09G	100.1	-61.1	19.63	2006-02-03	9.30	
KLX10	1,001.2	-85.2	18.28	2005-10-15	12.10	
KLX11A	992.29	-76.8	27.14	2006-03-02	12.05	
KLX11B	100.2	-89.9	27.27	2006-04-28	2.54	
KLX11E	121.3	-60.9	22.65	2006-04-21	2.00	
KLX12A	602.29	-75.3	17.74	2006-03-04	17.92	
KLX14A	176.27	-50.0	16.35	2006-09-04	6.45	
KLX15A	1,000.43	-54.4	14.59	2007-02-25	11.65	
KLX16A	433.55	-65.0	18.85	2007-01-09	11.25	
KLX18A	611.28	-82.1	21.01	2006-05-02	11.83	
KLX19A	800.07	-57.5	16.87	2006-09-20	522.40	
KLX20A	457.92	-50.0	27.24	2006-04-24	99.50	
KLX26A	101.14	-60.4	15.63	2006-08-11	2.64	
KLX26B	50.37	-60.0	15.82	2006-08-17	2.31	
KLX28A	80.23	-60.0	10.05	2006-09-20	5.10	
KLX29A	60.25	-60.9	13.63	2006-09-13	2.35	
KSH01A	1,003.0	-80.4	5.32	2002-12-18	12.10	
KSH02	1,001.11	-85.6	5.48	2003-06-11	80.00	
KSH03A	1,000.7	-59.2	4.15	2003-11-07	100.05	
SSM000001	3.0	-86.7	2.79	2002-10-08		
SSM000008	7.6	-88.2	4.64	2003-12-08		
SSM000011	3.8	-88.6	16.50	2004-01-29		
SSM000012	9.5	-86.0	1.77	2004-01-22		
SSM000014	6.3	-85.9	1.64	2003-12-09		
SSM000017	2.15	-81.2	10.98	2004-05-04		
SSM000018	6.4	-86.2	0.78	2003-12-11		
SSM000019	3.2	-82.8	13.21	2004-05-04		
SSM000021	4.15	-86.4	12.63	2004-05-04		
SSM000022	11.4	-87.7	5.03	2004-01-12		
SSM000027	5.2	-87.8	9.21	2004-06-28		

Borehole	Borehole length (m)	Inclination at ground (°)	Elevation at TOC (m.a.s.l.)	Drilling completed	Length of casing (m)	Comment
SSM000028	3.1	-87.8	4.09	2004-06-09		
SSM000029	7.1	-87.5	1.26	2004-06-08		
SSM000030	8.2	-85.7	11.19	2004-09-10		
SSM000031	4.1	-87.2	6.32	2004-06-10		
SSM000032	4.1	-86.4	2.81	2004-06-15		
SSM000033	2.1	-88.3	5.82	2004-06-15		
SSM000034	4.5	-89.7	0.48	2004-06-16		
SSM000035	4.1	-82.9	27.11	2004-06-09		
SSM000037	5.95	-86.4	12.70	2004-06-22		
SSM000039	5.1	-85.7	11.70	2004-06-21		
SSM000040	3.2	-88.8	1.16	2004-06-14		
SSM000041	4.6	-82.9	4.15	2004-07-07		
SSM000042	5.3	-88.3	3.35	2004-06-17		
SSM000210	4.1	-87.7	11.31	2004-06-28		
SSM000213	4.0	-85.0	11.85	2004-07-06		
SSM000215	4.7	-88.5	6.74	2004-12-03		
SSM000217	4.9	-88.4	12.58	2004-12-02		
SSM000218	5.2	-88.5	18.93	2005-06-02		
SSM000219	5.1	-88.6	16.27	2005-06-01		
SSM000220	3.1	-85.6	13.13	2005-05-31		
SSM000221	3.1	-86.6	13.17	2005-05-30		
SSM000222	7.4	-87.6	12.79	2005-08-22		
SSM000223	12.3	-87.5	13.69	2005-08-24		
SSM000224	21.6	-88.5	6.90	2005-08-29		
SSM000225	10.1	-87.6	6.94	2005-09-14		
SSM000226	8.3	-88.6	6.97	2005-09-14		
SSM000227	2.1	-86.5	7.28	2005-09-14		
SSM000228	13.0	-87.9	13.09	2005-09-19		
SSM000229	7.3	-88.6	13.68	2005-09-20		
SSM000230	8.0	-88.4	5.10	2005-09-21		
SSM000237	5.6	-86.4	15.93	2005-10-31		
SSM000238	12.2	-90.0	0.36	2006-02-21		Manual levelling in PSM000267 with the elevation 1.56 m.a.s.l.
SSM000239	5.3	-90.0	0.56	2006-02-22		Manual levelling in PSM000268 with the elevation 1.61 m.a.s.l.
SSM000240	6.4	-90.0	0.61	2006-02-23		Manual levelling in PSM000269 with the elevation 1.44 m.a.s.l.
SSM000241	33.1	-90.0	0.34	2006-02-15		Manual levelling in PSM000270 with the elevation 1.47 m.a.s.l. From 2007-06-29 the elevation is 1.35 m.a.s.l.
SSM000242	18.1	-90.0	2.11	2006-02-07		Manual levelling in PSM000271 with the elevation 3.21 m.a.s.l.
SSM000243	15.0	-90.0	4.28	2006-02-13		
SSM000244	17.0	-90.0	1.91	2006-02-28		
SSM000245	7.9	-90.0	27.26	2006-02-02		

Borehole	Borehole length (m)	Inclination at ground (°)	Elevation at TOC (m.a.s.l.)	Drilling completed	Length of casing (m)	Comment
SSM000246	4.1	-90.0	27.58	2006-02-02		
SSM000249	6.6	-86.9	22.07	2006-01-26		
SSM000250	8.0	-87.2	16.84	2006-01-27		
SSM000252	7.7	-89.0	18.39	2006-07-13		
SSM000253	4.5	-88.8	17.96	2006-07-12		
SSM000255	10.2	-85.3	5.94	2006-05-16		
SSM000256	5.4	-88.2	3.60	2006-07-11		
SSM000257	7.0	-85.9	3.36	2006-07-10		
SSM000260	9.67	-89.8	10.80	2006-10-25		
SSM000261	15.7	-88.6	10.65	2006-10-24		
SSM000262	18.7	-86.8	11.46	2006-10-30		
SSM000263	10.32	-88.3	4.63	2006-11-02		
SSM000264	8.4	-89.3	15.89	2006-11-16		
SSM000265	7.55	-87.1	6.73	2006-11-08		
SSM000266	6.87	-84.6	6.78	2006-11-08		
SSM000267	8.85	-85.6	13.78	2006-11-07		
SSM000268	7.26	-85.7	11.21	2006-11-15		
SSM000269	4.6	-88.3	15.16	2006-11-15		
SSM000270	5.12	-88.5	14.15	2006-11-15		
SSM000271	4.74	-89.2	15.82	2006-11-14		

? = Information is not found in the Sicada database.

3 Equipment

3.1 Description

Drawings of the borehole equipment for permanent instrumentation in core boreholes and percussion boreholes are presented in Figure 3-1 and Figure 3-2, respectively. Figure 3-3 shows a more detailed close-up of the standpipe in which the pressure transducer is situated in these boreholes.

In Figure 3-4 the instrumentation in soil wells is shown. In open percussion and core boreholes, as in the soil wells, a transducer or data logger is submerged in the groundwater without any other equipment.

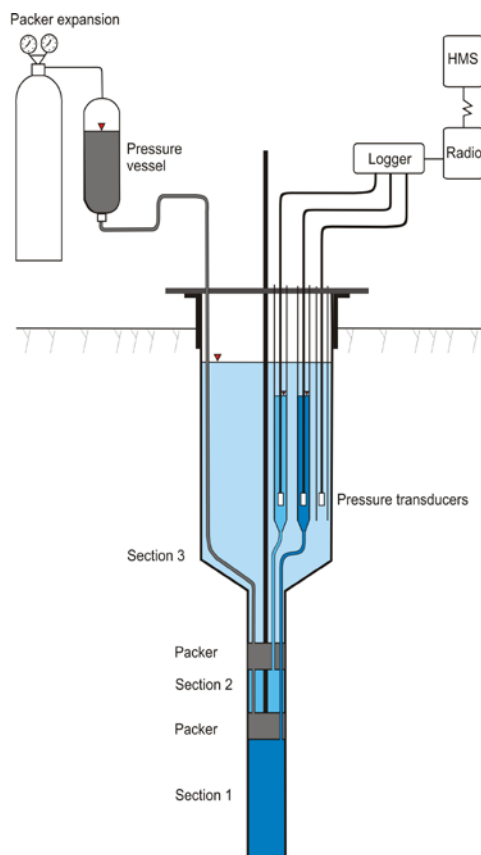


Figure 3-1. Explanatory sketch of permanent instrumentation in core boreholes.

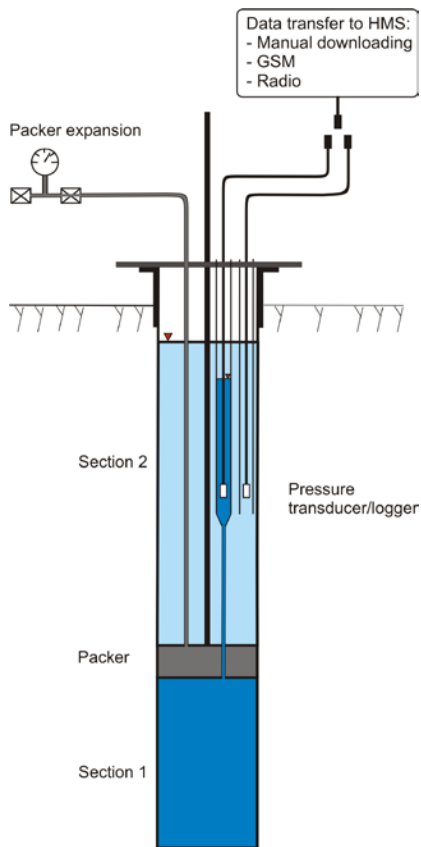


Figure 3-2. Explanatory sketch of instrumentation in percussion boreholes.

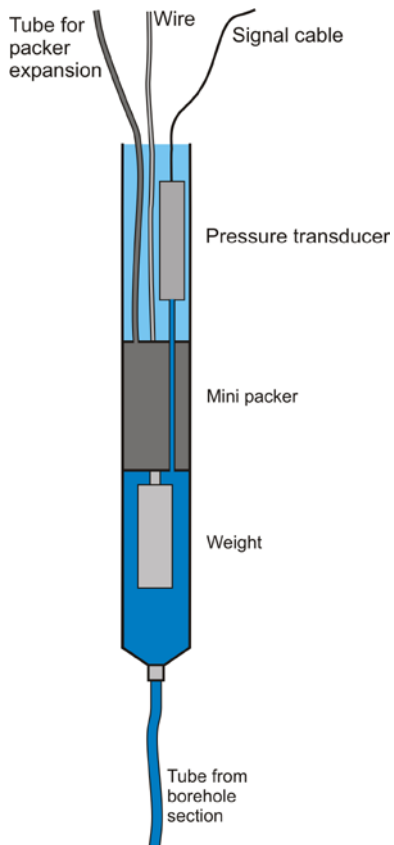


Figure 3-3. Explanatory sketch of instrumentation in standpipes in core and percussion boreholes.

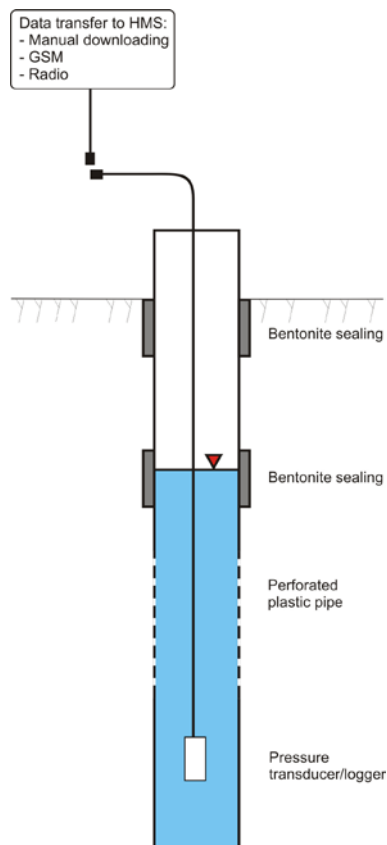


Figure 3-4. Explanatory sketch of instrumentation in soil wells.

3.2 Data collection

The data collecting system, which is part of the Hydro Monitoring System (HMS), consists of two measurement stations (computers). A measurement station collects data from a number of data sources, see Figure 3-5. The computers are connected to the SKB Ethernet LAN.

The on-line system is designed to be able to handle short interruptions in the communication. Data can be stored for at least a couple of hours in the loggers. All data are finally stored in the main measurement station. Tape backup is made of all data.

All data are collected by means of different types of pressure transducers connected to different types of data loggers or by manual levelling. Table 3-1 shows the monitoring equipment used in different boreholes and probing points. The following data loggers are used:

Minitroll: a single channel data logger of stand-alone type where the transducer is integrated in the logger. The logger is submerged in the groundwater and has the capacity to store 80,000 data.

Leveltroll: the successor to Minitroll, which is no longer manufactured. It is a logger that in most respects is equal to Minitroll, but has the capacity to store 350,000 data.

Mitec: a data logger connected on-line by means of GSM telephony. A pressure transducer of the type Druck PTX is connected to the logger. Only the transducer is submerged in the groundwater. The logger uses two or four channels. During monitoring in boreholes, one channel is used for monitoring of the battery voltage and the other ones can be used for pressure and temperature monitoring.

Datataker: a data logger connected on-line by means of radio or network. The logger has 42 channels and is used only for monitoring in percussion and core boreholes.

Monitored data that have been quality assured are transferred quarterly to the site characterization database, Sicada.

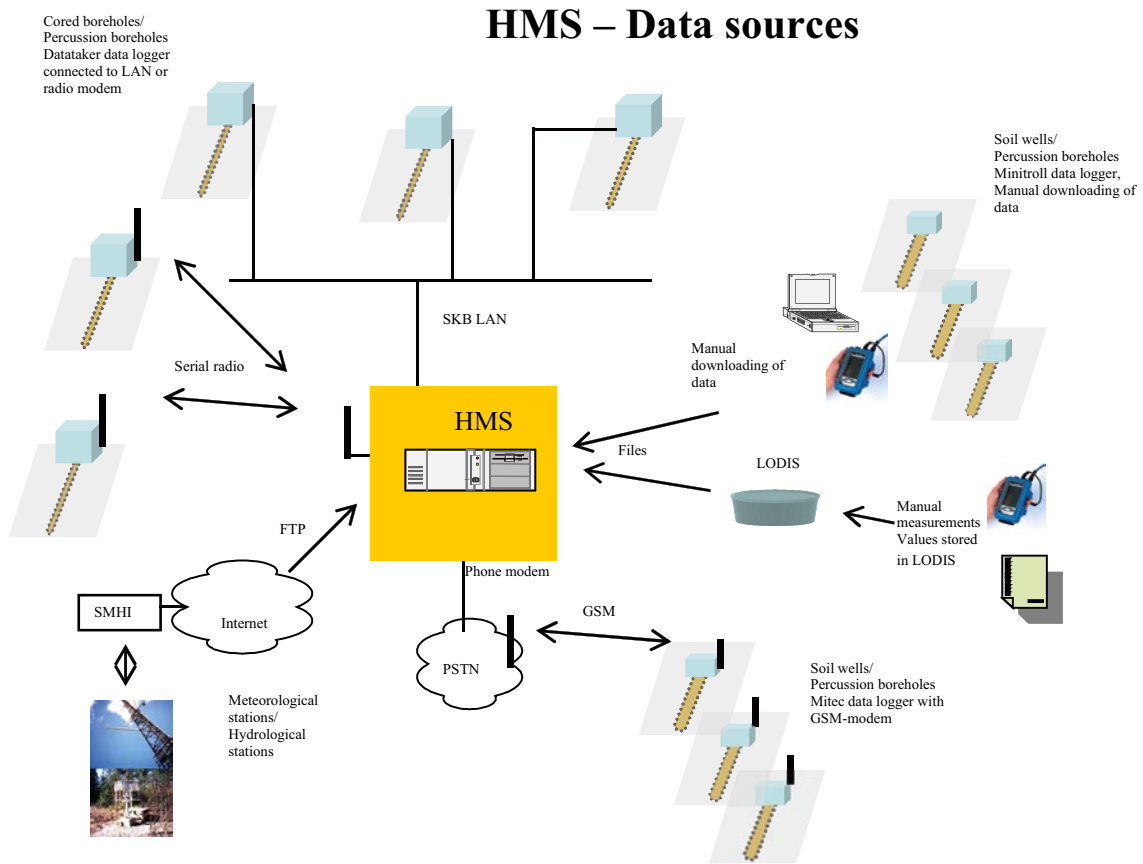


Figure 3-5. HMS data sources.

Table 3-1. Monitoring equipment.

Borehole	Logger	From	To
HAV02	Minitroll	2004-05	
HAV06	Mitec	2004-05	
HLX01	Minitroll	2005-09	
HLX02	Minitroll	2005-10	
HLX06	Minitroll	2005-09	
HLX07	Minitroll	2005-09	
HLX08	Mitec	2004-06	
HLX09	Mitec	2004-06	
HLX10	Manual levelling	2004-03	2007-01
HLX11	Minitroll	2005-10	
HLX13	Minitroll	2004-04	
HLX14	Manual levelling	2006-04	2007-02
HLX15	LevelTroll	2006-08	
HLX16	LevelTroll	2006-08	2007-01
HLX17	LevelTroll	2006-08	2007-01
HLX18	Minitroll	2004-12	
HLX19	LevelTroll	2006-08	2007-01
HLX21	Minitroll	2004-09	
HLX22	DataTaker	2006-11	
HLX23	Minitroll	2004-12	
HLX24	Minitroll	2004-09	
HLX25	Minitroll	2004-11	
HLX26	Minitroll	2004-11	
HLX27	Minitroll	2005-09	2007-05
HLX28	LevelTroll	2006-11	2007-04
HLX30	Minitroll	2004-11	
HLX31	Minitroll	2004-12	
HLX32	Minitroll	2005-09	2007-06
HLX33	Minitroll	2004-12	2007-03
HLX34	Minitroll	2005-09	
HLX35	Minitroll	2005-05	2007-08
HLX36	Minitroll	2005-09	
HLX37	Minitroll	2005-11	2007-05
HLX38	LevelTroll	2006-11	
HLX39	Minitroll	2006-08	
HLX40	Minitroll	2006-05	
HLX41	Minitroll	2006-08	
HLX42	LevelTroll	2006-11	
HLX43	LevelTroll	2006-11	2007-06
HMJ01	LevelTroll	2006-11	
HSH01	Minitroll	2004-04	
HSI04	Mitec	2004-06	
HSI13	Mitec	2005-01	
KAV01	DataTaker	2005-09	
KAV02	Mitec	2004-05	
KAV03	Minitroll	2004-07	
KAV04A	DataTaker	2005-05	
KBH03	Mitec	2004-09	
KLX01	DataTaker	2004-11	
KLX02	DataTaker	2004-04	
KLX03	DataTaker	2006-01	

Borehole	Logger	From	To
KLX04	DataTaker	2005-01	
KLX05	DataTaker	2005-11	
KLX06	DataTaker	2005-07	
KLX07A	DataTaker	2006-03	
KLX07B	DataTaker	2006-03	
KLX08	DataTaker	2007-06	
KLX09	DataTaker	2006-12	
KLX09F	Minitroll	2006-05	
KLX09G	Minitroll	2007-07	
KLX10	DataTaker	2006-08	
KLX11A	LevelTroll	2006-11	2007-05
KLX11B	LevelTroll	2006-11	2007-04
KLX11E	Minitroll	2006-10	
KLX12A	DataTaker	2006-11	
KLX14A	LevelTroll	2007-04	2007-04
KLX15A	Minitroll	2007-05	2007-06
	DataTaker	2007-08	
KLX16A	Minitroll	2007-05	2007-05
KLX18A	DataTaker	2007-02	
KLX19A	DataTaker	2007-04	
KLX20A	LevelTroll	2006-10	2007-06
	DataTaker	2007-08	
KLX26A	LevelTroll	2007-02	2007-02
KLX26B	LevelTroll	2007-02	2007-02
KLX28A	LevelTroll	2007-06	
KLX29A	LevelTroll	2007-06	
KSH01A	DataTaker	2004-10	
KSH02	DataTaker	2005-01	
KSH03A	DataTaker	2004-05	
PSM000272	Minitroll	2007-02	
PSM000273	Minitroll	2007-06	
SSM000001	Mitec	2004-06	
SSM000008	Mitec	2004-09	
SSM000011	Minitroll	2004-04	
SSM000012	Mitec	2004-08	
SSM000014	Mitec	2004-09	
SSM000017	LevelTroll	2006-09	
SSM000018	Mitec	2004-08	
SSM000019	LevelTroll	2006-09	
SSM000021	Minitroll	2004-08	
SSM000022	Mitec	2004-09	
SSM000027	Minitroll	2005-07	
SSM000028	Minitroll	2005-06	
SSM000029	Minitroll	2005-06	
SSM000030	Minitroll	2005-04	
SSM000031	Mitec	2005-04	
SSM000032	Minitroll	2005-04	
SSM000033	Minitroll	2005-04	
SSM000034	Minitroll	2005-04	
SSM000035	Minitroll	2005-06	
SSM000037	Mitec	2005-04	

Borehole	Logger	From	To
SSM000039	Mitec	2005-07	
SSM000040	Minitroll	2005-07	
SSM000041	Minitroll	2005-07	
SSM000042	Minitroll	2005-06	
SSM000210	LevelTroll	2006-09	
SSM000213	Minitroll	2004-09	
SSM000215	LevelTroll	2006-09	
SSM000217	LevelTroll	2007-04	
SSM000218	Minitroll	2005-06	
SSM000219	Minitroll	2005-06	
SSM000220	Minitroll	2005-06	
SSM000221	Minitroll	2005-06	
SSM000222	LevelTroll	2005-11	
SSM000223	LevelTroll	2005-11	
SSM000224	LevelTroll	2005-11	
SSM000225	LevelTroll	2005-11	
SSM000226	LevelTroll	2005-11	
SSM000227	LevelTroll	2005-11	
SSM000228	LevelTroll	2005-11	
SSM000229	LevelTroll	2005-11	
SSM000230	LevelTroll	2005-11	
SSM000237	Minitroll	2005-11	
SSM000238	LevelTroll	2007-01	
SSM000239	LevelTroll	2006-07	
SSM000240	LevelTroll	2006-07	
SSM000241	LevelTroll	2006-07	
SSM000242	LevelTroll	2006-07	
SSM000243	LevelTroll	2006-09	
SSM000244	LevelTroll	2006-09	
SSM000245	LevelTroll	2006-09	
SSM000246	LevelTroll	2006-09	
SSM000249	Minitroll	2006-02	
SSM000250	Minitroll	2006-02	
SSM000252	LevelTroll	2006-08	
SSM000253	LevelTroll	2006-08	
SSM000255	Minitroll	2006-06	
SSM000256	LevelTroll	2006-08	
SSM000257	LevelTroll	2006-08	
SSM000260	LevelTroll	2006-12	
SSM000261	LevelTroll	2006-12	
SSM000262	LevelTroll	2007-01	
SSM000263	LevelTroll	2007-01	
SSM000264	LevelTroll	2007-01	
SSM000265	Minitroll	2006-12	
SSM000266	Minitroll	2006-12	
SSM000267	LevelTroll	2007-01	
SSM000268	LevelTroll	2006-11	
SSM000269	LevelTroll	2006-11	
SSM000270	LevelTroll	2007-01	
SSM000271	LevelTroll	2006-11	

Note - Data not relevant for the reported period January–August 2007 are to be found in earlier reports /1, 2/ or /3/.

4 Execution

4.1 General

Data are collected to the measurement system, HMS, as described in Chapter 3.

4.2 Field work

Manual levelling is generally performed once a month. At the same time, the equipment is checked and maintenance is performed.

All data from stand-alone type loggers are manually transferred to a portable PC or PDA and then transmitted to the measurement station.

4.3 Data handling

4.3.1 Calibration method

Manual levelling of all sections is normally made once every month, in order to calibrate the registrations from the data loggers.

The logger data is transformed to water levels by means of a linear calibration equation and also by subtracting the air pressure since all transducers give the absolute pressure. Converted logger data are then compared with results from manual levelling. If the two differs, calibration constants are adjusted until an acceptable agreement is obtained.

4.3.2 Recording interval

Measurements of the groundwater level are normally made with one-minute intervals for percussion and core boreholes and with five-minute intervals for soil wells.

Measured values are not stored unless they differ from the previously stored value by more than 0.1 m for percussion and core boreholes, and 0.05 m for soil wells. In addition to this, a value is always stored every two hours.

However, in most boreholes the recording intervals are shortened since they are located in areas of high interest.

4.4 Quality assurance

Preliminary inspection of all collected data is performed once every week. The purpose of this is to certify that all loggers are sending data and that all transducers are functioning.

All data collected are subject to a quality check once every quarter. During this Q/A, obviously erroneous data are removed and calibration constants are corrected so that the monitored data agree with the manual levelling data (see section 4.3.1). At this occasion, the status of the equipment is also checked and service might be initiated by notifying the client via e-mail.

4.5 Nonconformities

There are no nonconformities with respect to the activity plan or the method description.

5 Results

5.1 General

Original data from the reported activity are stored in the primary database Sicada. Data are traceable in Sicada by the Activity Plan number (AP PS 400-06-159). Only data in databases are accepted for further interpretation and modelling. The data presented in this report are regarded as copies of the original data. Data in the databases may be revised, if needed. However, such revision of the database will not necessarily result in a revision of this report, although the normal procedure is that major data revisions entail a revision of P-reports. Minor data revisions are normally presented as supplements, available at www.skb.se.

5.2 Groundwater levels

Diagrams of groundwater levels are presented in Appendix 1. All levels in the diagrams are given as meters above sea level in the national elevation system (RT90-RHB70).

In the diagrams, daily values are presented for each section. The data point shown is the first stored data point after midnight. When registrations are missing, manually levelled data, if available, are inserted.

A list of monitored borehole sections is presented in Table 5-1, where the lengths along the boreholes to top and bottom of each section are given. When packers have been installed in percussion or cored boreholes, the dates for installation/removal of the packers are given. In open boreholes (except the soil wells), the dates for installation/removal of pressure transducer/logger are given together with a comment. No information about periods between packer removal and re-installation or between measurement periods is given. For the soil wells, the dates refer to when drilling was completed.

Table 5-1. Monitored sections.

Borehole	Section no	Section installed		Borehole length **		Comment
		from	to	from (m)	to (m)	
HAV02	1	2004-05-17		16.0	163.0	
	2	2004-05-17		0.0	15.0	Not monitored
HAV06	1	2004-05-04		17.0	100.0	
	2	2004-05-04		0.0	16.0	
HLX01	1	2005-09-23		16.0	100.0	
	2	2005-09-23		0.0	15.0	Not monitored
HLX02	1	2005-09-23		0.0	132.0	Measurement start date
HLX06	1	2005-09-23		0.0	100.0	Measurement start date
HLX07	1	2005-09-23		16.0	100.0	
	2	2005-09-23		0.0	15.0	Not monitored
HLX08	1	2004-06-21		0.0	40.0	Measurement start date
HLX09	1	2004-05-05		17.0	151.0	
	2	2004-05-05		0.0	16.0	
HLX10	1	2004-03		0.0	85.0	Measurement start date
HLX11	1	2004-05-05		14.0	70.0	
	2	2004-05-05		0.0	13.0	
HLX13	1	2004-04-27		0.0	202.2	Measurement start date
HLX14	1	2006-03-29		0.0	115.9	

Borehole	Section no	Section installed		Borehole length **		Comment
		from	to	from (m)	to (m)	
HLX15	1	2006-02-15		5.0	151.9	
	2	2006-02-15		0.0	4.0	Not monitored
HLX16	1	2006-08-28	2007-01-11	0.0	202.2	Measurement start/stop date
HLX17	1	2006-08-28	2007-01-11	0.0	202.2	Measurement start/stop date
HLX18	1	2004-12-20		91.0	181.2	
	2	2004-12-20		0.0	90.0	
HLX19	1	2006-08-28	2007-01-11	0.0	202.2	Measurement start/stop date
HLX21	1	2006-07-13		81.0	150.3	
	2	2006-07-13		0.0	80.0	
HLX22	1	2006-12-15		0.0	163.2	Measurement start date
HLX23	1	2005-07-05		61.0	160.2	
	2	2005-07-05		0.0	60.0	
HLX24	1	2004-12-10		41.0	175.2	
	2	2004-12-10		0.0	40.0	
HLX25	1	2004-11-17		61.0	202.5	
	2	2004-11-17		0.0	60.0	
HLX26	1	2004-11-04		11.0	151.2	
	2	2004-11-04		0.0	10.0	Not monitored
HLX27	1	2006-11-28	2007-05-28	133.0	164.7	
	2	2006-11-28	2007-05-28	0.0	132.0	
HLX28	1	2006-11-28	2007-04-03	0.0	154.2	Measurement start/stop date
	1	2007-04-17	2007-05-09	0.0	154.2	Measurement start/stop date
HLX30	1	2005-09-14		101.0	164.4	
	2	2005-09-14		0.0	100.0	
HLX31	1	2005-10-17		0.0	133.5	
HLX32	1	2006-12-07	2007-06-25	16.0	162.6	
	2	2006-12-07	2007-06-25	0.0	15.0	Not monitored
HLX33	1	2006-12-07	2007-03-05	31.0	202.1	
	2	2006-12-07	2007-03-05	0.0	30.0	
HLX34	1	2005-09-27		0.0	151.8	Measurement start date
HLX35	1	2006-08-03	2007-08-21	65.0	151.8	
	2	2006-08-03	2007-08-21	0.0	64.0	
HLX36	1	2006-11-13		50.0	199.8	
	2	2006-11-13		0.0	49.0	
HLX37	1	2006-11-07	2007-05-03	149.0	199.8	
	2	2006-11-07	2007-05-03	118.0	148.0	
	3	2006-11-07	2007-05-03	0.0	117.0	
HLX38	1	2006-09-06		0.0	199.5	Measurement start date
HLX39	1	2006-08-03	2007-08-28	0.0	199.3	Measurement start/stop date
HLX40	1	2006-08-03		40.0	199.5	
	2	2006-08-03		0.0	39.0	Not monitored
HLX41	1	2006-08-03		0.0	199.5	Measurement start date
HLX42	1	2006-11-22	2007-05-08	30.0	152.6	
	2	2006-11-22	2007-05-08	0.0	29.0	
	1	2007-05-28		30.0	152.6	
	2	2007-05-28		0.0	29.0	
HLX43	1	2006-12-07	2007-06-11	21.0	170.6	
	2	2006-12-07	2007-06-11	0.0	20.0	
HMJ01	1	2006-09-07		32.9	46.0	
	2	2006-09-07		0.0	31.9	
HSH01	1	2004-04-01		25.0	200.0	

Borehole	Section no	Section installed		Borehole length **		Comment
		from	to	from (m)	to (m)	
	2	2004-04-01		0.0	24.0	
HSI04	1	2004-06-23		0.0	37.0	Measurement start date
HSI13	1	2004-06-23		0.0	4.0	Measurement start date
KAV01	1	2005-09-05		582.93	742.93	
	2	2005-09-05		434.93	581.93	
	3	2005-09-05		390.93	433.93	
	4	2005-09-05		108.93	306.93	
	5	2005-09-05		0.0	107.93	
KAV02	1	2005-01-14		0.0	97.1	
KAV03	1	2004-05-11		16.0	248.4	
	2	2004-05-11		0.0	15.0	Not monitored
KAV04A	1	2005-04-27		675.0	1,000.0	
	2	2005-04-27		440.0	674.0	
	3	2005-04-27		214.0	439.0	
	4	2005-04-27		0.0	213.0	
KBH03	1	2004-06-23		0.0	100.43	Measurement start date
KLX01	1	2004-10-26		705.0	1,077.99	
	2	2004-10-26		191.0	704.0	
	3	2004-10-26		171.0	190.0	
	4	2004-10-26		0.0	170.0	
KLX02	1	2004-11-15		1,165.0	1,700.0	
	2	2004-11-15		1,145.0	1,164.0	
	3	2004-11-15		718.0	1,144.0	
	4	2004-11-15		495.0	717.0	
	5	2004-11-15		452.0	494.0	
	6	2004-11-15		348.0	451.0	
	7	2004-11-15		208.0	347.0	
	8	2004-11-15		0.0	207.0	
KLX03	1	2006-01-16		965.5	971.5	
	2	2006-01-16		830.5	964.5	
	3	2006-01-16		752.5	829.5	
	4	2006-01-16		729.5	751.5	
	5	2006-01-16		652.5	728.5	
	6	2006-01-16		465.5	651.5	
	7	2006-01-16		349.5	464.5	
	8	2006-01-16		199.5	348.5	
	9	2006-01-16		193.5	198.5	
	10	2006-01-16		0.0	192.5	
KLX04	1	2005-01-29		898.0	1,000.0	
	2	2005-01-29		870.0	897.0	
	3	2005-01-29		686.0	869.0	
	4	2005-01-29		531.0	685.0	
	5	2005-01-29		507.0	530.0	
	6	2005-01-29		231.0	506.0	
	7	2005-01-29		163.0	230.0	
	8	2005-01-29		0.0	162.0	
KLX05	1	2005-11-03		721.0	1,000.0	
	2	2005-11-03		634.0	720.0	
	3	2005-11-03		625.0	633.0	
	4	2005-11-03		501.0	624.0	
	5	2005-11-03		361.0	500.0	

Borehole	Section no	Section installed		Borehole length **		Comment	
		from	to	from (m)	to (m)		
KLX06	6	2005-11-03		256.0	360.0		
	7	2005-11-03		241.0	255.0		
	8	2005-11-03		220.0	240.0		
	9	2005-11-03		128.0	219.0		
	10	2005-11-03		0.0	127.0		
	1	2005-07-05		761.0	1,000.0		
	2	2005-07-05		571.0	760.0		
	3	2005-07-05		554.0	570.0		
	4	2005-07-05		411.0	553.0		
	5	2005-07-05		276.0	410.0		
KLX07A	6	2005-07-05		256.0	275.0		
	7	2005-07-05		146.0	255.0		
	8	2005-07-05		0.0	145.0		
	1	2006-02-21		781.0	844.73		
	2	2006-02-21		753.0	780.0		
	3	2006-02-21		612.0	752.0		
	4	2006-02-21		457.0	611.0		
	5	2006-02-21		333.0	456.0		
KLX07B	6	2006-02-21		204.0	332.0		
	7	2006-02-21		104.0	203.0		
	8	2006-02-21		0.0	103.0		
	1	2006-03-01		95.0	200.0		
	2	2006-03-01		0.0	94.0		
	KLX08	1	2007-06-11		840.0	1,000.41	
		2	2007-06-11		684.0	839.0	
		3	2007-06-11		626.0	683.0	
4		2007-06-11		594.0	625.0		
5		2007-06-11		497.0	593.0		
6		2007-06-11		355.0	496.0		
7		2007-06-11		243.0	354.0		
8		2007-06-11		160.0	242.0		
9		2007-06-11		102.0	159.0		
10		2007-06-11		0.0	101.0		
KLX09	1	2006-12-15		564.0	880.38		
	2	2006-12-15		470.0	563.0		
	3	2006-12-15		199.0	469.0		
	4	2006-12-15		104.0	198.0		
	5	2006-12-15		0.0	103.0		
KLX09F	1	2006-05-18		0.0	152.3	Measurement start date	
KLX09G	1	2007-07-03		0.0	100.1	Measurement start date	
KLX10	1	2006-07-05		711.0	1,001.0		
	2	2006-07-05		689.0	710.0		
	3	2006-07-05		465.0	688.0		
	4	2006-07-05		369.0	464.0		
	5	2006-07-05		351.0	368.0		
	6	2006-07-05		291.0	350.0		
	7	2006-07-05		131.0	290.0		
	8	2006-07-05		0.0	130.0		
KLX11A	1	2006-11-15	2007-05-08	0.0	992.29	Measurement start/stop date	
KLX11B	1	2006-11-15	2007-04-26	0.0	100.2	Measurement start/stop date	
KLX11E	1	2006-04-25		0.0	121.3	Measurement start date	

Borehole	Section no	Section installed		Borehole length **		Comment
		from	to	from (m)	to (m)	
KLX12A	1	2006-11-08		546.0	602.3	
	2	2006-11-08		535.0	545.0	
	3	2006-11-08		426.0	534.0	
	4	2006-11-08		386.0	425.0	
	5	2006-11-08		291.0	385.0	
	6	2006-11-08		160.0	290.0	
	7	2006-11-08		142.0	159.0	
	8	2006-11-08		104.0	141.0	
	9	2006-11-08		0.0	103.0	
KLX14A	1	2007-04-03	2007-04-18	120.0	176.27	
	2	2007-04-03	2007-04-18	73.0	119.0	
	3	2007-04-03	2007-04-18	0.0	72.0	
KLX15A	1	2007-05-29	2007-06-07	421.0	1,000.43	
	2	2007-05-29	2007-06-07	189.0	420.0	
	3	2007-05-29	2007-06-07	0.0	188.0	
KLX16A	1	2007-05-14	2007-05-23	327.0	433.55	
	2	2007-05-14	2007-05-23	191.0	326.0	
	3	2007-05-14	2007-05-23	0.0	190.0	
KLX18A	1	2007-02-16		571.0	611.28	
	2	2007-02-16		490.0	570.0	
	3	2007-02-16		472.0	489.0	
	4	2007-02-16		315.0	471.0	
	5	2007-02-16		155.0	314.0	
	6	2007-02-16		104.0	154.0	
	7	2007-02-16		0.0	103.0	
KLX19A	1	2007-04-04		661.0	800.07	
	2	2007-04-04		518.0	660.0	
	3	2007-04-04		509.0	517.0	
	4	2007-04-04		481.5	508.0	
	5	2007-04-04		311.0	480.5	
	6	2007-04-04		291.0	310.0	
	7	2007-04-04		136.0	290.0	
	8	2007-04-04		0.0	135.0	
KLX20A	1	2006-10-16	2007-06-04	0.0	457.92	Measurement start/stop date
	1	2007-08-17		294.0	457.92	
	2	2007-08-17		260.0	293.0	
	3	2007-08-17		181.0	259.0	
	4	2007-08-17		145.0	180.0	
	5	2007-08-17		103.0	144.0	
	6	2007-08-17		0.0	102.0	
KLX26A	1	2007-02-19	2007-02-22	48.0	101.14	
	2	2007-02-19	2007-02-22	22.0	47.0	
	3	2007-02-19	2007-02-22	0.0	21.0	
KLX26B	1	2007-02-15	2007-02-19	47.0	50.37	
	2	2007-02-15	2007-02-19	21.0	46.0	
	3	2007-02-15	2007-02-19	0.0	20.0	
KLX28A	1	2007-06-26		0.0	80.23	Measurement start date
KLX29A	1	2007-06-26		0.0	60.25	Measurement start date
KSH01A	1	2004-10-07		800.0	1,003.0	
	2	2004-10-07		671.0	799.0	
	3	2004-10-07		573.0	670.0	

Borehole	Section no	Section installed		Borehole length **		Comment
		from	to	from (m)	to (m)	
	4	2004-10-07		532.0	572.0	
	5	2004-10-07		331.0	531.0	
	6	2004-10-07		278.0	330.0	
	7	2004-10-07		238.0	277.0	
	8	2004-10-07		181.0	237.0	
	9	2004-10-07		0.0	180.0	
KSH02	1	2004-12-16		955.0	963.0	
	2	2004-12-16		649.0	954.0	
	3	2004-12-16		440.0	648.0	
	4	2004-12-16		411.0	439.0	
	5	2004-12-16		111.0	410.0	
	6	2004-12-16		91.0	110.0	
	7	2004-12-16		0.0	90.0	
KSH03A	1	2004-06-01		281.15	1,000.7	
	2	2004-06-01		180.65	280.15	
	3	2004-06-01		0.0	179.65	
SSM000001	1	2002-10-08		0.0	3.1*	
	screen			2.0	3.0	
SSM000008	1	2003-12-08		0.0	5.1*	
	screen			3.0	5.0	
SSM000011	1	2004-01-29		0.0	3.1*	
	screen			1.0	3.0	
SSM000012	1	2004-01-22		0.0	6.1*	
	screen			5.0	6.0	
SSM000014	1	2003-12-09		0.0	3.1*	
	screen			2.0	3.0	
SSM000017	1	2004-05-04		0.0	2.1*	
	screen			1.0	2.0	
SSM000018	1	2003-12-11		0.0	3.1*	
	screen			2.0	3.0	
SSM000019	1	2004-05-04		0.0	3.1*	
	screen			2.0	3.0	
SSM000021	1	2004-05-04		0.0	4.1*	
	screen			3.0	4.0	
SSM000022	1	2004-01-12		0.0	7.1*	
	screen			5.0	7.0	
SSM000027	1	2004-06-28		0.0	5.1*	
	screen			3.0	5.0	
SSM000028	1	2004-06-09		0.0	3.1*	
	screen			2.0	3.0	
SSM000029	1	2004-06-08		0.0	7.1*	
	screen			5.0	7.0	
SSM000030	1	2004-09-10		0.0	5.1*	
	screen			4.0	5.0	
SSM000031	1	2004-06-10		0.0	4.1*	
	screen			3.0	4.0	
SSM000032	1	2004-06-15		0.0	4.1*	
	screen			3.0	4.0	
SSM000033	1	2004-06-15		0.0	2.1*	
	screen			1.0	2.0	
SSM000034	1	2004-06-16		0.0	4.1*	

Borehole	Section no	Section installed		Borehole length **		Comment
		from	to	from (m)	to (m)	
	screen			3.0	4.0	
SSM000035	1	2004-06-09		0.0	4.1*	
	screen			3.0	4.0	
SSM000037	1	2004-06-22		0.0	4.1*	
	screen			3.0	4.0	
SSM000039	1	2004-06-21		0.0	5.1*	
	screen			3.0	5.0	
SSM000040	1	2004-06-14		0.0	3.1*	
	screen			2.0	3.0	
SSM000041	1	2004-07-07		0.0	4.1*	
	screen			2.0	4.0	
SSM000042	1	2004-06-17		0.0	5.1*	
	screen			3.0	5.0	
SSM000210	1	2004-06-28		0.0	4.1*	
	screen			2.0	4.0	
SSM000213	1	2004-07-06		0.0	2.1*	
	screen			1.0	2.0	
SSM000215	1	2004-12-03		0.0	4.1*	
	screen			2.0	4.0	
SSM000217	1	2004-12-02		0.0	4.1*	
	screen			2.0	4.0	
SSM000218	1	2005-06-02		0.0	3.1*	
	screen			2.0	3.0	
SSM000219	1	2005-06-01		0.0	5.1*	
	screen			4.0	5.0	
SSM000220	1	2005-05-31		0.0	3.1*	
	screen			2.0	3.0	
SSM000221	1	2005-05-30		0.0	3.1*	
	screen			2.0	3.0	
SSM000222	1	2005-08-22		0.0	5.1*	
	screen			4.0	5.0	
SSM000223	1	2005-08-24		0.0	8.1*	
	screen			6.0	8.0	
SSM000224	1	2005-08-29		0.0	17.1*	
	screen			16.0	17.0	
SSM000225	1	2005-09-14		0.0	10.1*	
	screen			9.0	10.0	
SSM000226	1	2005-09-14		0.0	5.1*	
	screen			4.0	5.0	
SSM000227	1	2005-09-14		0.0	2.1*	
	screen			1.0	2.0	
SSM000228	1	2005-09-19		0.0	7.1*	
	screen			6.0	7.0	
SSM000229	1	2005-09-20		0.0	4.1*	
	screen			3.0	4.0	
SSM000230	1	2005-09-21		0.0	5.1*	
	screen			4.0	5.0	
SSM000237	1	2005-10-31		0.0	3.1*	
	screen			2.0	3.0	
SSM000238	1	2006-02-21		0.0	12.1*	
	screen			11.0	12.0	

Borehole	Section no	Section installed		Borehole length **		Comment
		from	to	from (m)	to (m)	
SSM000239	1	2006-02-22		0.0	5.1*	
	screen			4.0	5.0	
SSM000240	1	2006-02-23		0.0	6.1*	
	screen			5.0	6.0	
SSM000241	1	2006-02-15		0.0	33.1*	
	screen			32.0	33.0	
SSM000242	1	2006-02-07		0.0	18.1*	
	screen			17.0	18.0	
SSM000243	1	2006-02-13		0.0	12.1*	
	screen			11.0	12.0	
SSM000244	1	2006-02-28		0.0	12.1*	
	screen			11.0	12.0	
SSM000245	1	2006-02-02		0.0	5.1*	
	screen			4.0	5.0	
SSM000246	1	2006-02-02		0.0	4.1*	
	screen			3.0	4.0	
SSM000249	1	2006-01-26		0.0	3.1*	
	screen			2.0	3.0	
SSM000250	1	2006-01-27		0.0	4.1*	
	screen			2.0	4.0	
SSM000252	1	2006-07-13		0.0	7.7*	
	screen			5.0	7.0	
SSM000253	1	2006-07-12		0.0	4.1*	
	screen			3.0	4.0	
SSM000255	1	2006-05-16		0.0	6.1*	
	screen			4.0	6.0	
SSM000256	1	2006-07-11		0.0	5.1*	
	screen			3.0	5.0	
SSM000257	1	2006-07-10		0.0	4.1*	
	screen			3.0	4.0	
SSM000260	1	2006-10-25		0.0	9.65*	
	screen			7.45	9.45	
SSM000261	1	2006-10-24		0.0	10.5*	
	screen			9.2	10.2	
SSM000262	1	2006-10-30		0.0	15.0*	
	screen			11.7	14.7	
SSM000263	1	2006-11-02		0.0	8.6*	
	screen			6.3	8.3	
SSM000264	1	2006-11-16		0.0	8.0*	
	screen			3.0	5.0	
SSM000265	1	2006-11-08		0.0	5.88*	
	screen			3.58	5.58	
SSM000266	1	2006-11-08		0.0	4.31*	
	screen			3.01	4.01	
SSM000267	1	2006-11-07		0.0	6.3*	
	screen			4.0	6.0	
SSM000268	1	2006-11-15		0.0	4.33*	
	screen			3.03	4.03	
SSM000269	1	2006-11-15		0.0	?	
	screen			1.0	1.8	
SSM000270	1	2006-11-15		0.0	3.2*	
	screen			2.0	3.0	

In many boreholes, the groundwater level shows large and rapid variations. This is often due to nearby drilling. Also, many borehole sections are influenced by other activities such as pumping, water sampling, tracer tests etc.

Packers may deflate due to leakage, which can be difficult to discover. If a section in a borehole suddenly shows a pressure that is close to the pressure in a neighbouring section, the reason might be deflated packers.

5.2.2 Comments on some of the diagrams

HLX02: The groundwater level in this borehole responds quickly to rain/snowmelt.

HLX16: The borehole is mostly artesian from the middle of November 2006.

HLX35: The borehole packer has been deflated from the end of January to the middle of February 2007.

HLX37: Section 3 is artesian from the end of November 2006.

KLX01: The higher level that occurs for shorter periods in section 4 is due to precipitation/snowmelt.

KLX12A: Due to a leaking tube there is a short circuit between sections 2 and 5 from the installation in November 2006 until the end of April 2007, when the equipment is lifted for repair.

KLX14A: Absolute levels have been calculated from transducer positions as no manual levellings have been performed during the measurement period.

KLX26A and KLX26B: Absolute levels have been calculated from transducer positions as no manual levellings have been performed during the measurement period.

KSH01A: The deviating appearance for section 1 is probably caused by the very low transmissivity in this section (or poor communication between the standpipe and the section). The mini-packer is released when manual levelling is performed and a sudden jump in the level occurs. Thereafter, when the mini-packer is inflated again, the level is slowly approaching the actual level in the borehole section.

SSM000217 and SSM000218: Most of the data from June and from the later part of August have been removed because the boreholes were reported to be dry during those periods.

SSM000270: By the look of the registration, the borehole seems to be dry during most of June 2007. However, during this period no manual levelling has been performed to confirm this and therefore no data have been removed.

SSM000271: From the middle to the end of June 2007, the registered pressure is equal to the air pressure, implying that the groundwater level is below the pressure transducer. Prior to this, a pressure below air pressure is measured for about a week. This behaviour could possibly occur if the transducer is measuring in drying clay at the bottom of the borehole.

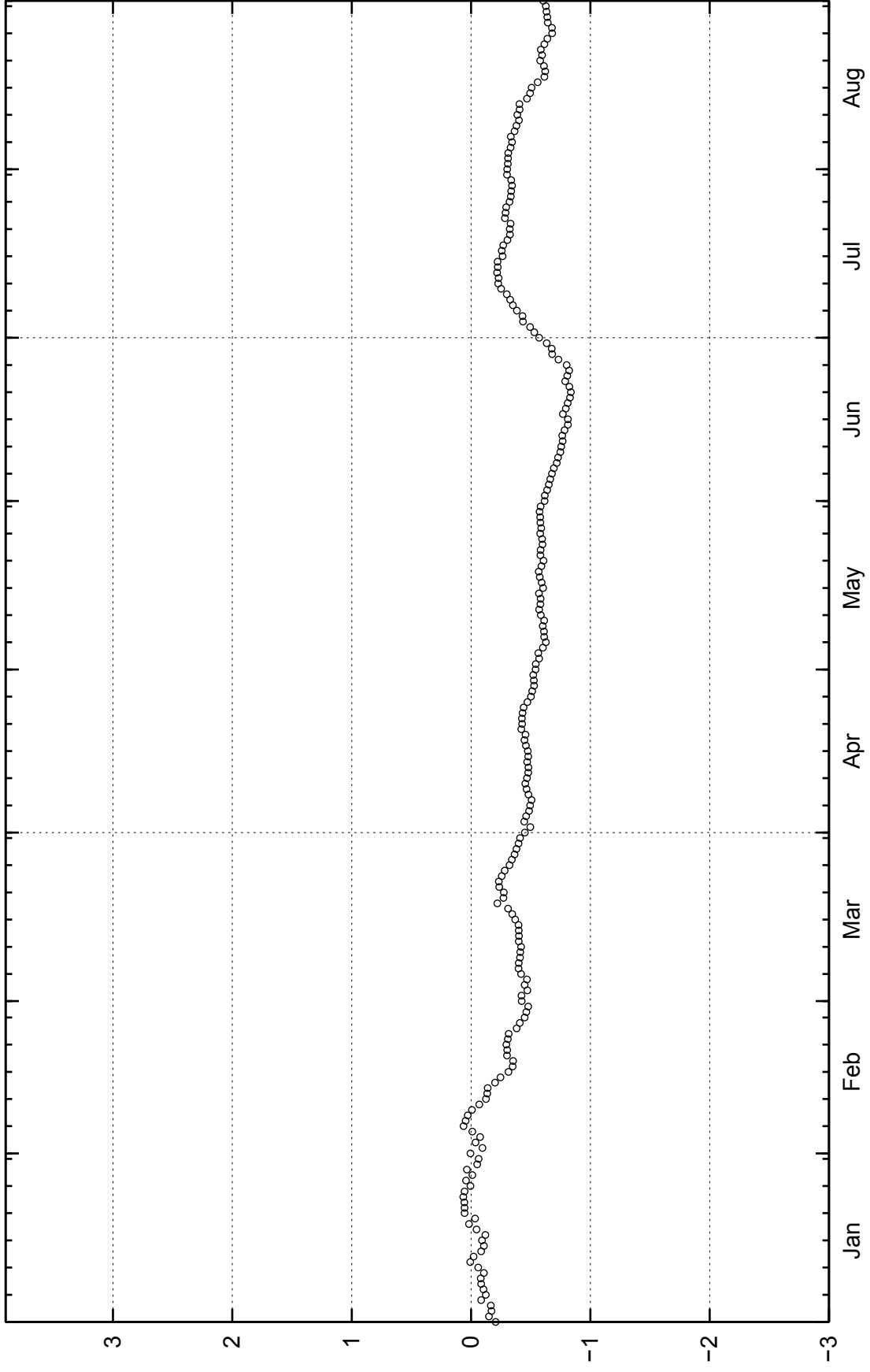
6 References

- /1/ **Nyberg G, Wass E, Askling P, 2005.** Oskarshamn site investigation. Groundwater monitoring program. Report for December 2002–October 2004. SKB P-05-205, Svensk Kärnbränslehantering AB.
- /2/ **Nyberg G, Wass E, 2005.** Oskarshamn site investigation. Groundwater monitoring program. Report for November 2004–June 2005. SKB P-05-282, Svensk Kärnbränslehantering AB.
- /3/ **Nyberg G, Wass E, in prep.** Oskarshamn site investigation. Groundwater monitoring program. Report for July 2005–December 2006. SKB P-xx-xx, in prep., Svensk Kärnbränslehantering AB.

Groundwater level

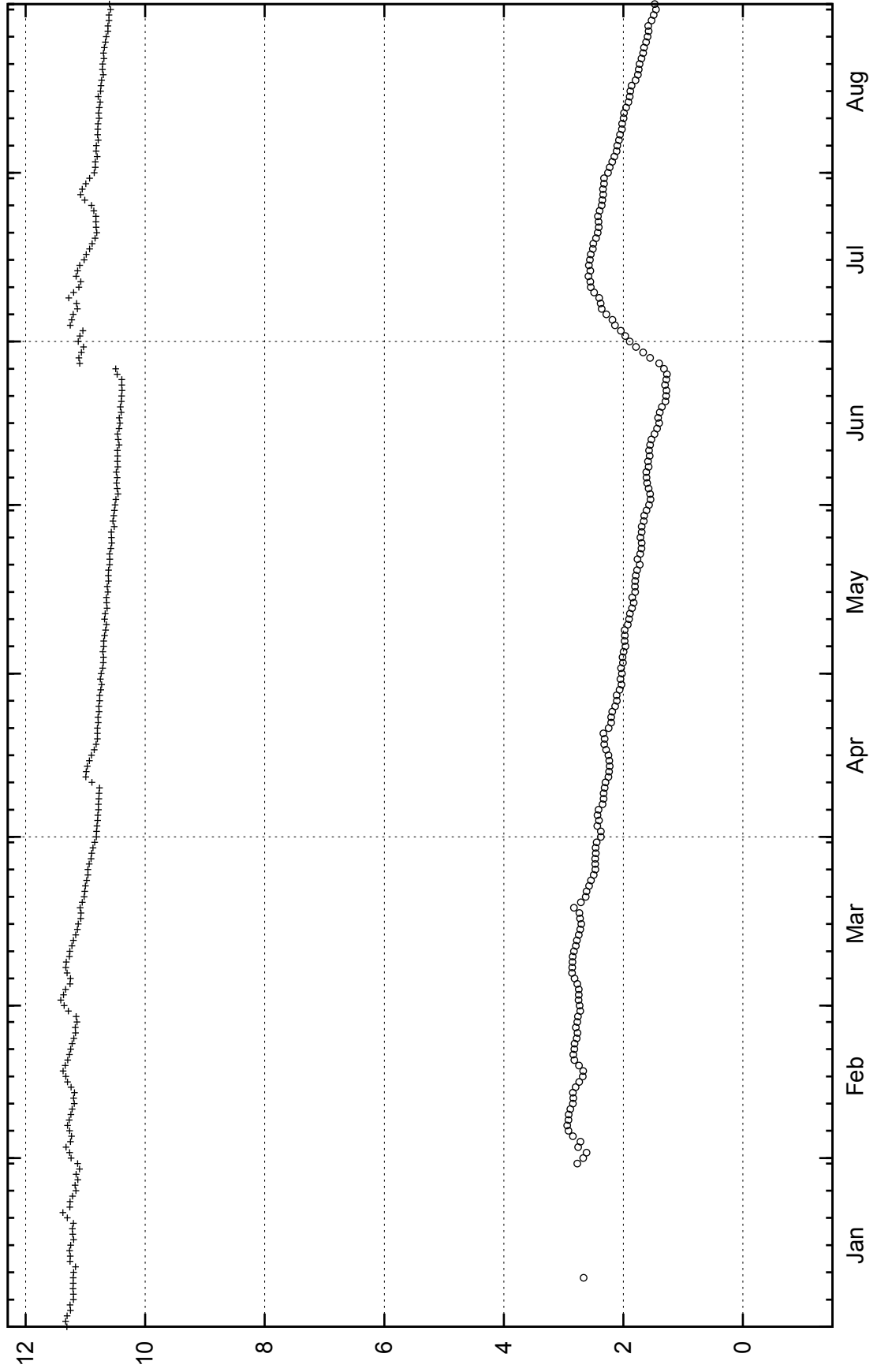
Percussion boreholes	Soil wells
HAV02	SSM000001
HAV06	SSM000008
HLX01	SSM000011
HLX02	SSM000012
HLX06–HLX11	SSM000014
HLX13–HLX19	SSM000017–SSM000019
HLX21–HLX28	SSM000021
HLX30–HLX43	SSM000022
HMJ01	SSM000027–SSM000035
HSH01	SSM000037
HSI04	SSM000039–SSM000042
HSI13	SSM000210
	SSM000213
	SSM000215
Core boreholes	
KAV01–KAV03	SSM000217–SSM000230
KAV04A	SSM000237–SSM000246
KBH03	SSM000249
KLX01–KLX06	SSM000250
KLX07A, -B	SSM000252
KLX08–KLX09	SSM000253
KLX09F, -G	SSM000255–SSM000257
KLX10	SSM000260–SSM000271
KLX11A, -B, -E	
KLX12A	
KLX14A	Water level in streams
KLX15A	PSM000272
KLX16A	PSM000273
KLX18A	
KLX19A	
KLX20A	
KLX26A, -B	
KLX28A	
KLX29A	
KSH01A	
KSH02	
KSH03A	

HAV02



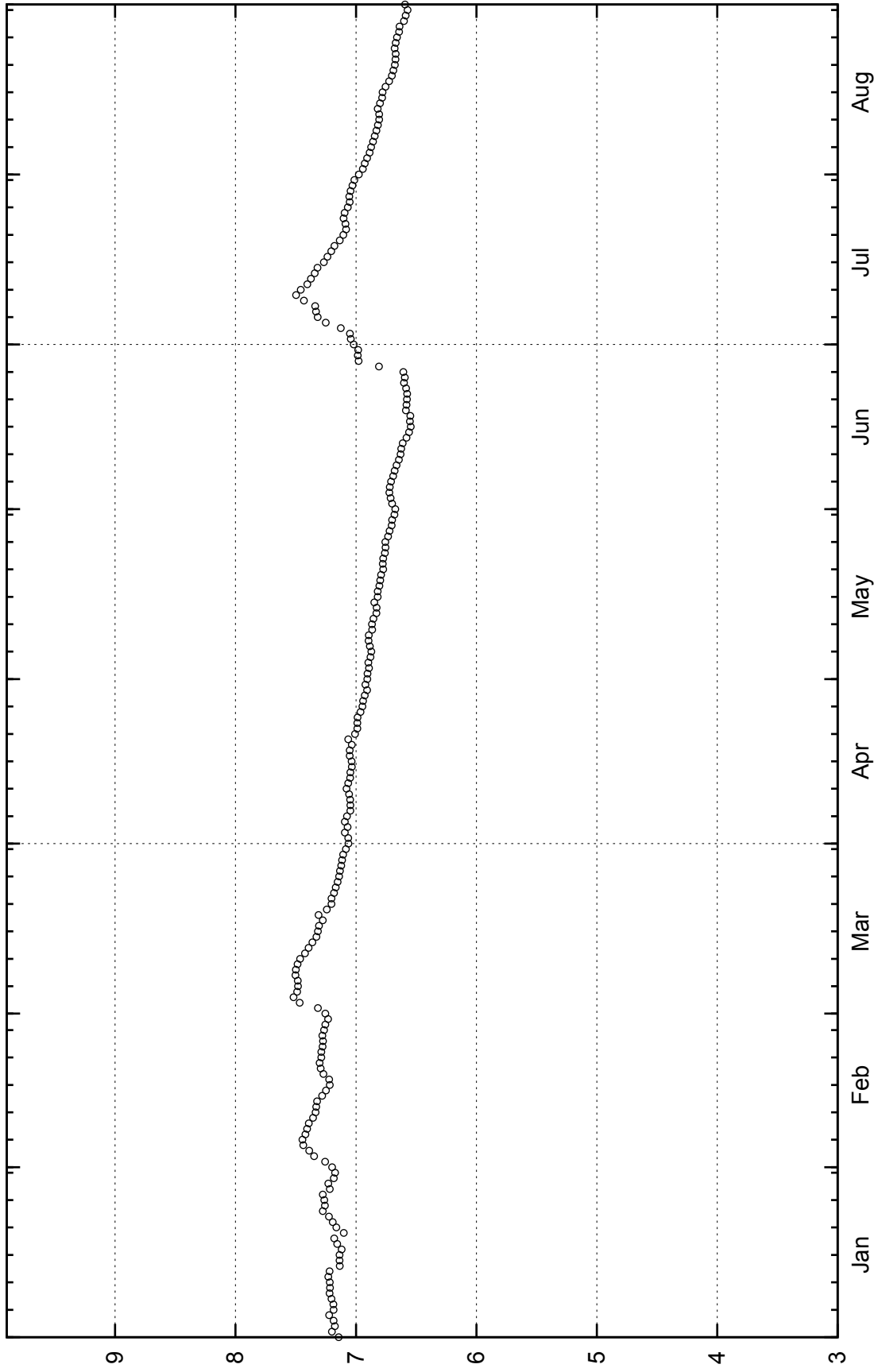
Start: 2007-01-01 month

HAV06



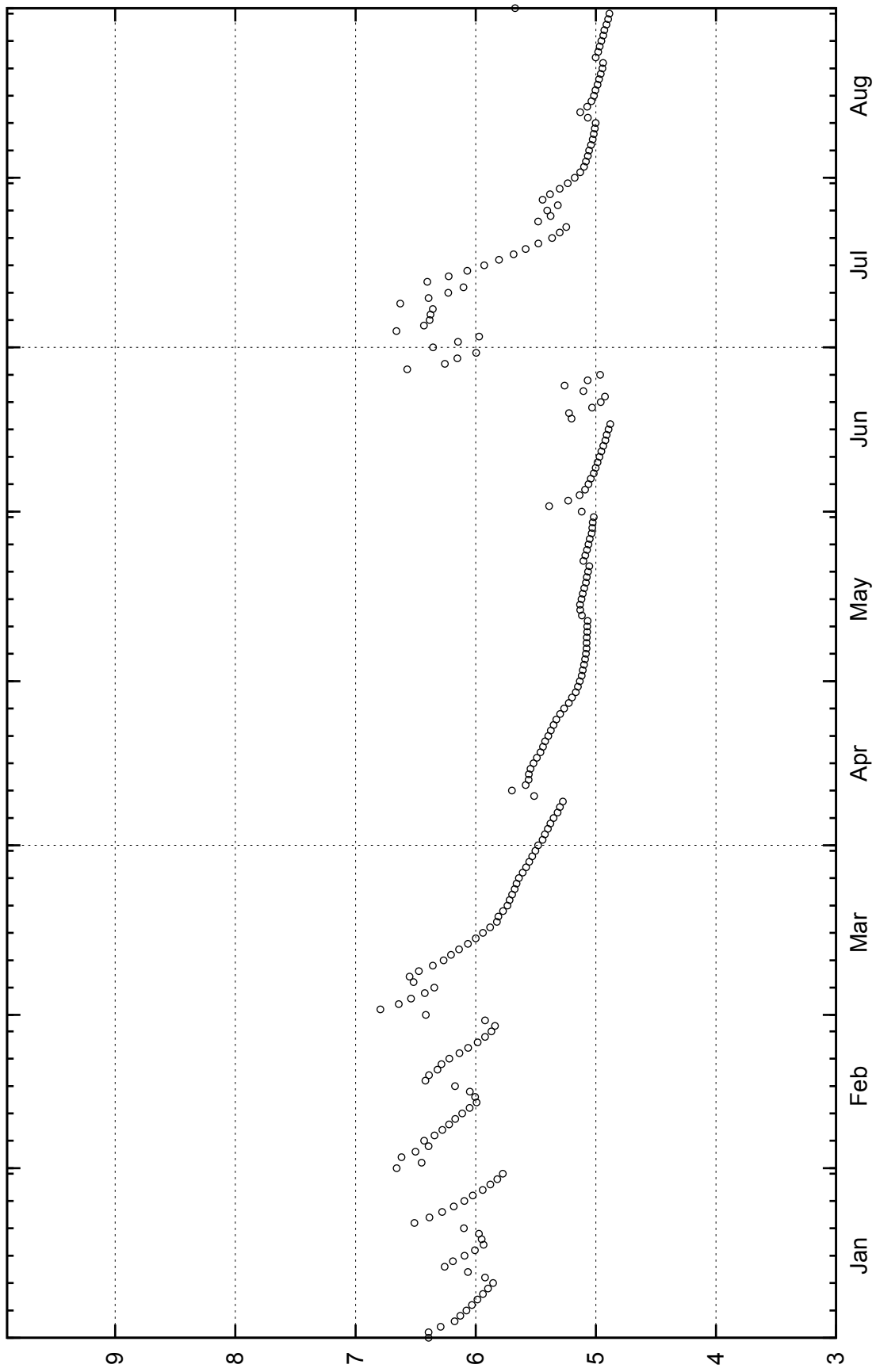
Start: 2007-01-01 month

HLX01



Start: 2007-01-01 month

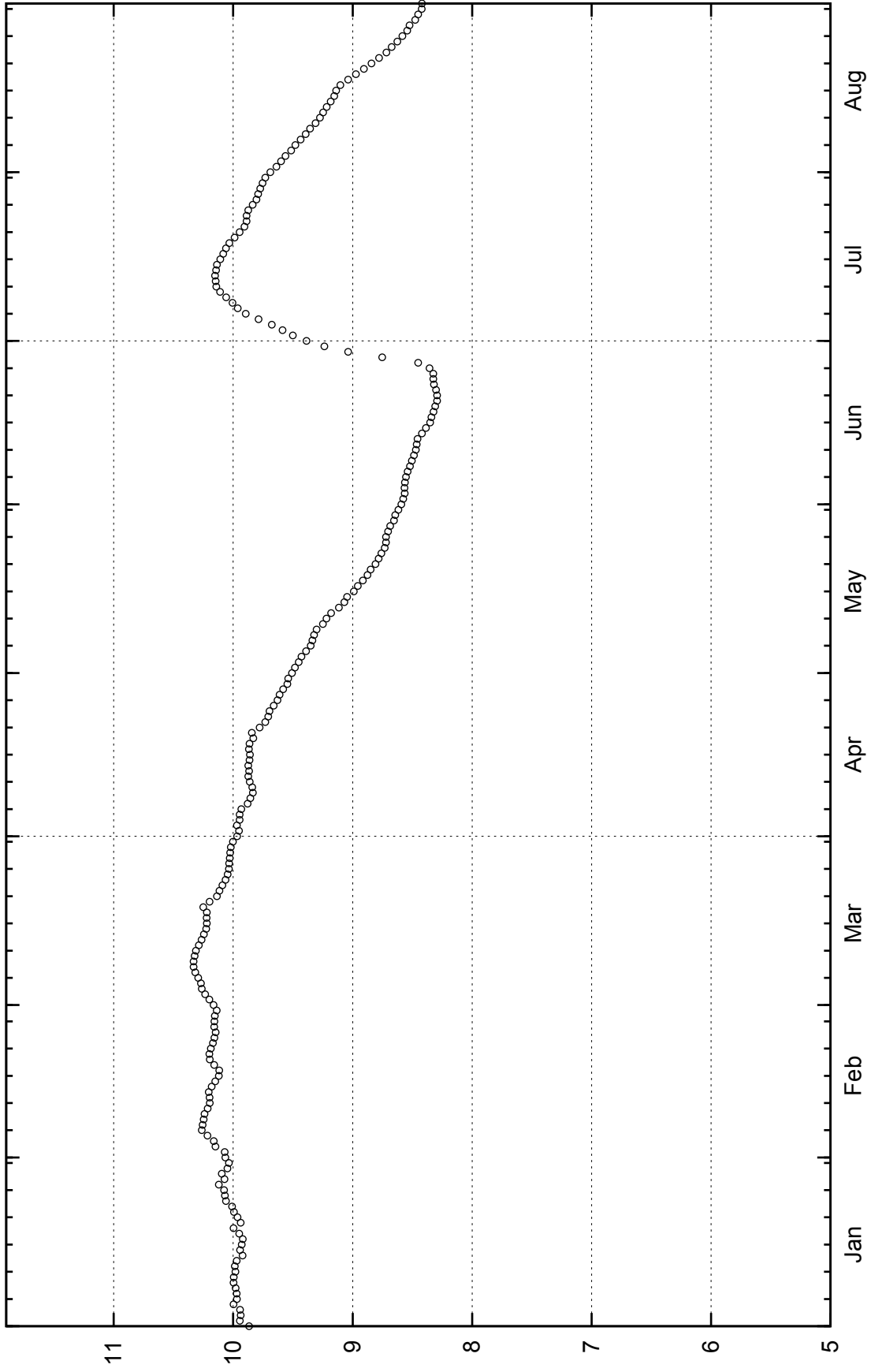
HLX02



Start: 2007-01-01 month

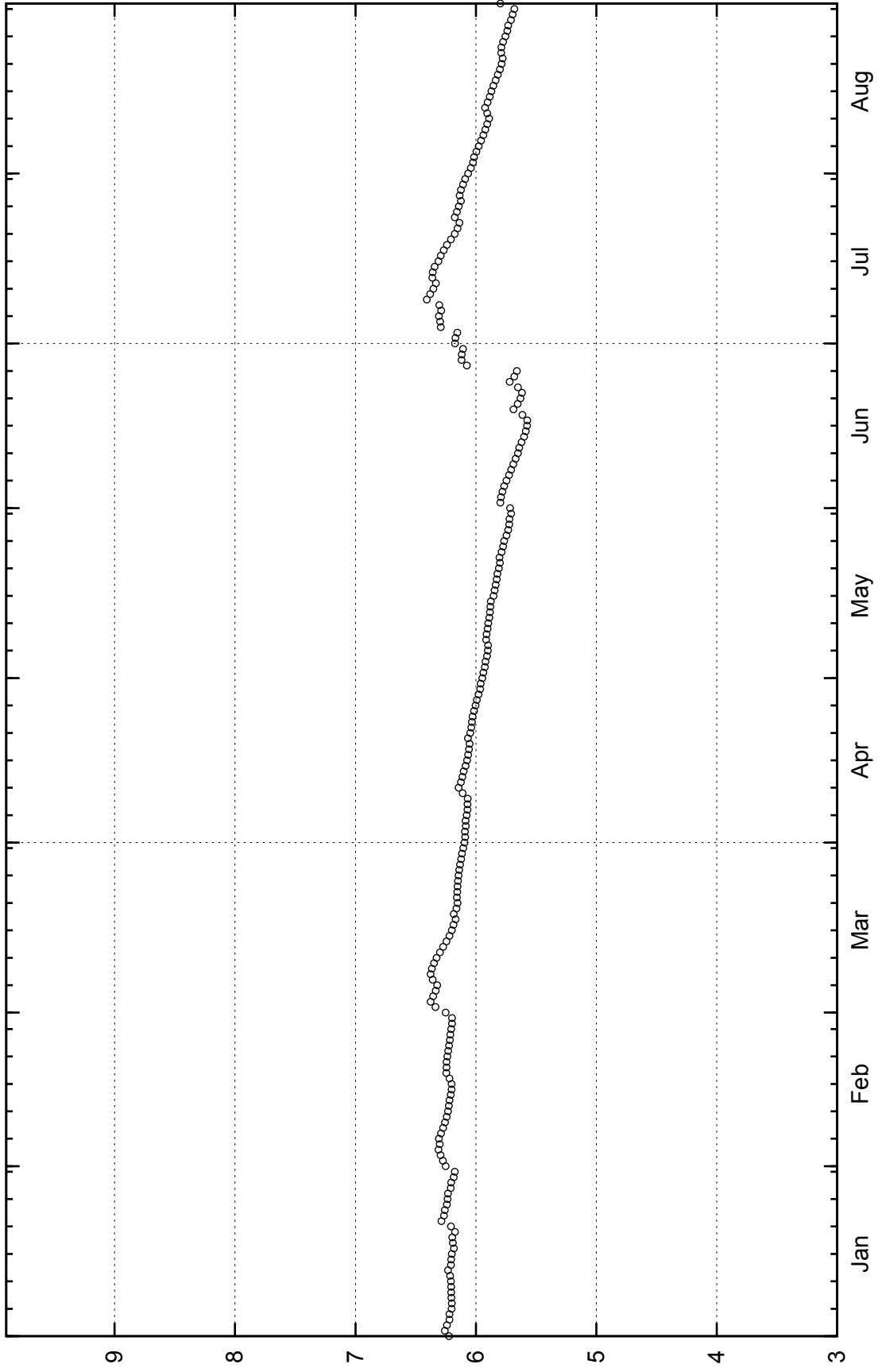
masl

HLX06



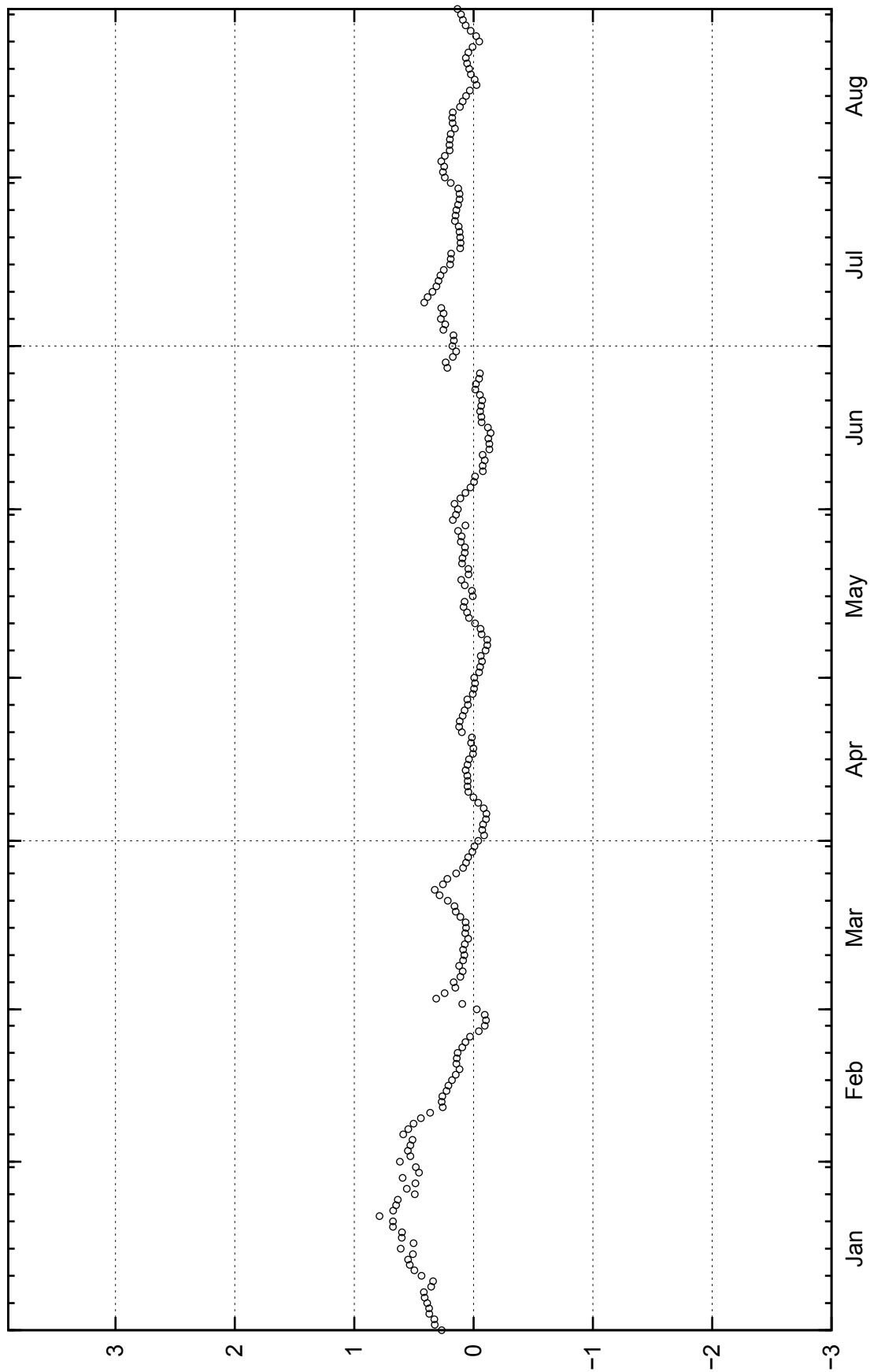
Start: 2007-01-01 month

HLX07



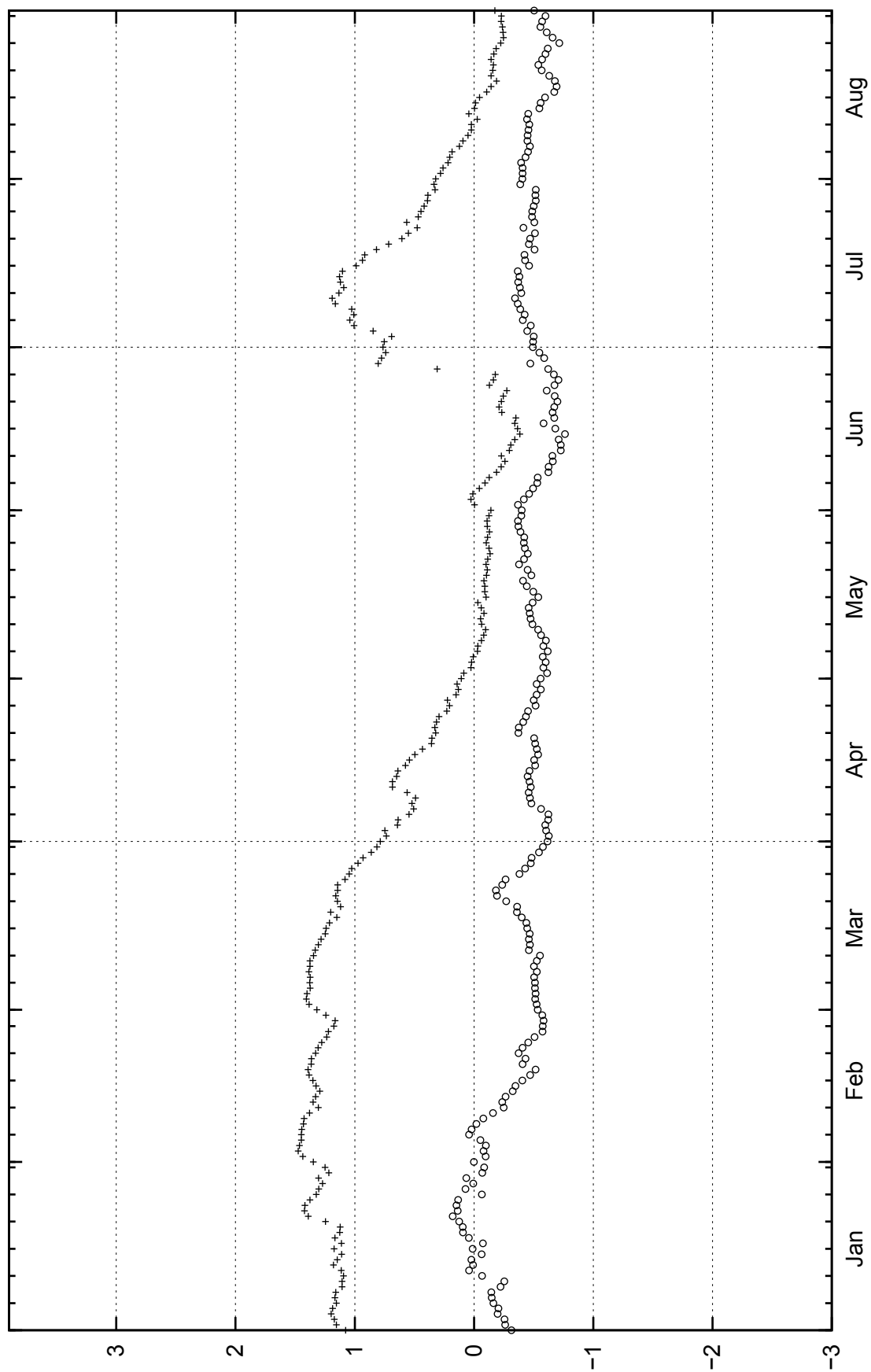
Start: 2007-01-01 month

HLX08

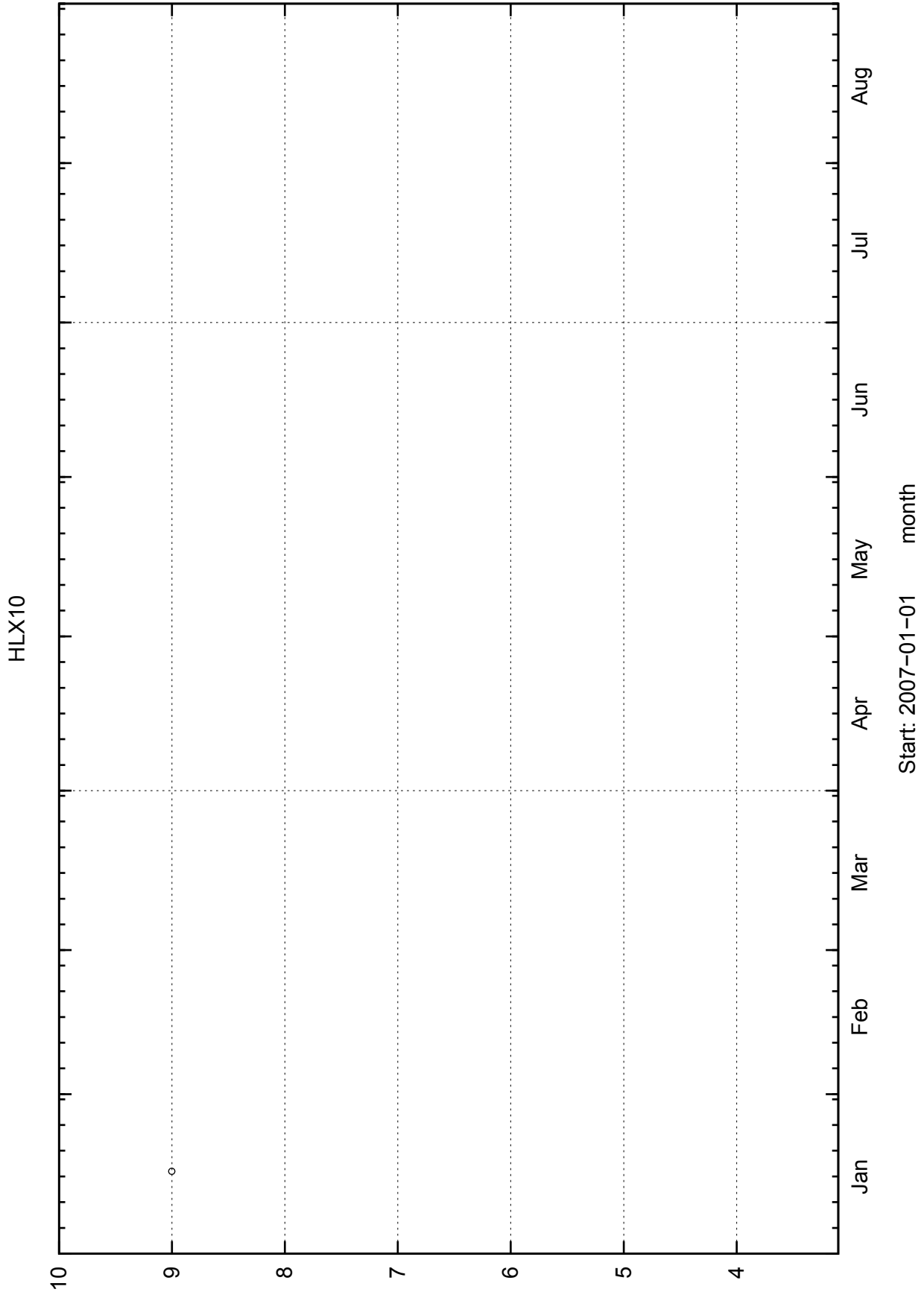


Start: 2007-01-01 month

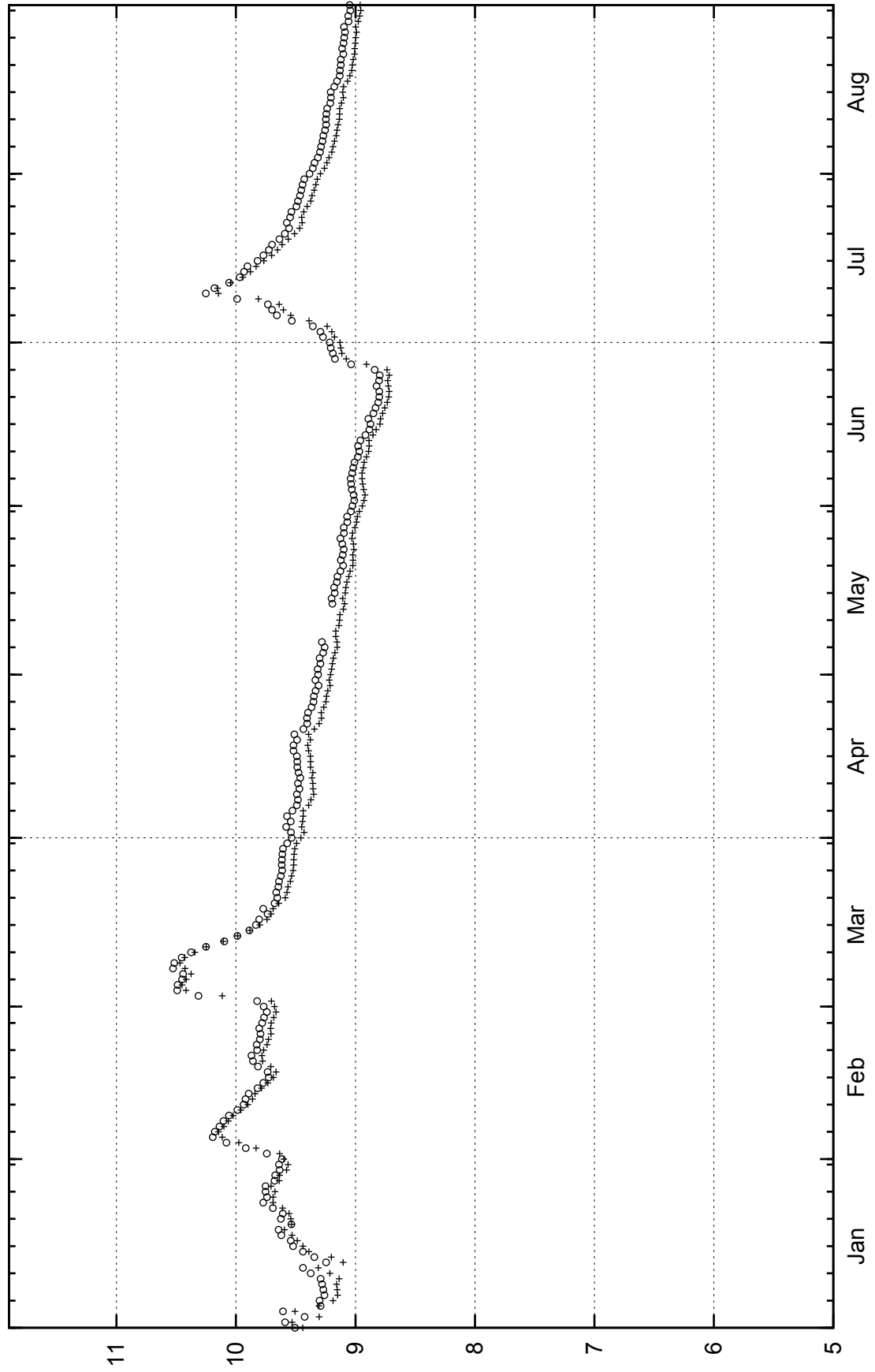
HLX09



Start: 2007-01-01 month



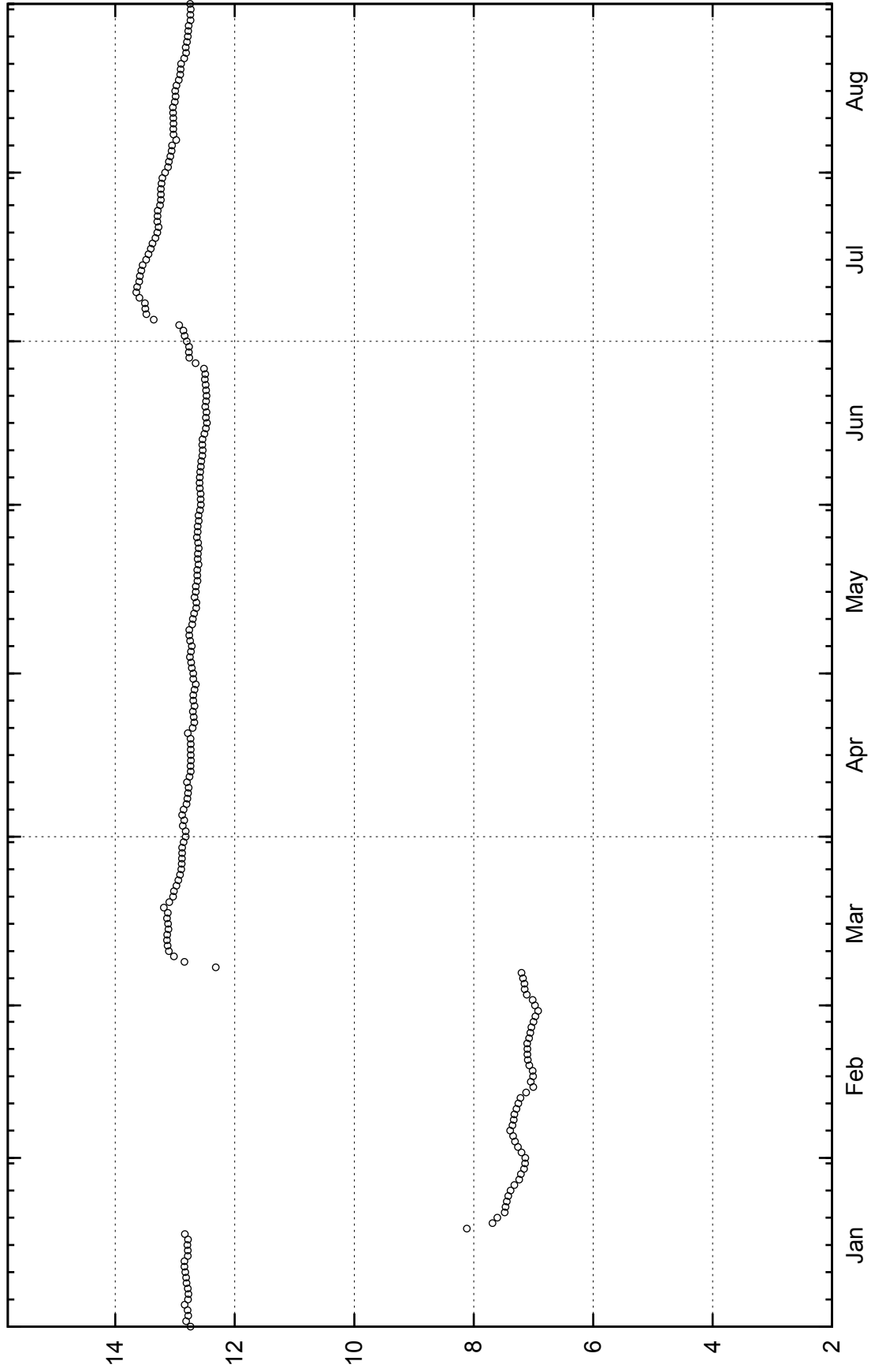
HLX11



Start: 2007-01-01 month

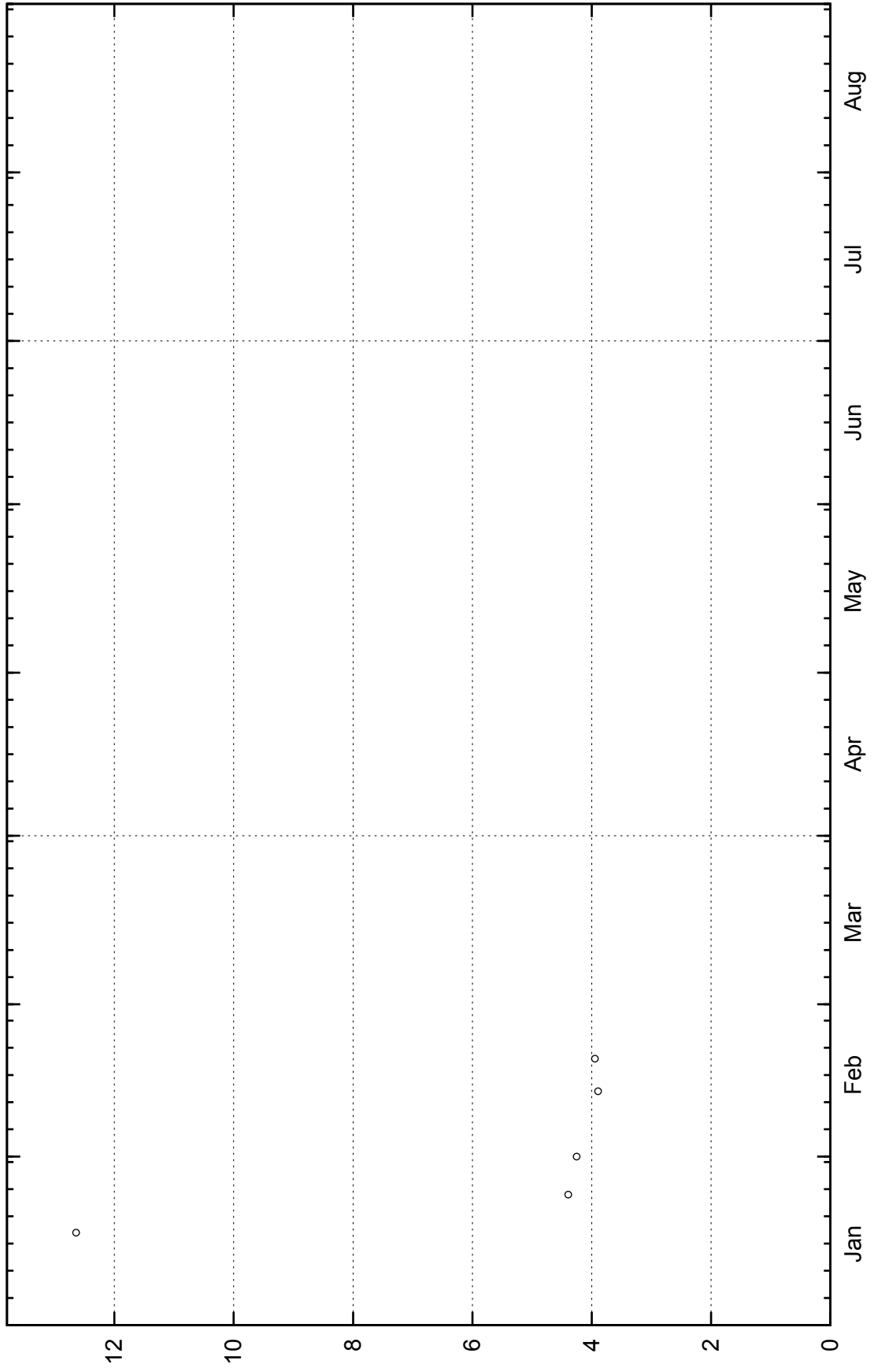
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HILX13



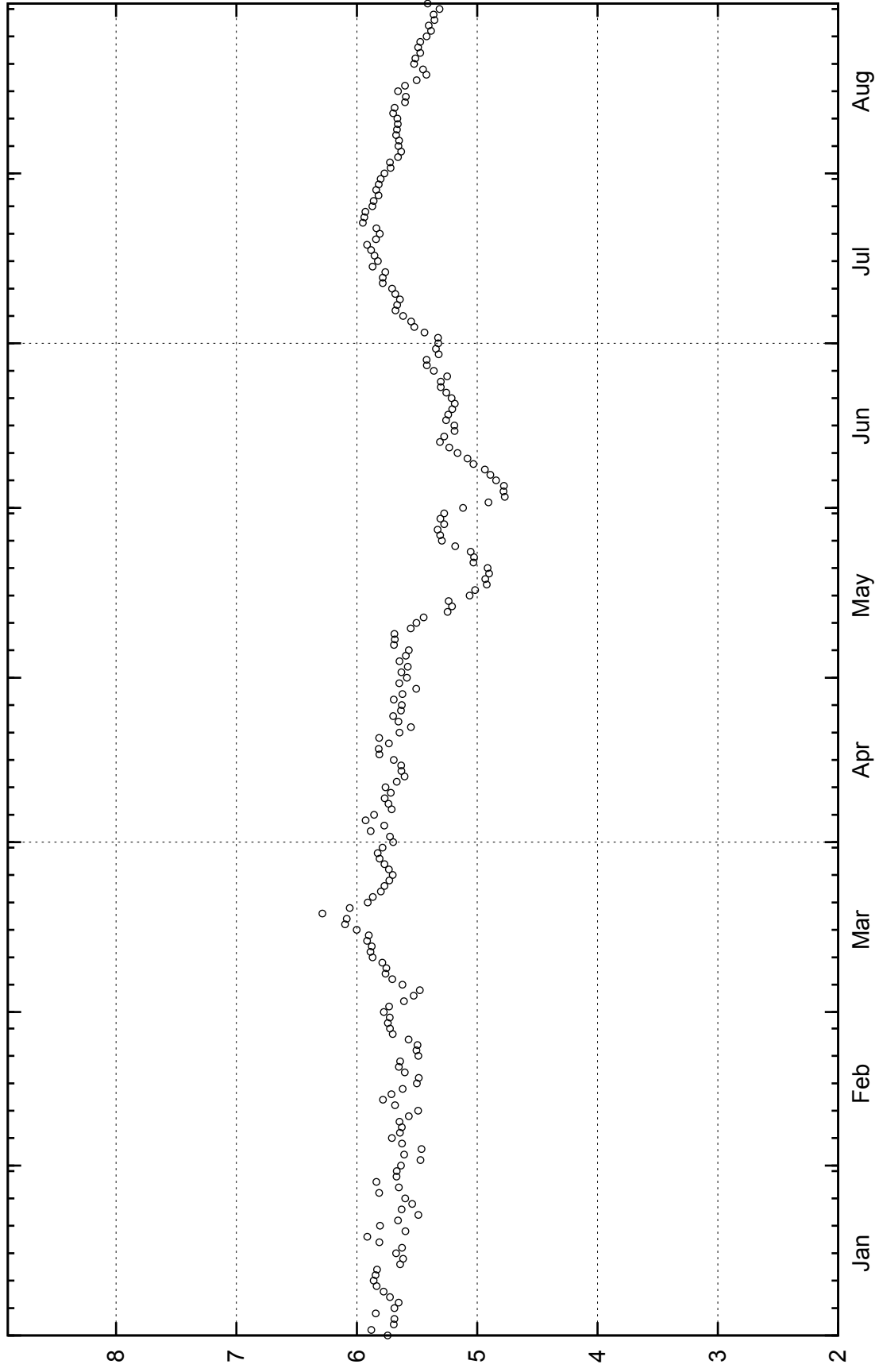
Start: 2007-01-01 month

HLX14



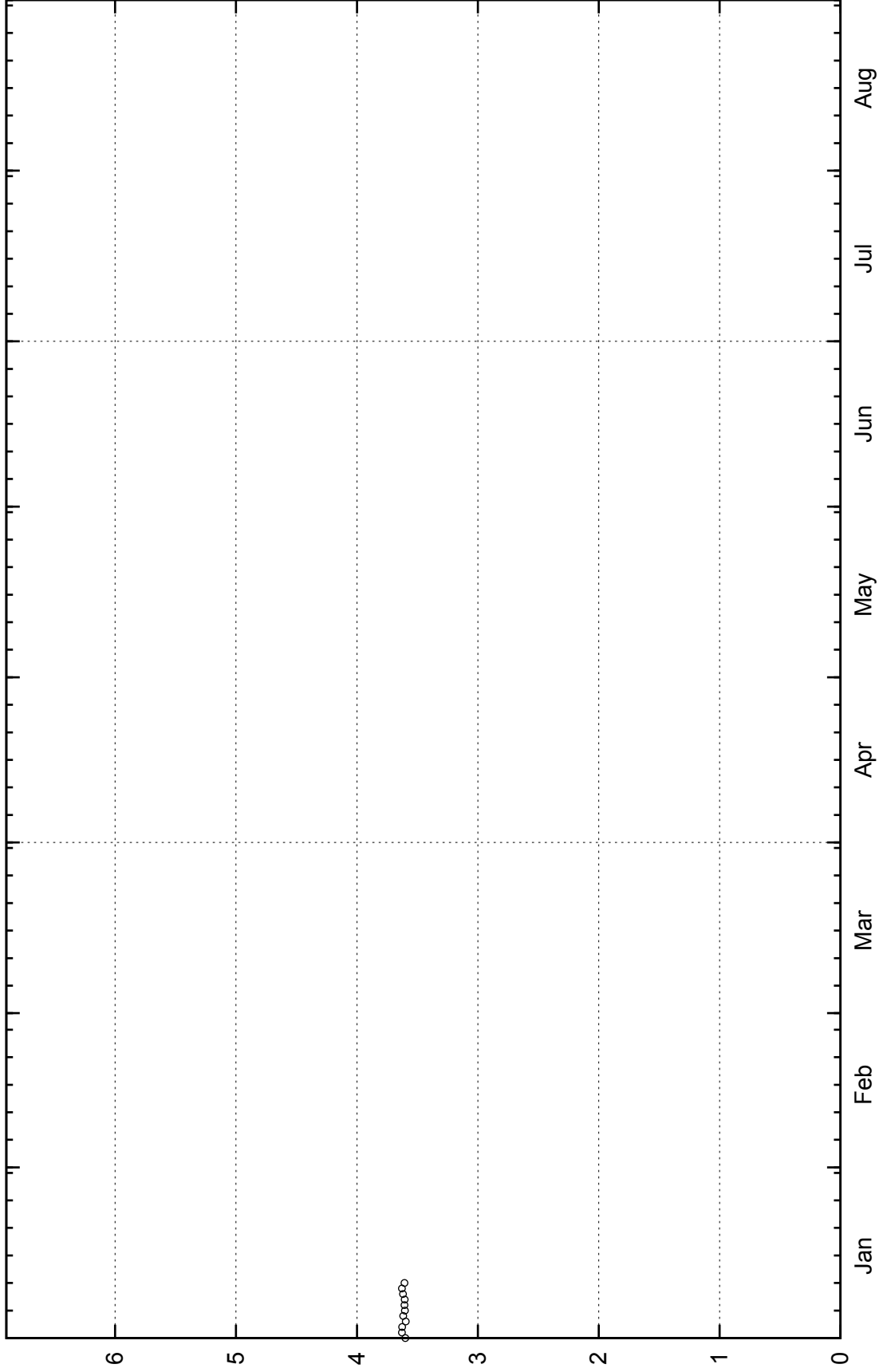
Start: 2007-01-01 month

HLX15



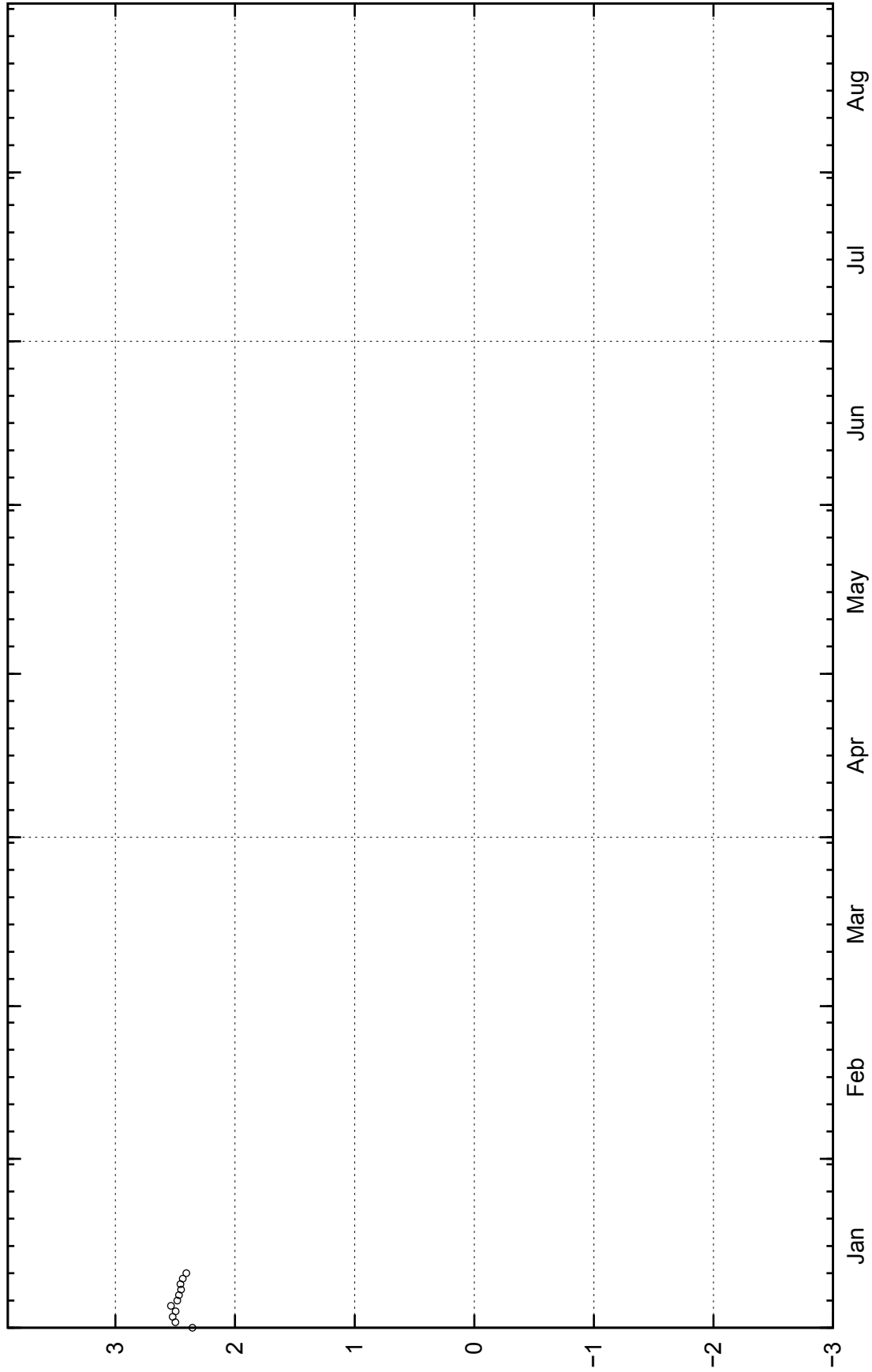
Start: 2007-01-01 month

HILX16



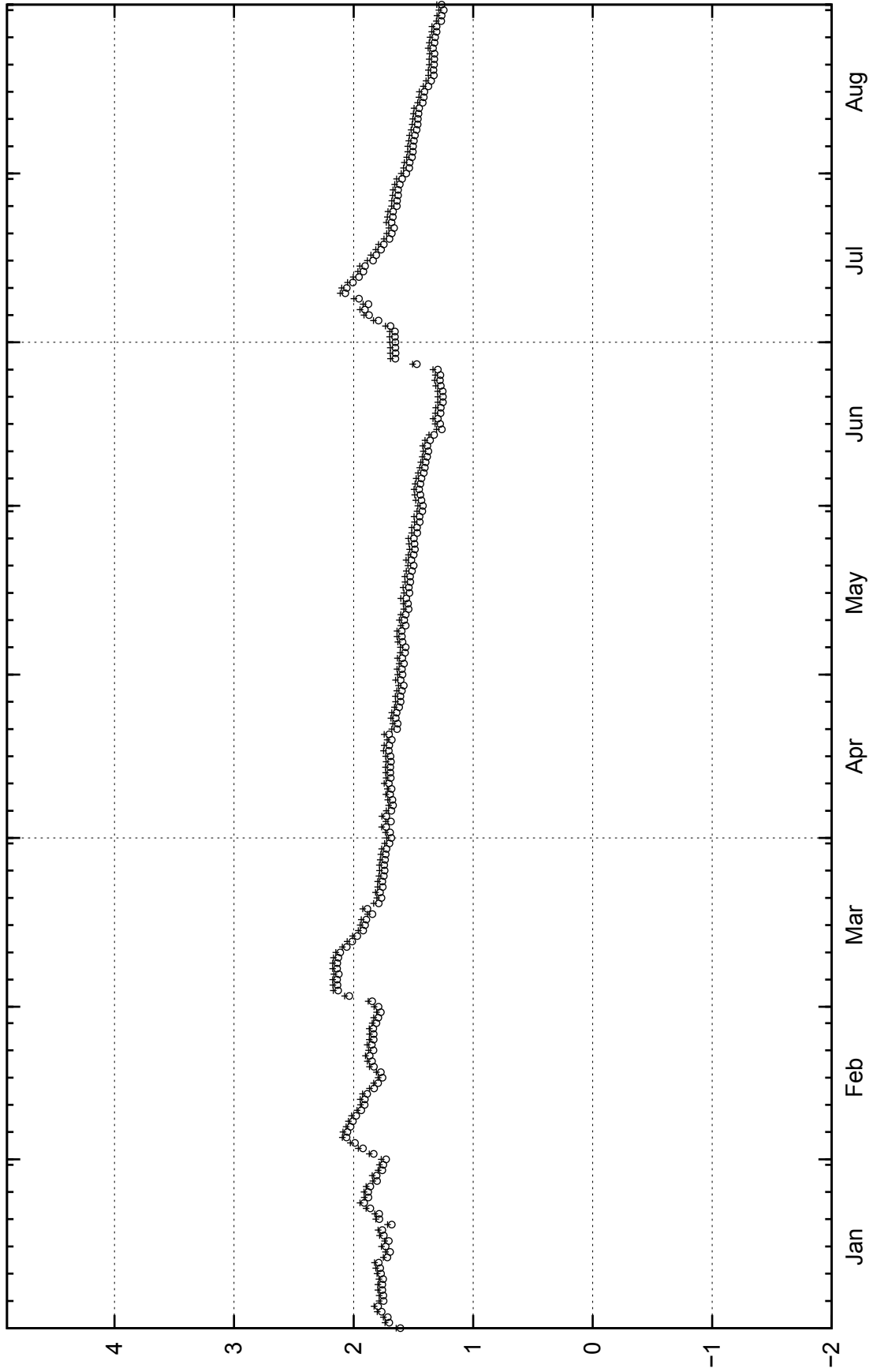
Start: 2007-01-01 month

HLX17



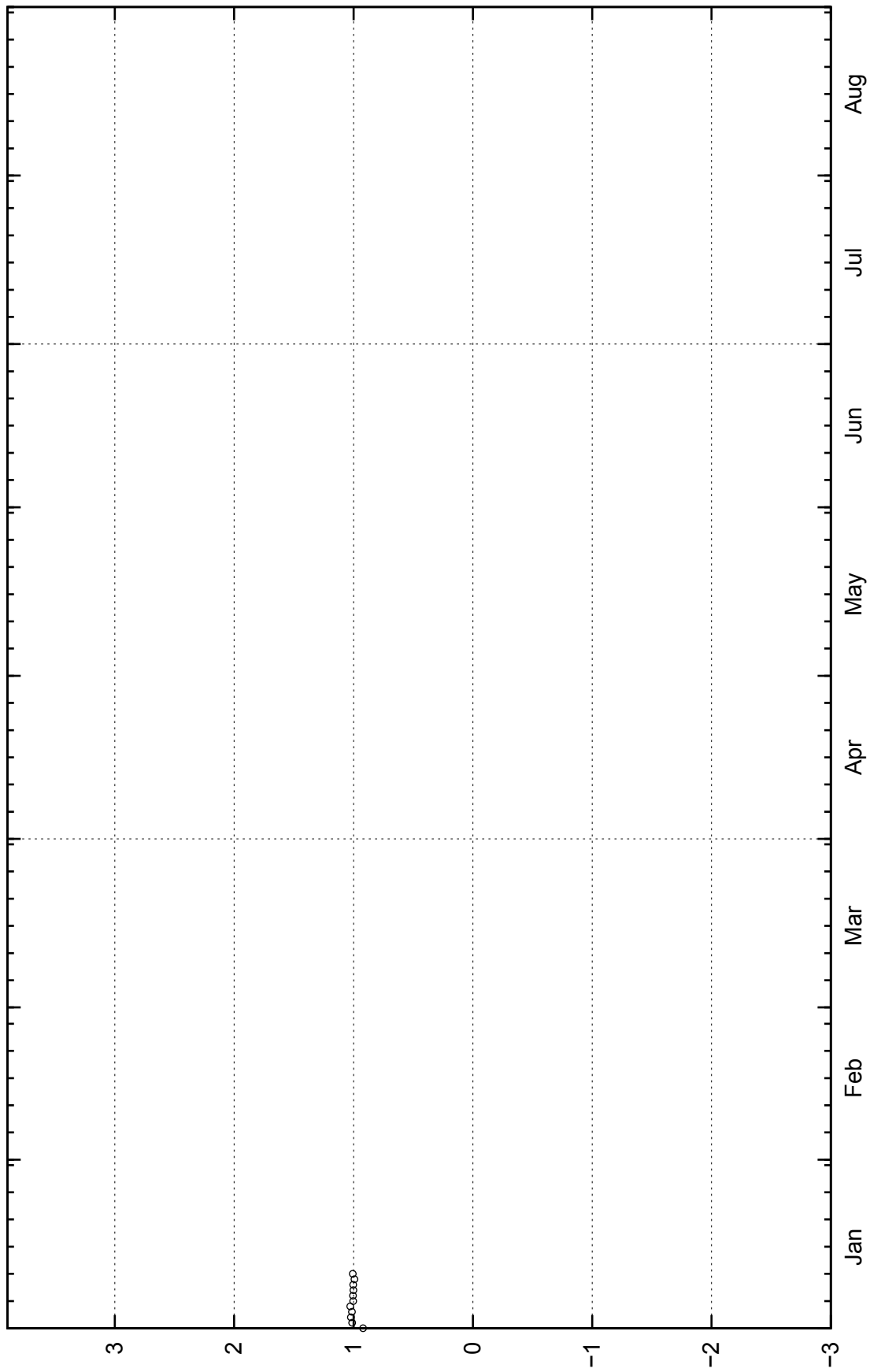
Start: 2007-01-01 month

HLX18



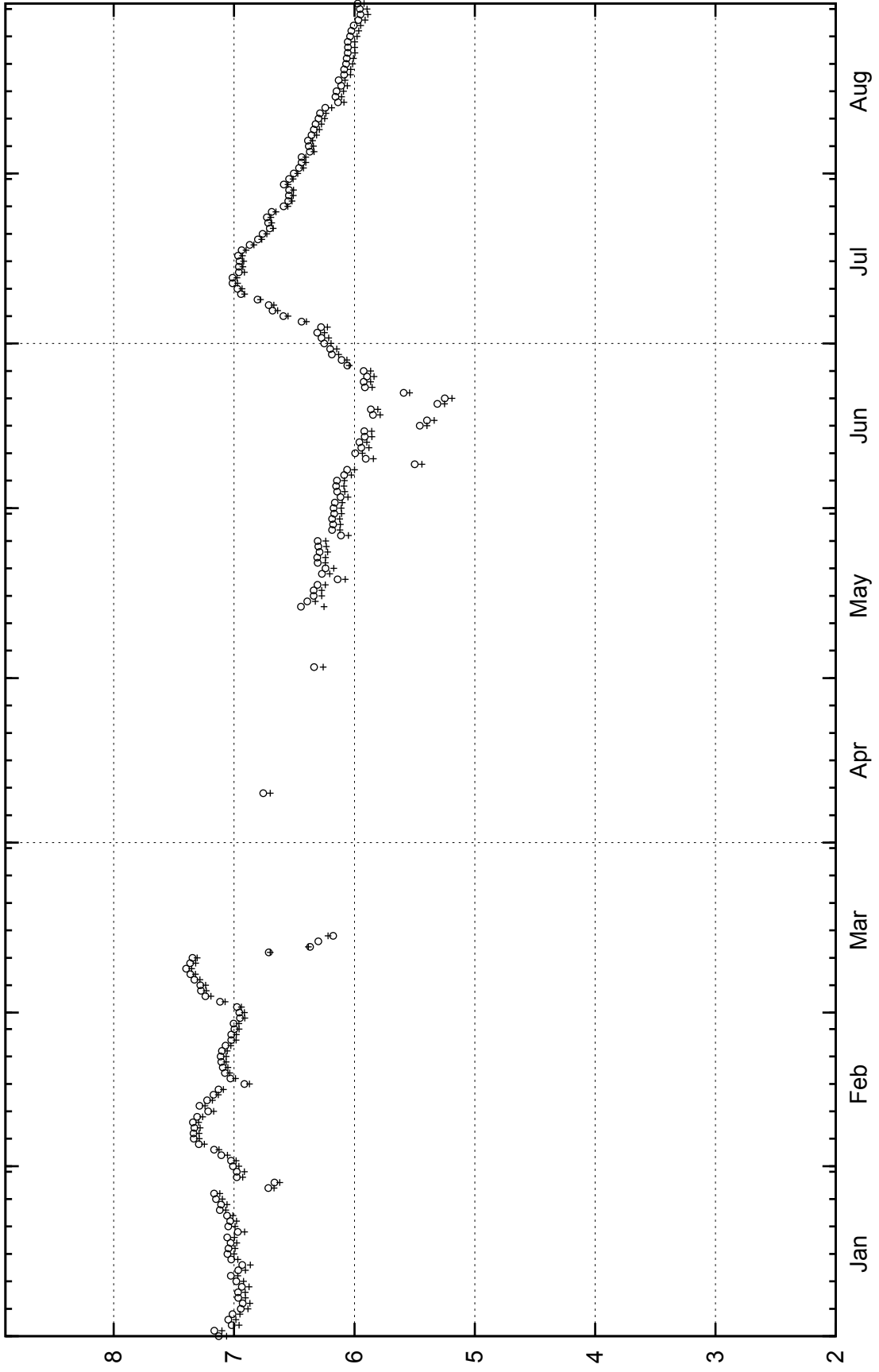
Start: 2007-01-01 month

HLX19



Start: 2007-01-01 month

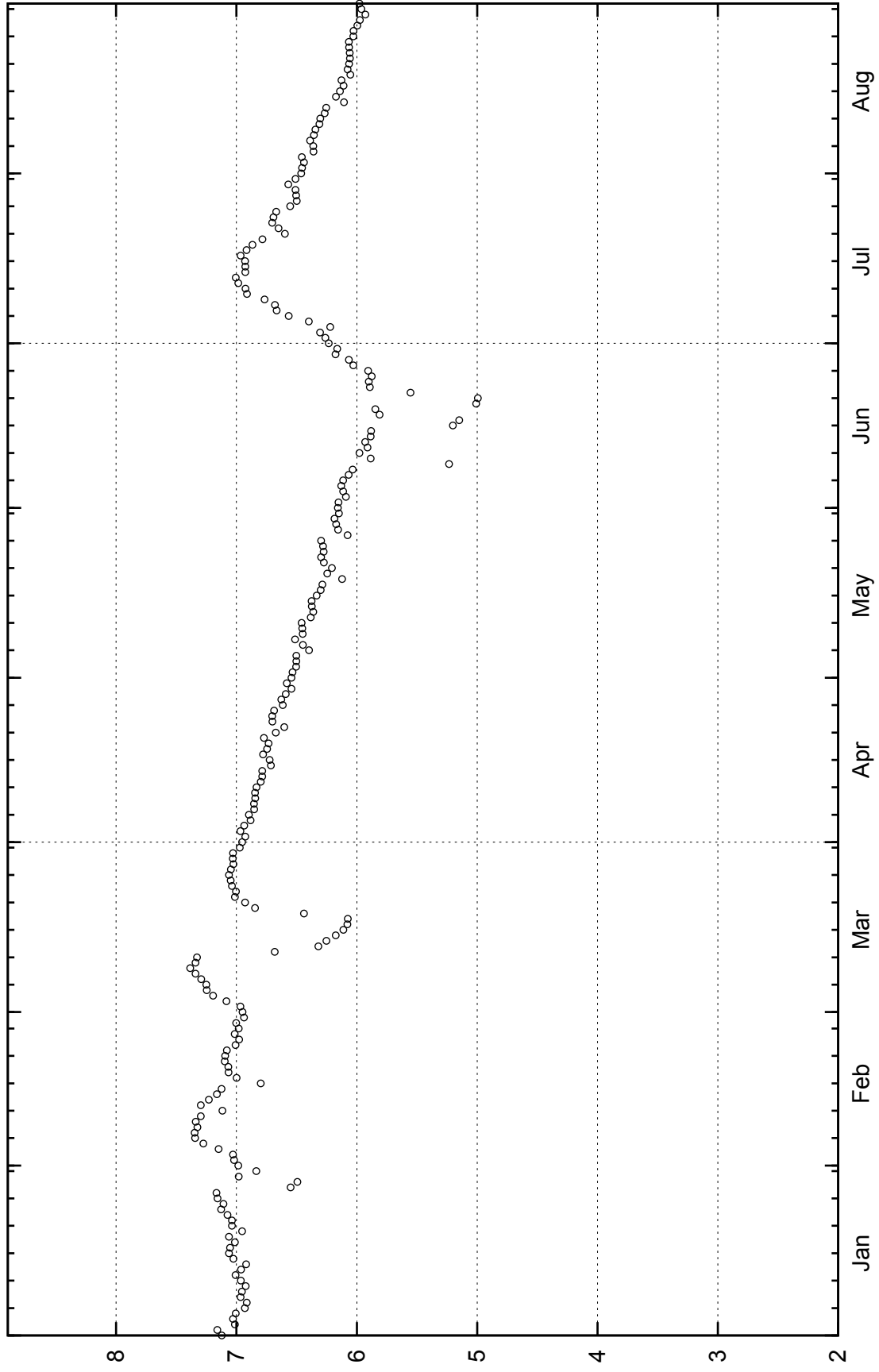
HXL21



Start: 2007-01-01 month

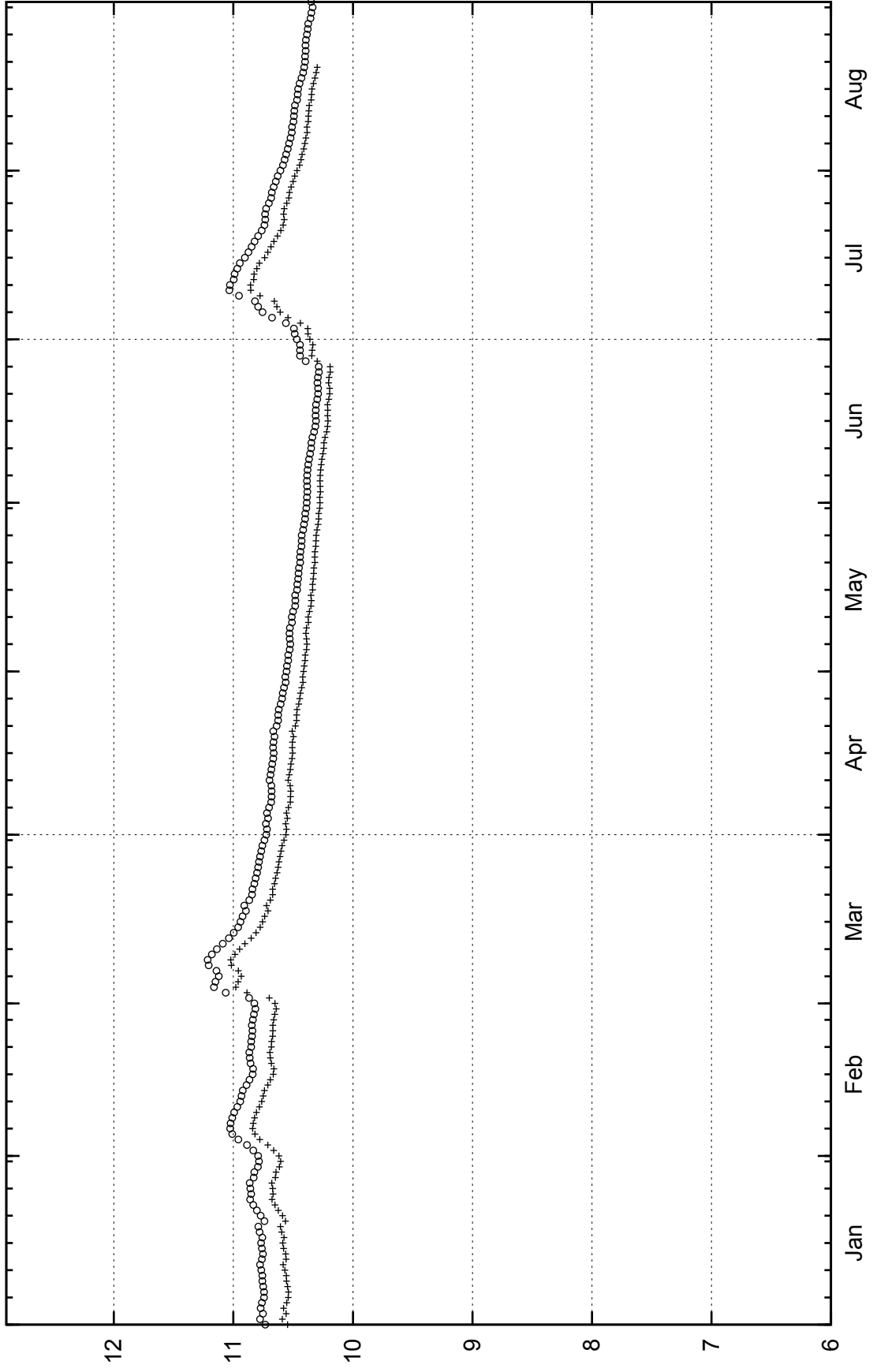
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HILX22



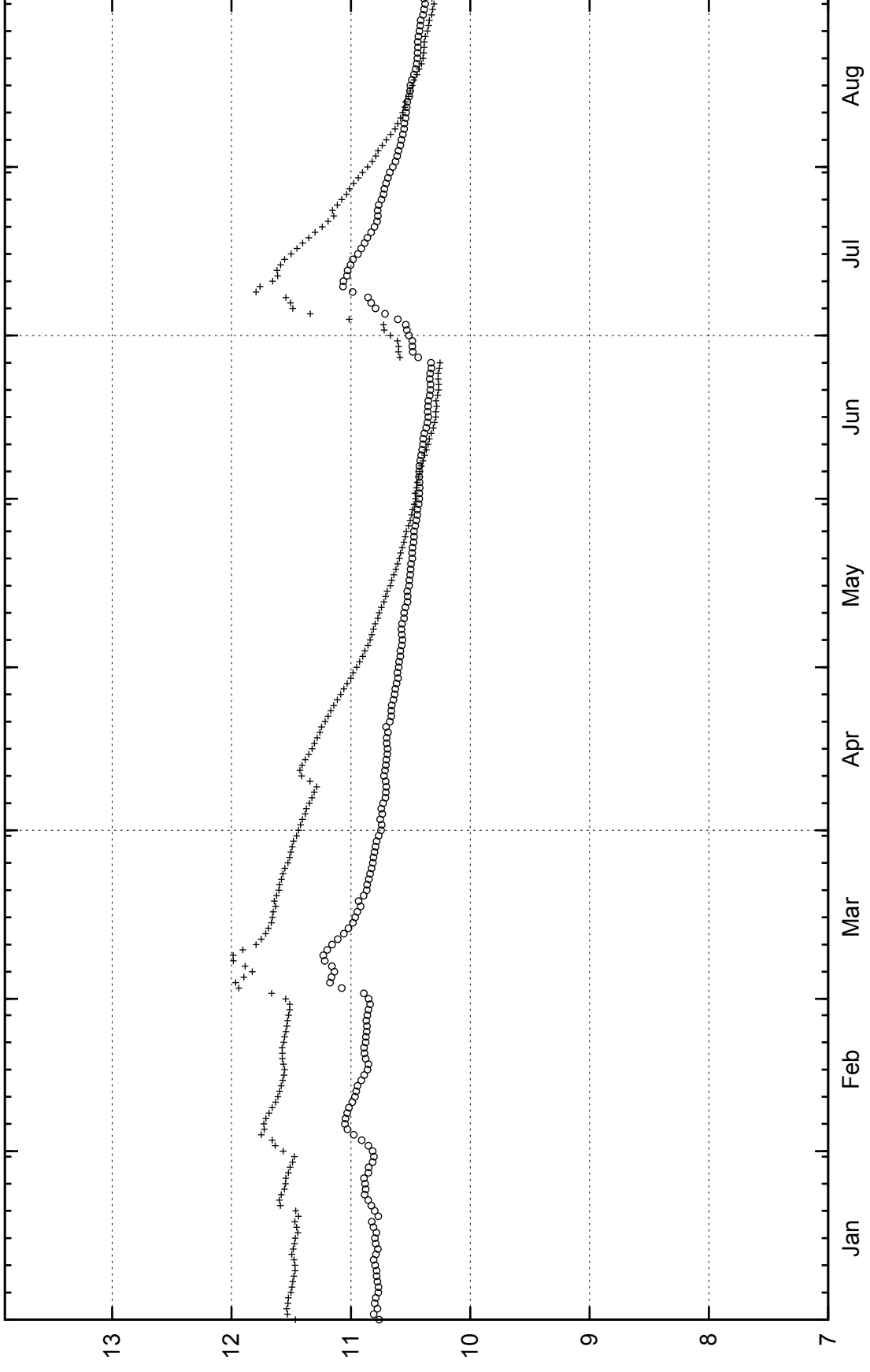
Start: 2007-01-01 month

HXL23



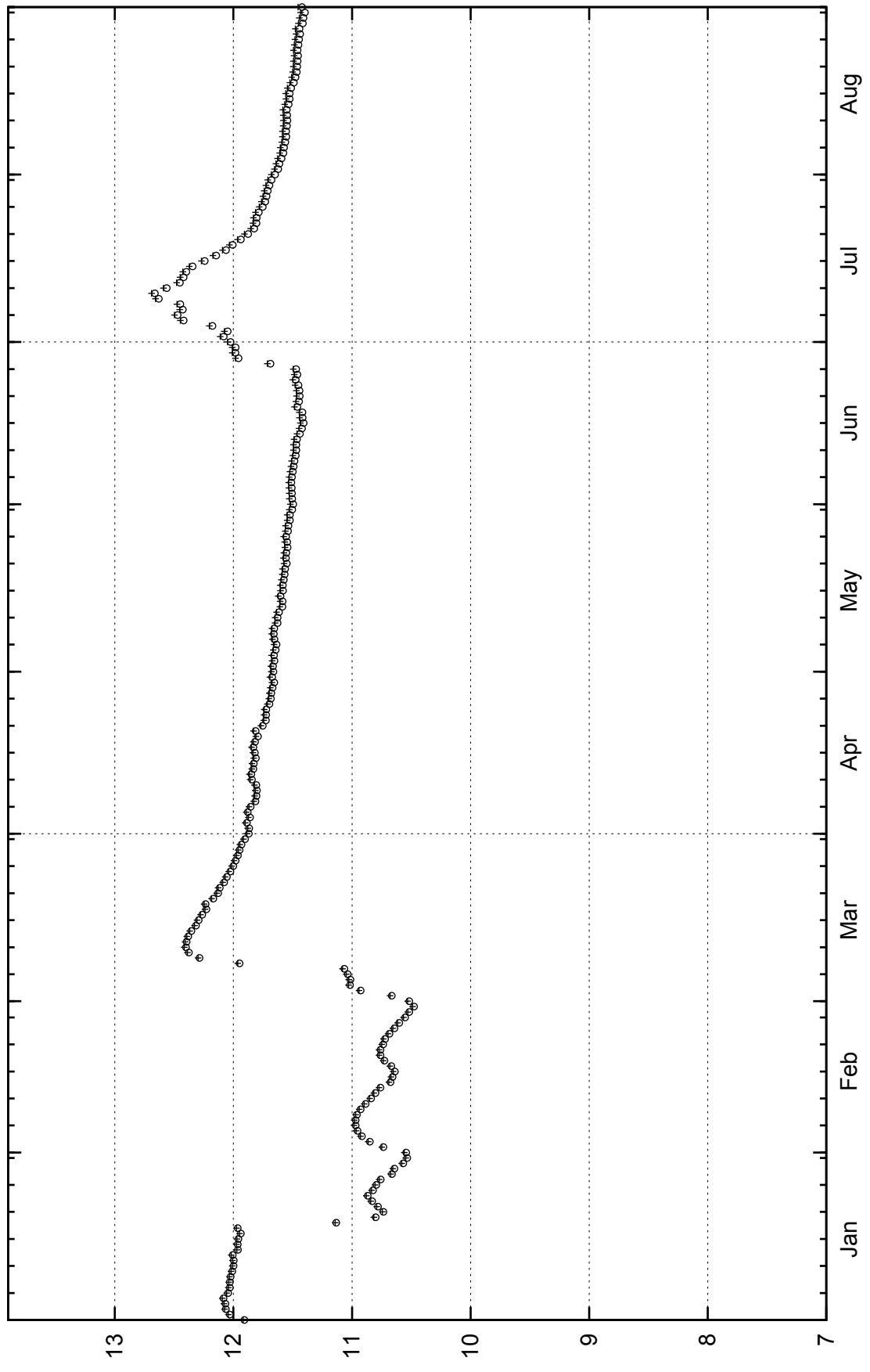
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HLX24



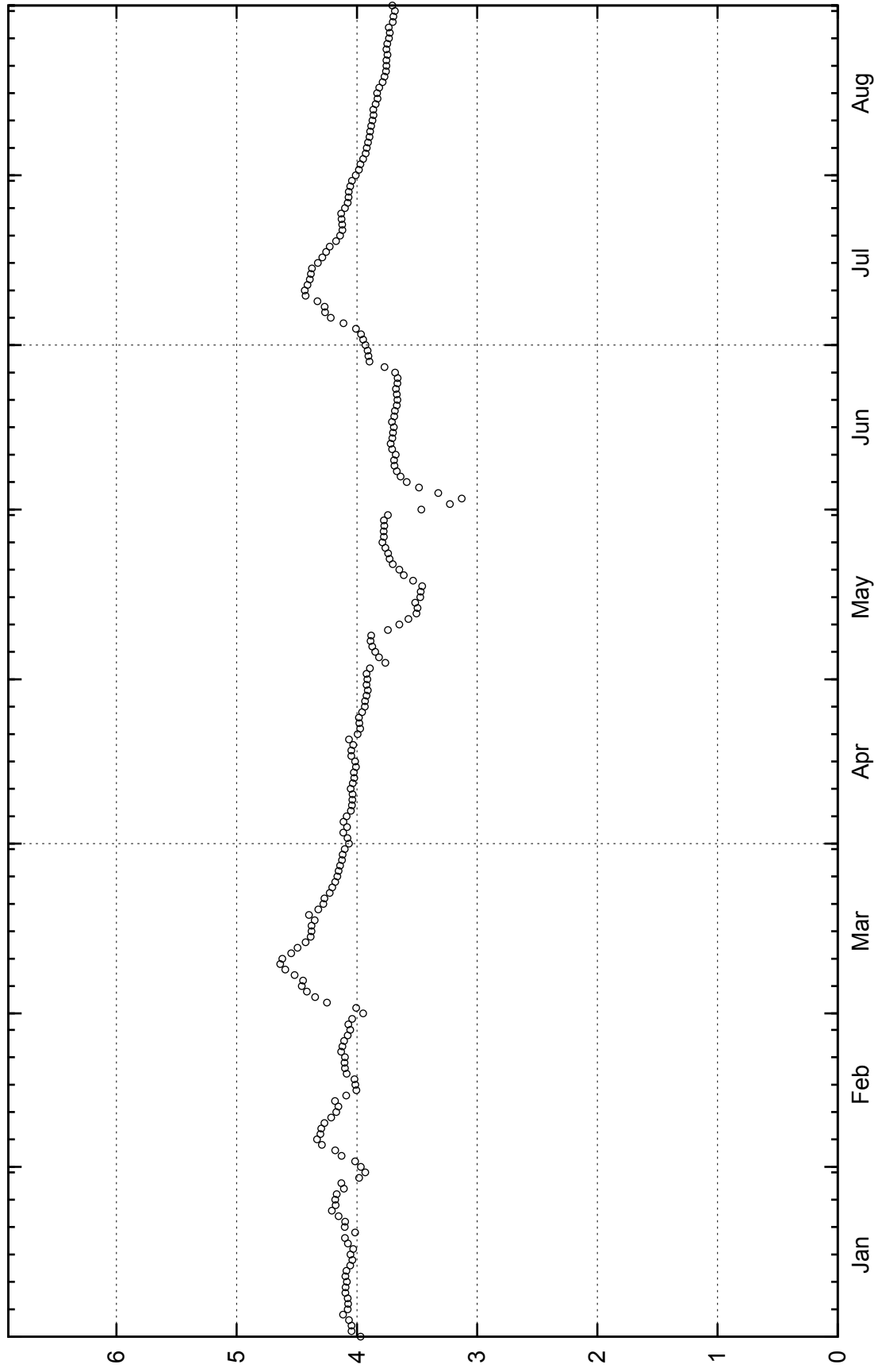
Start: 2007-01-01 month

HXL25



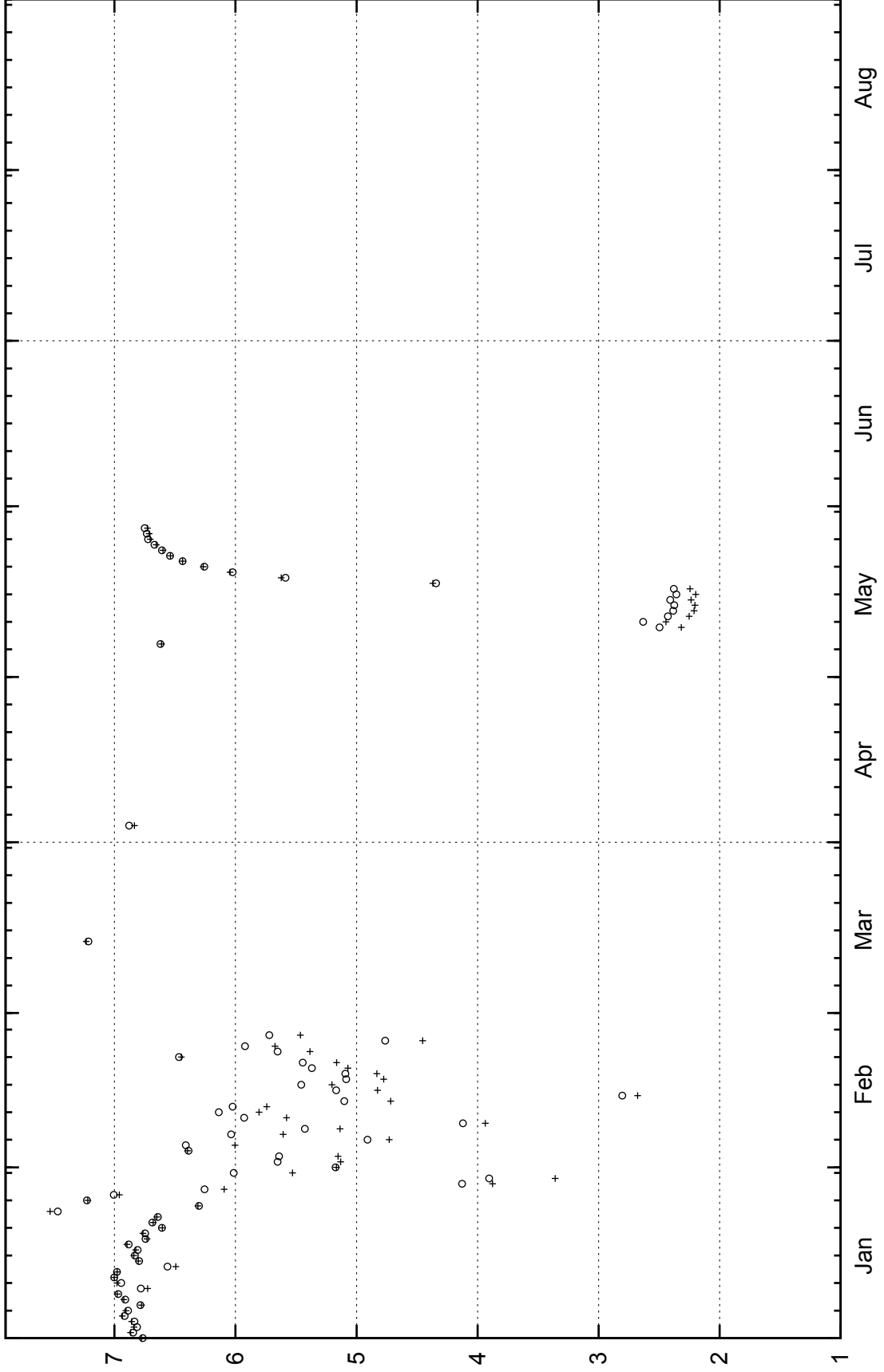
Start: 2007-01-01 month

HLX26



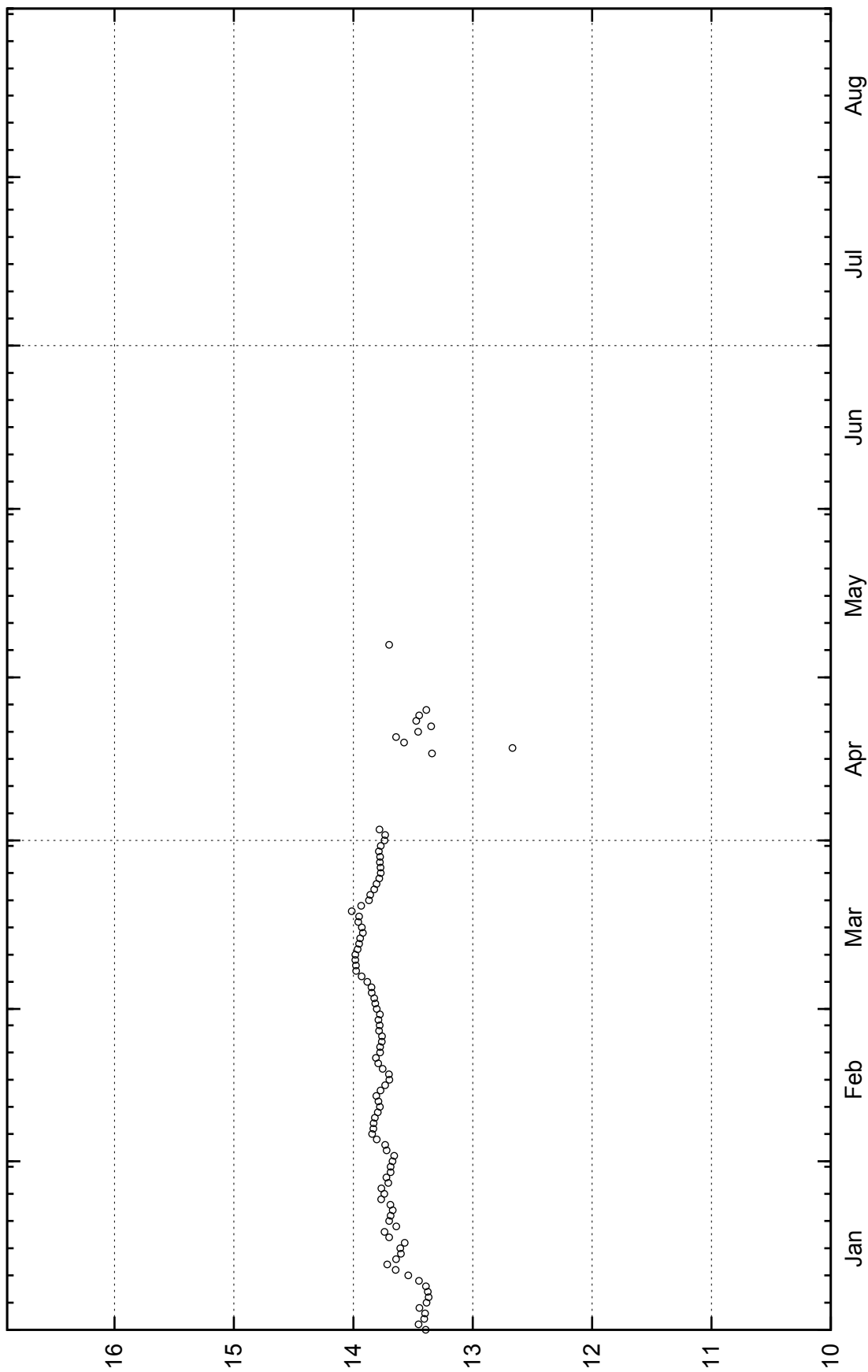
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HXL27



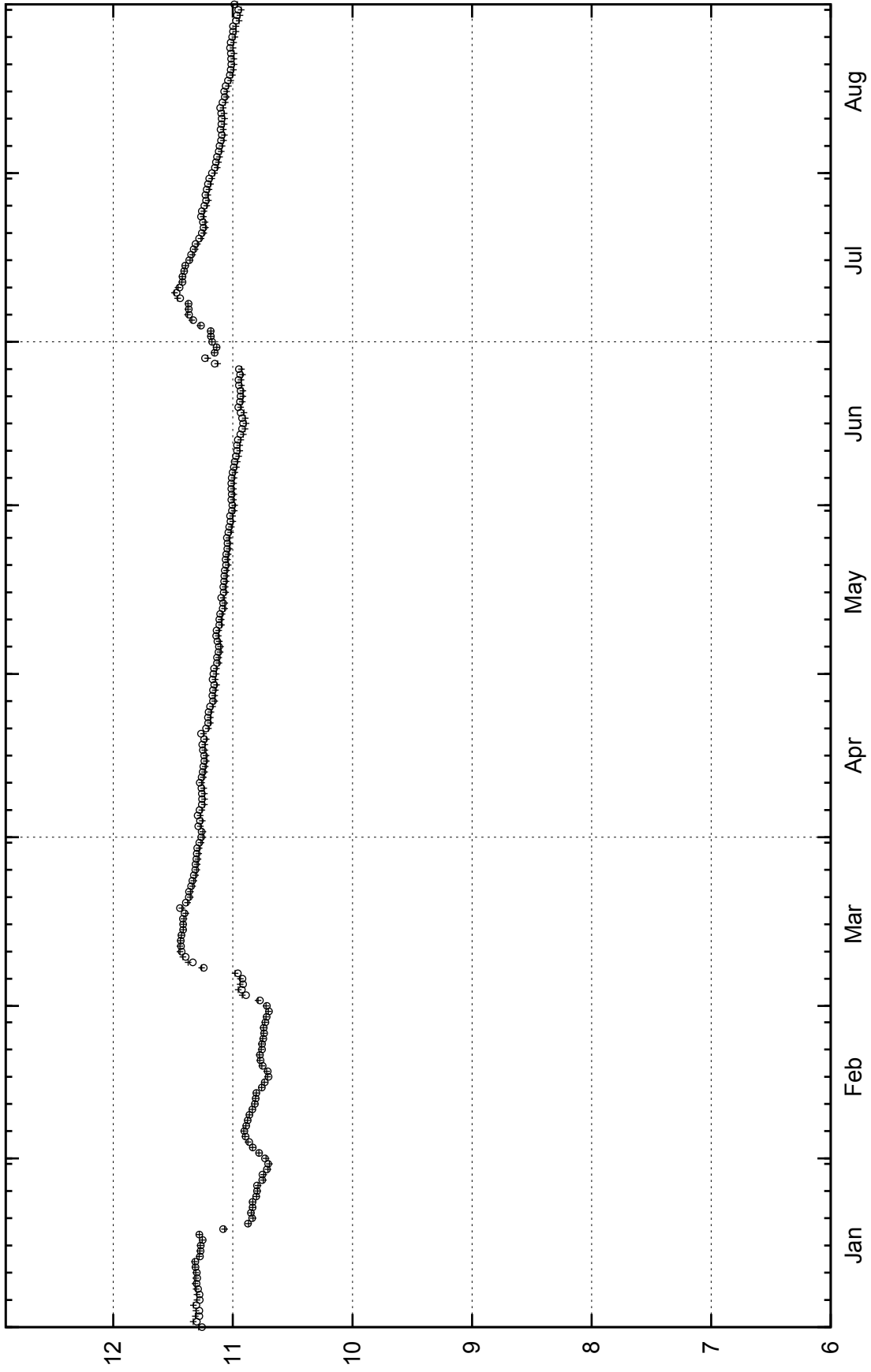
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HLX28



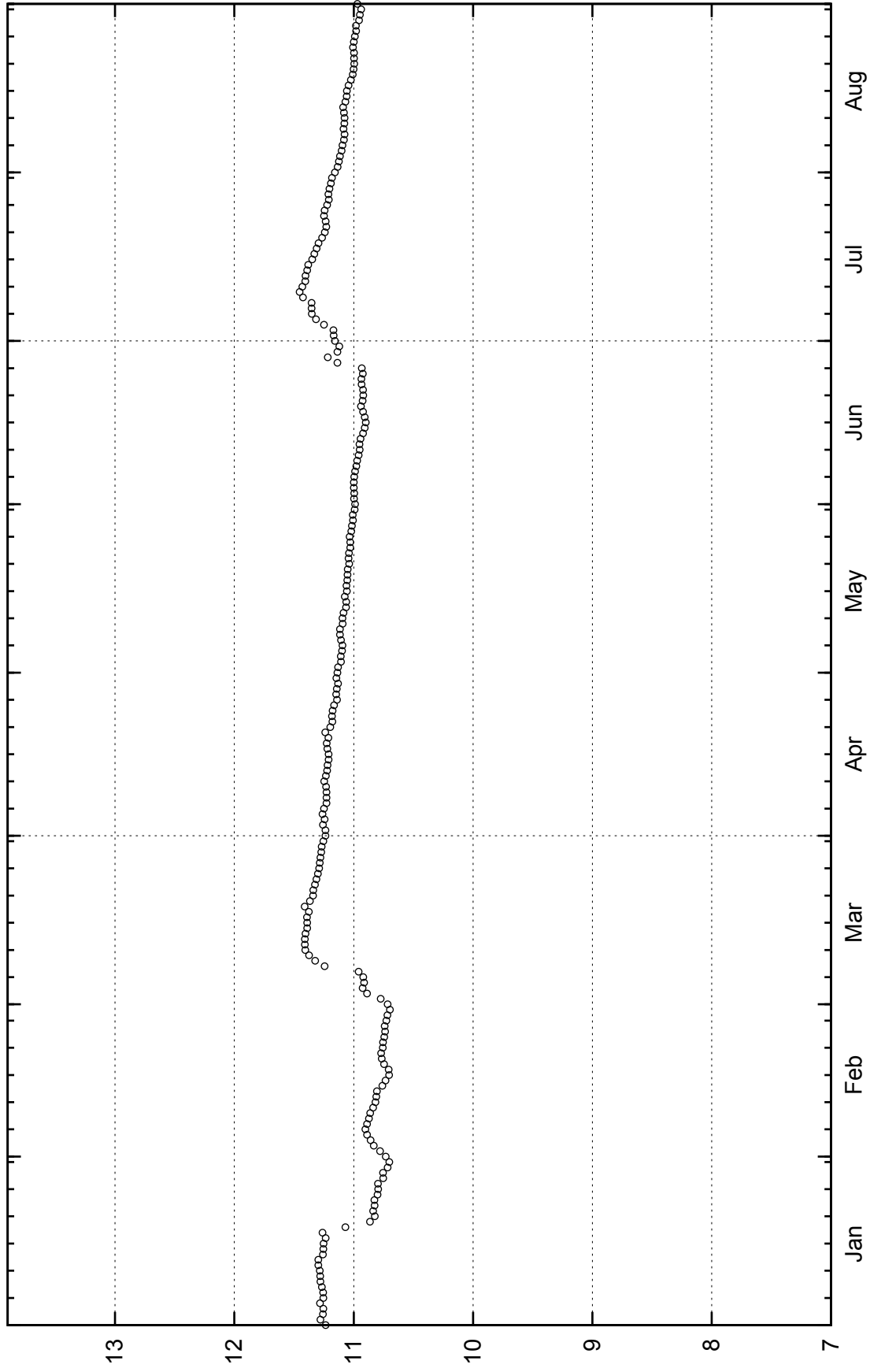
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HILX30



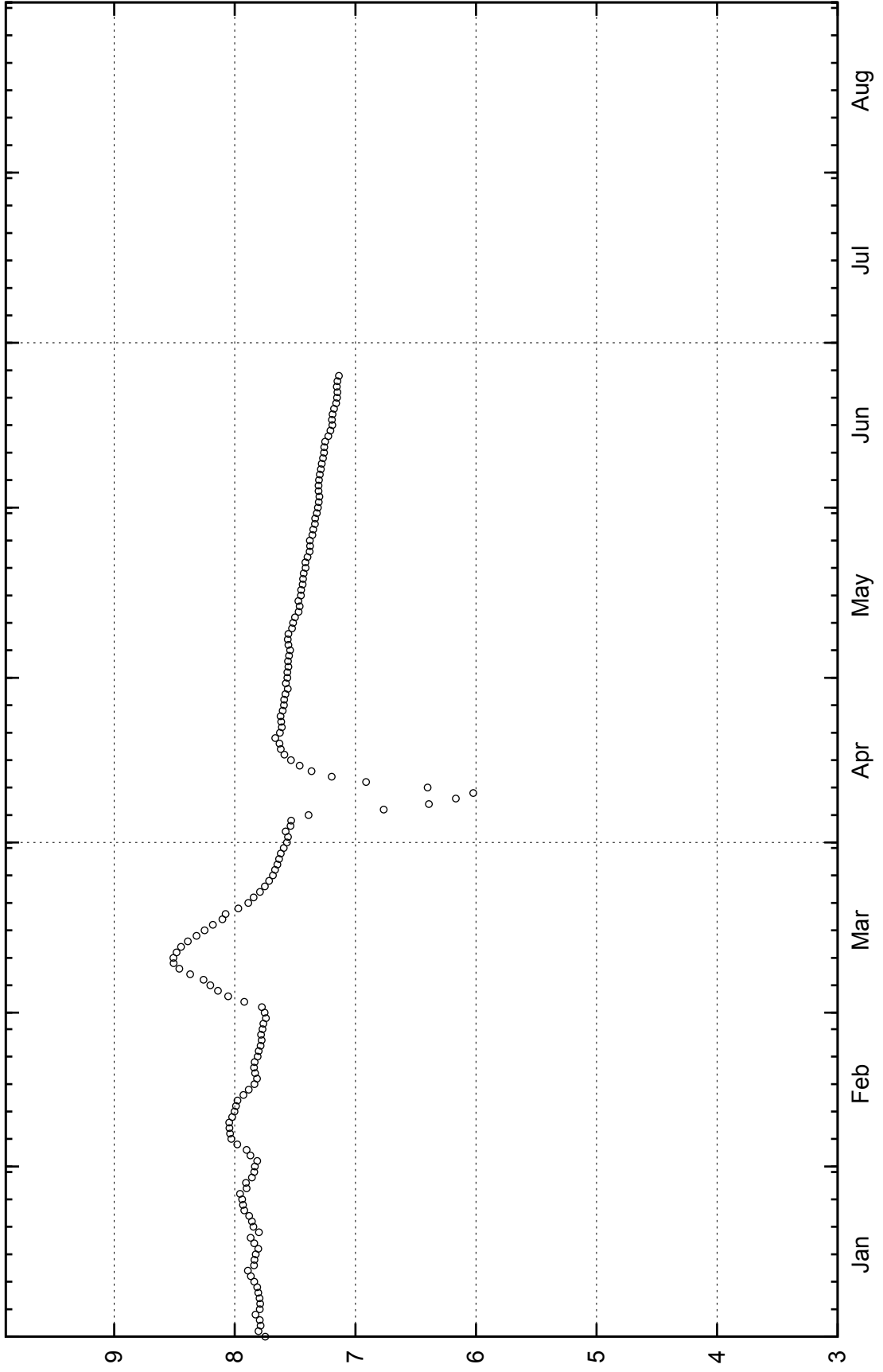
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HXL31



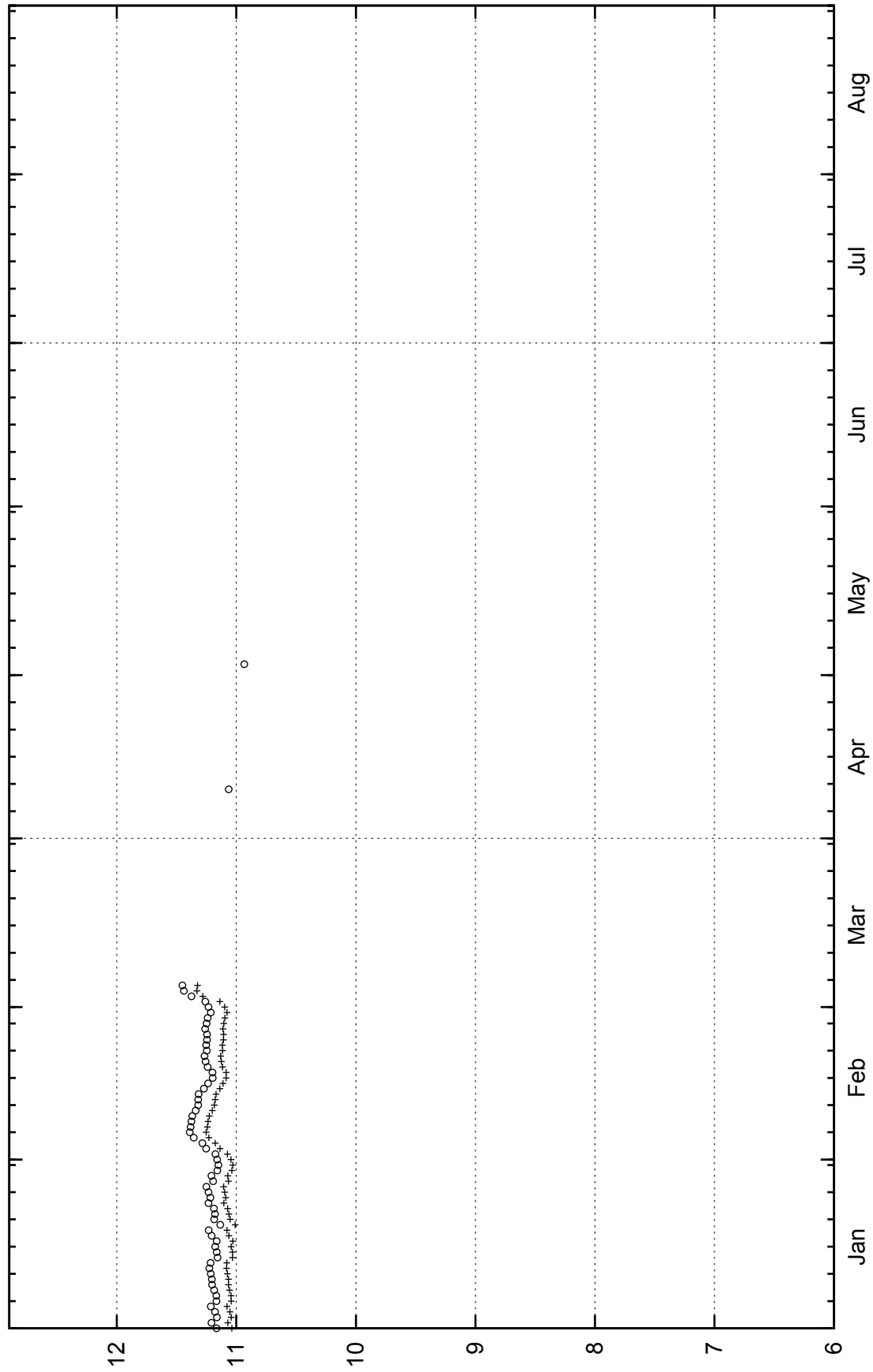
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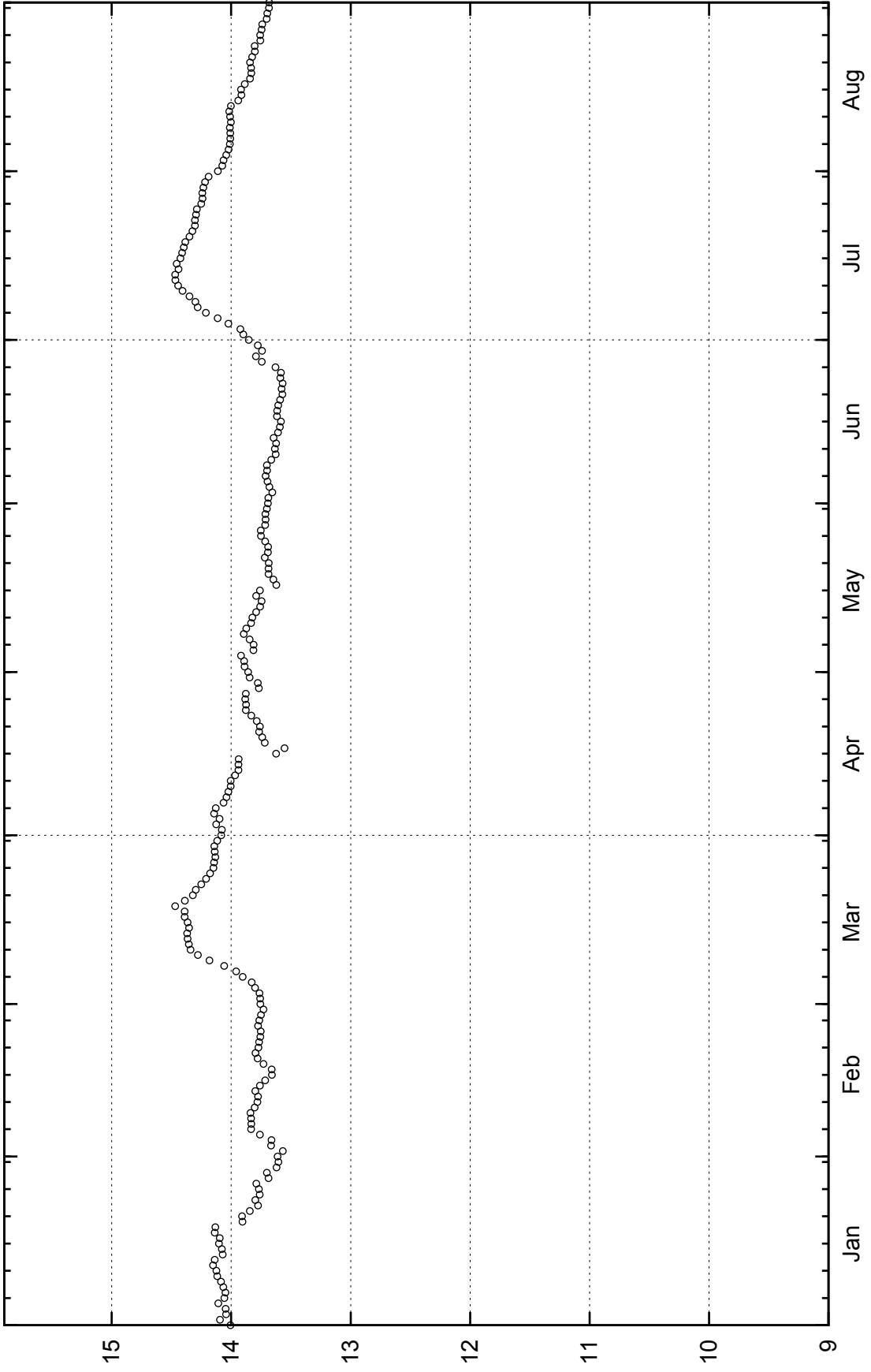
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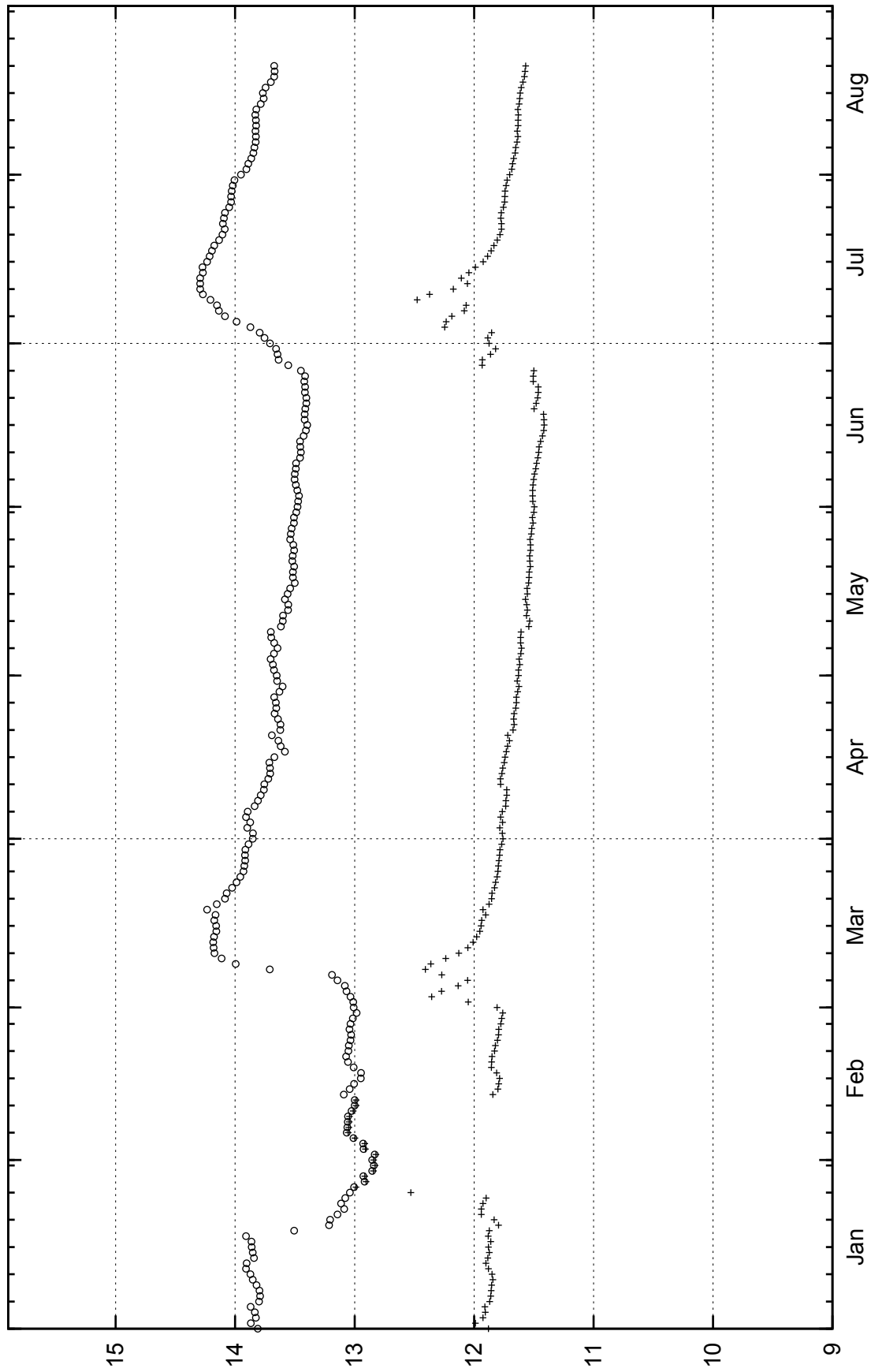
Start: 2007-01-01 month

HLX34



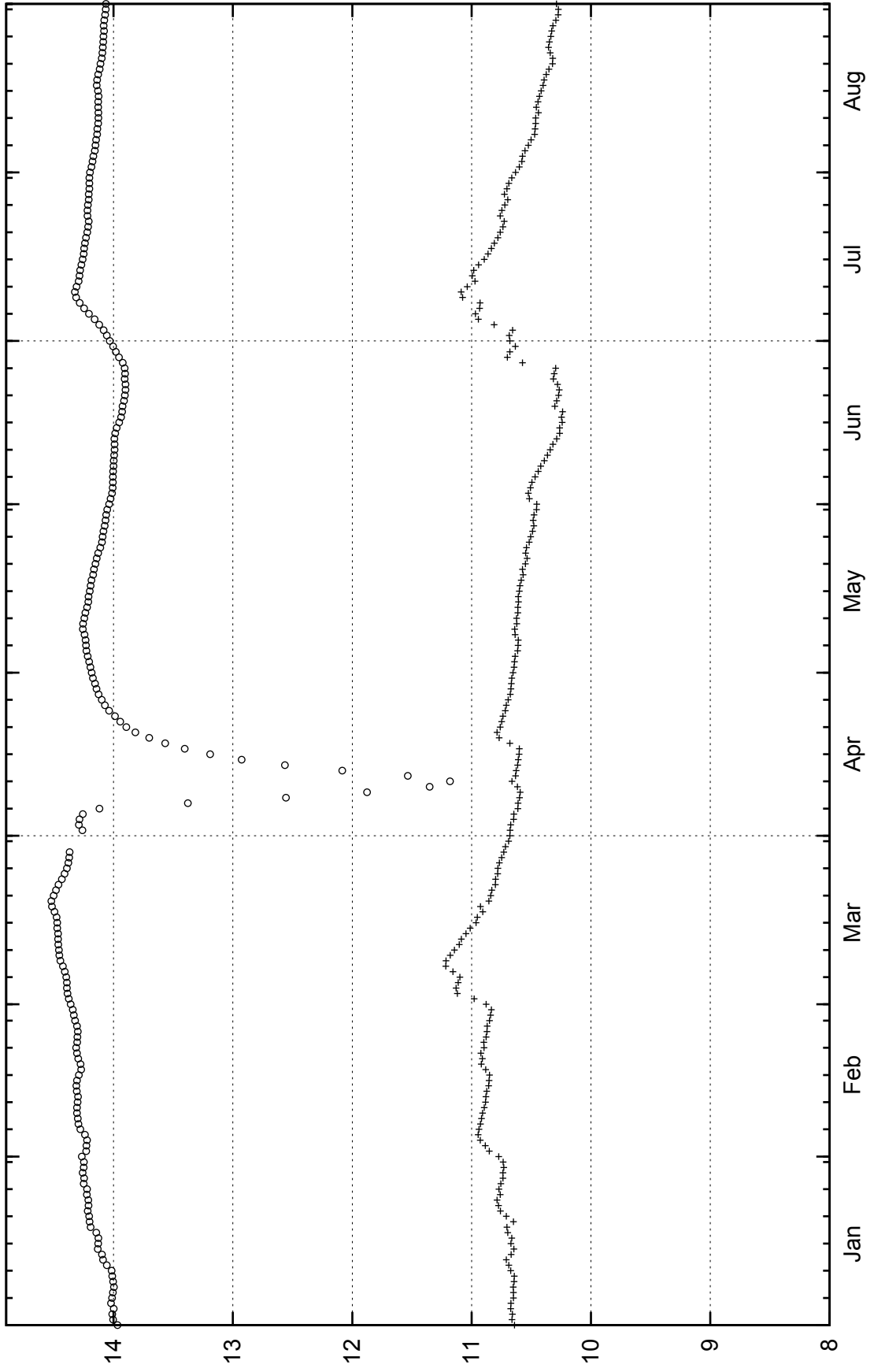
Start: 2007-01-01 month

HILX35



Start: 2007-01-01 month

HXL36

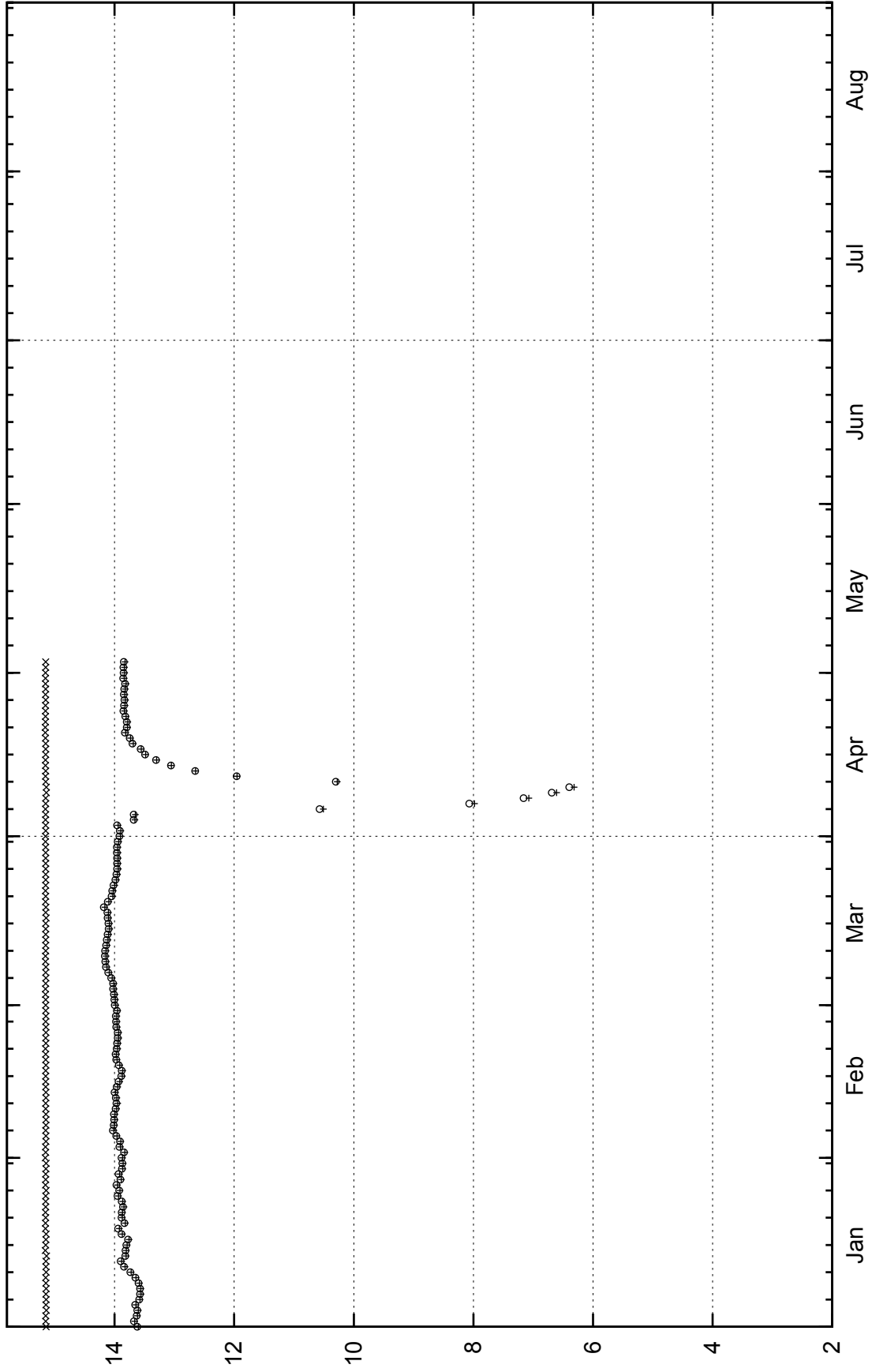


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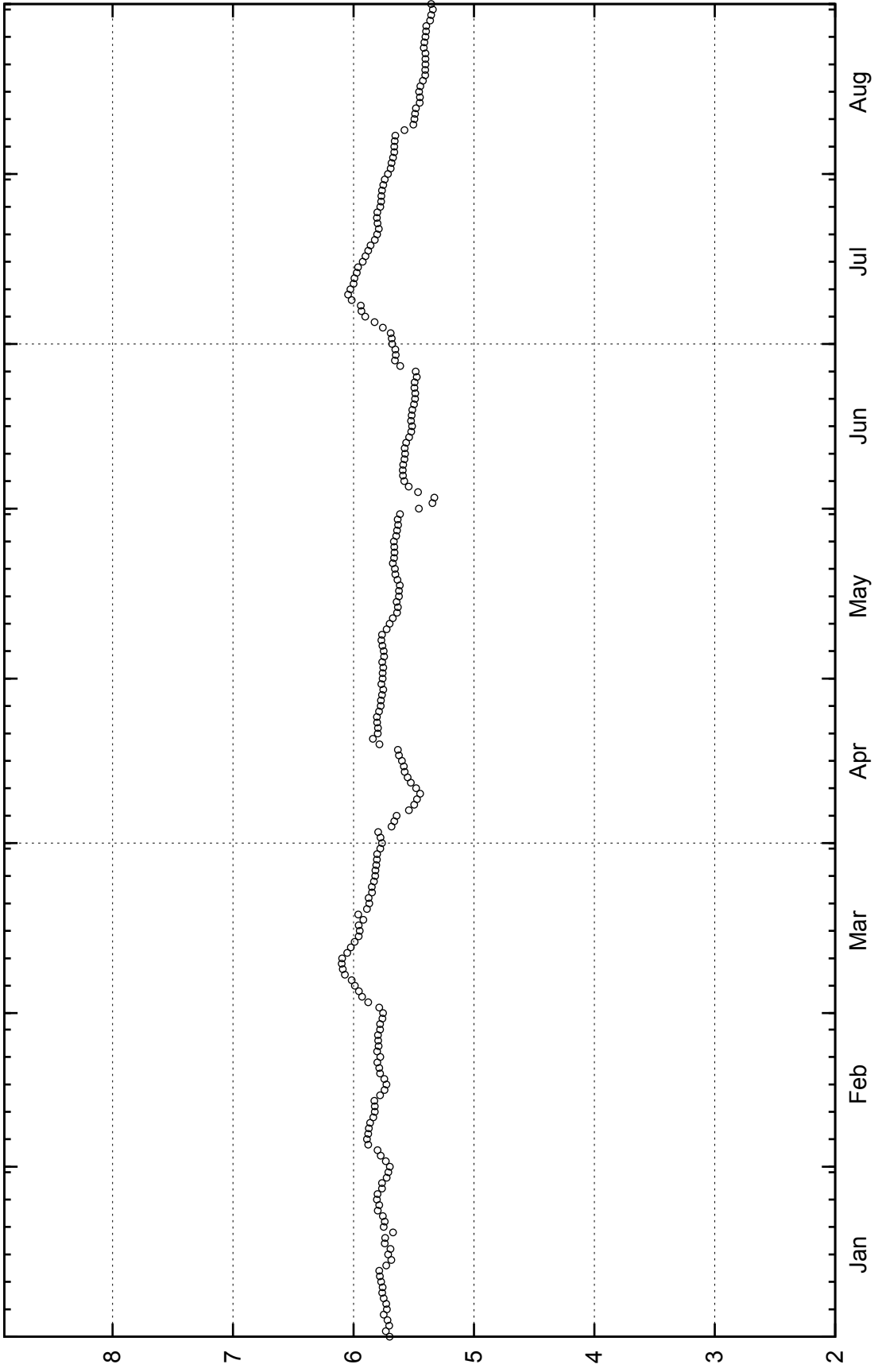
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H LX37



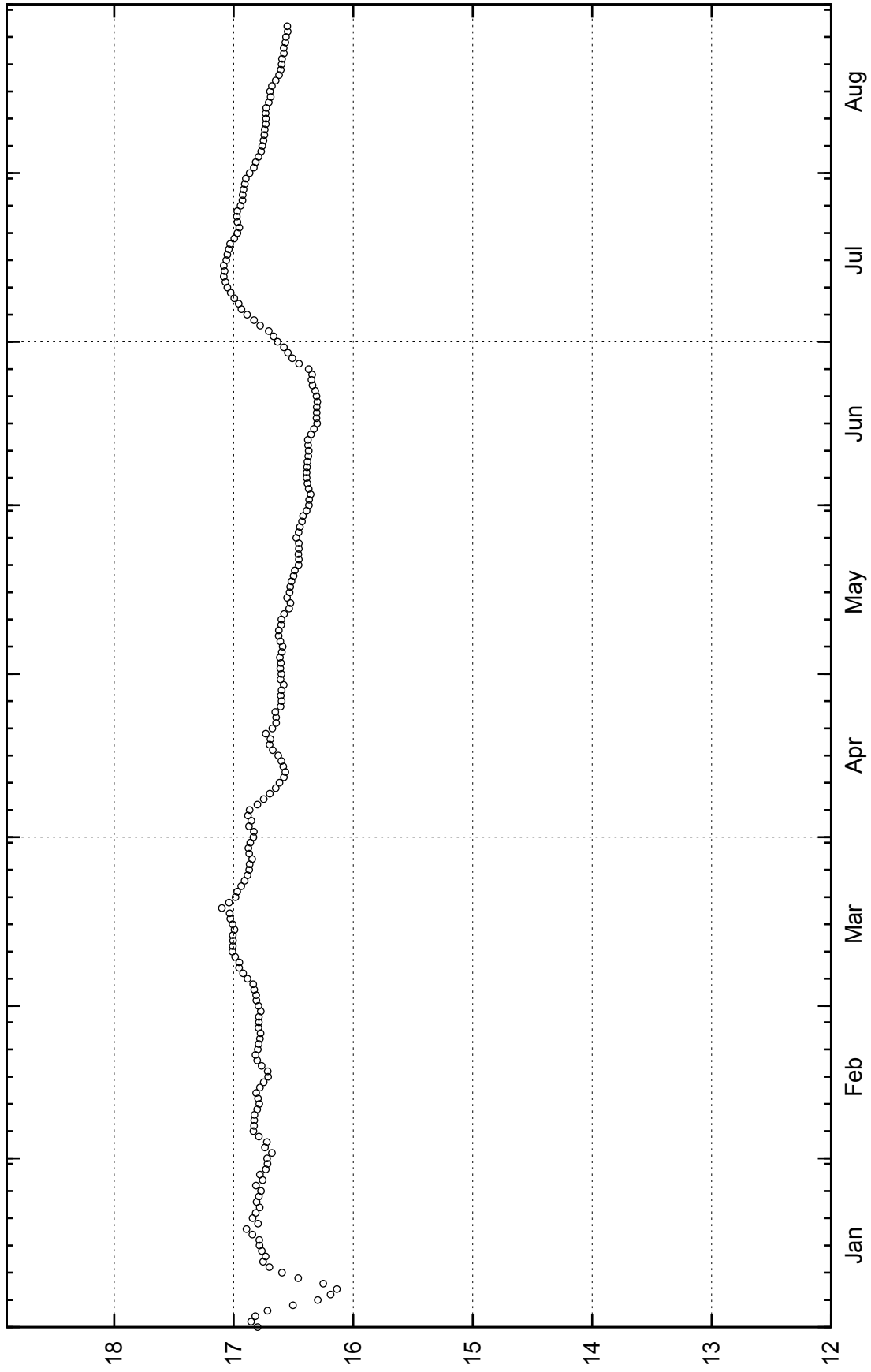
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HLY38



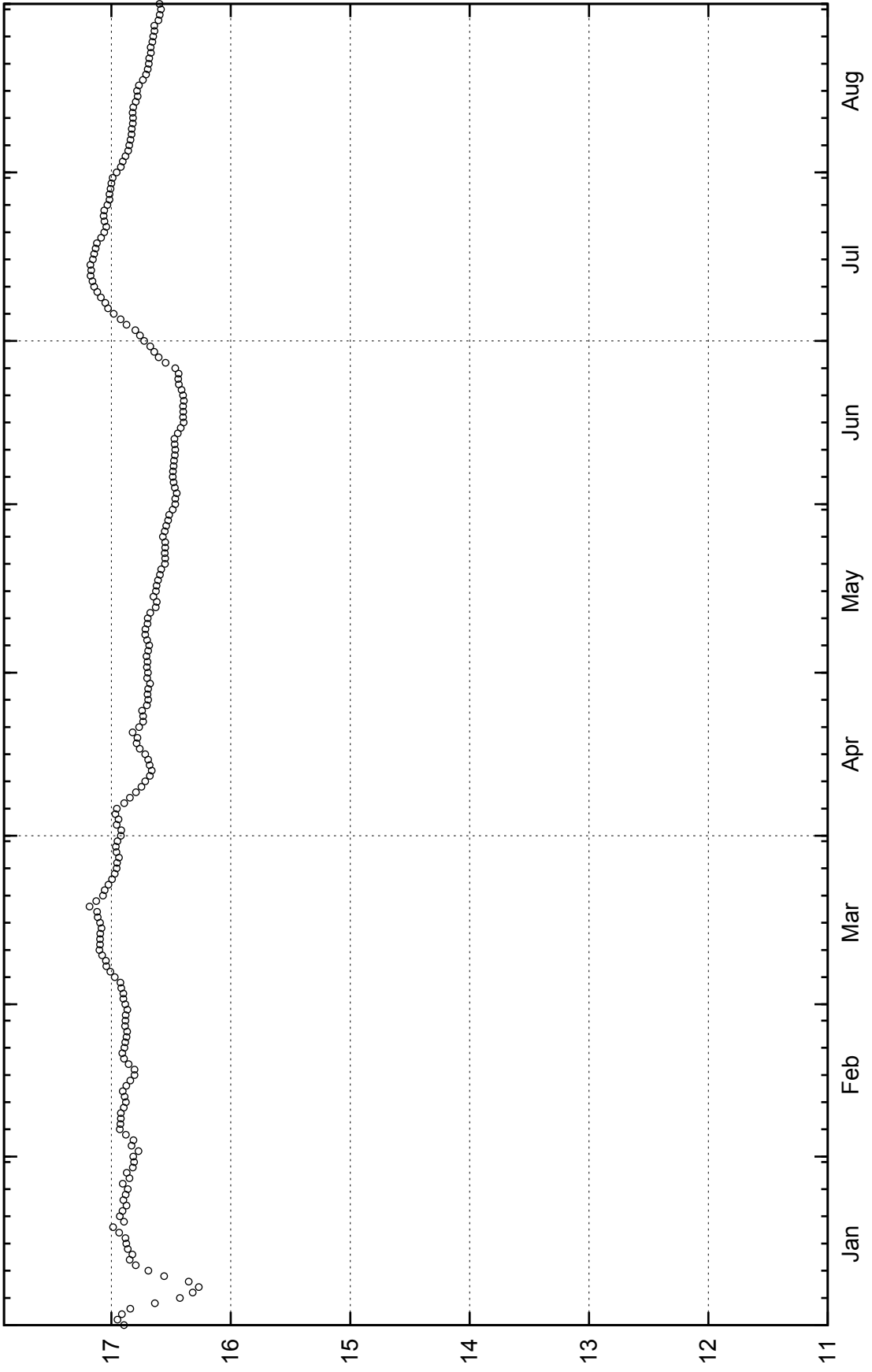
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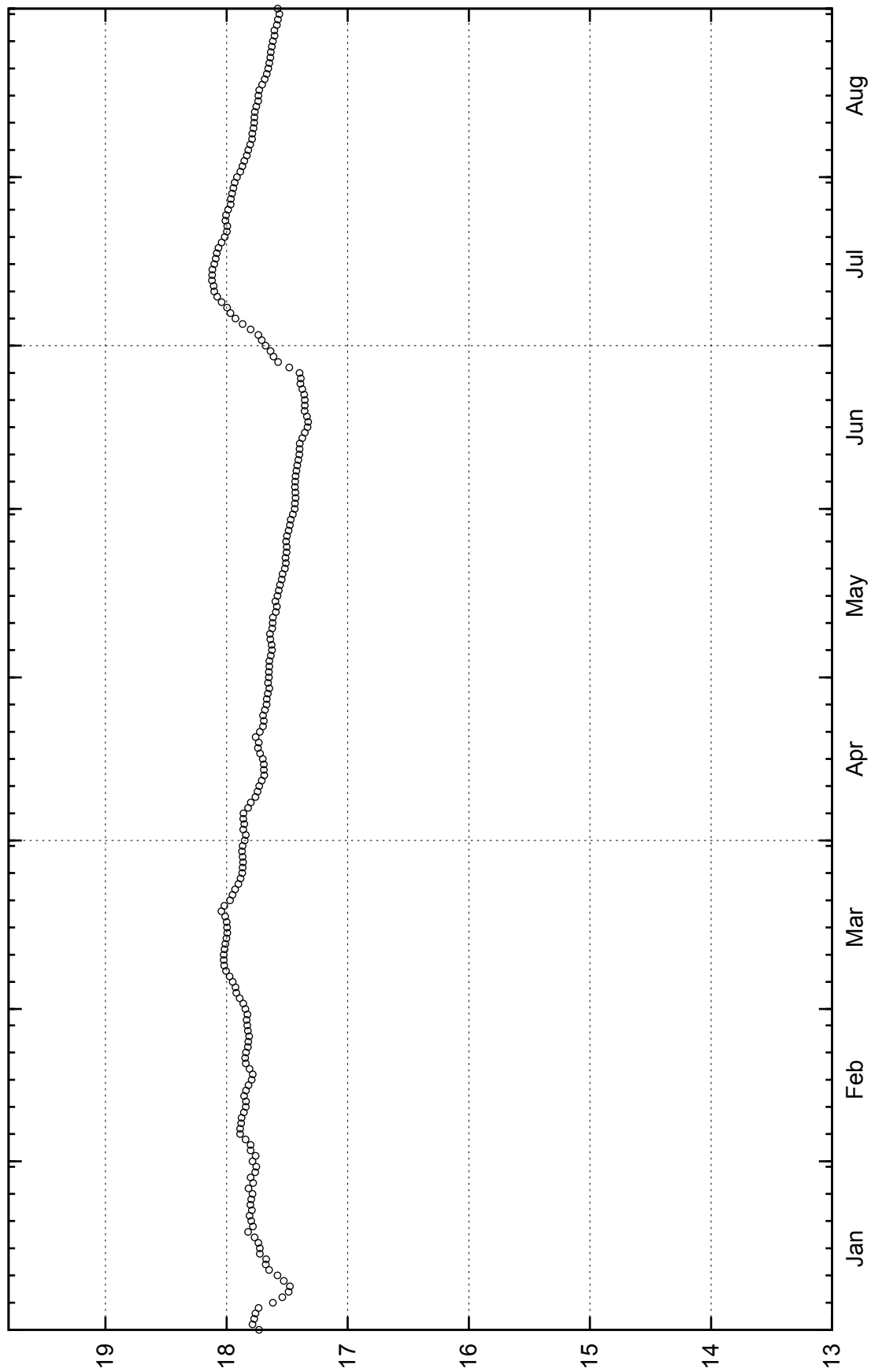
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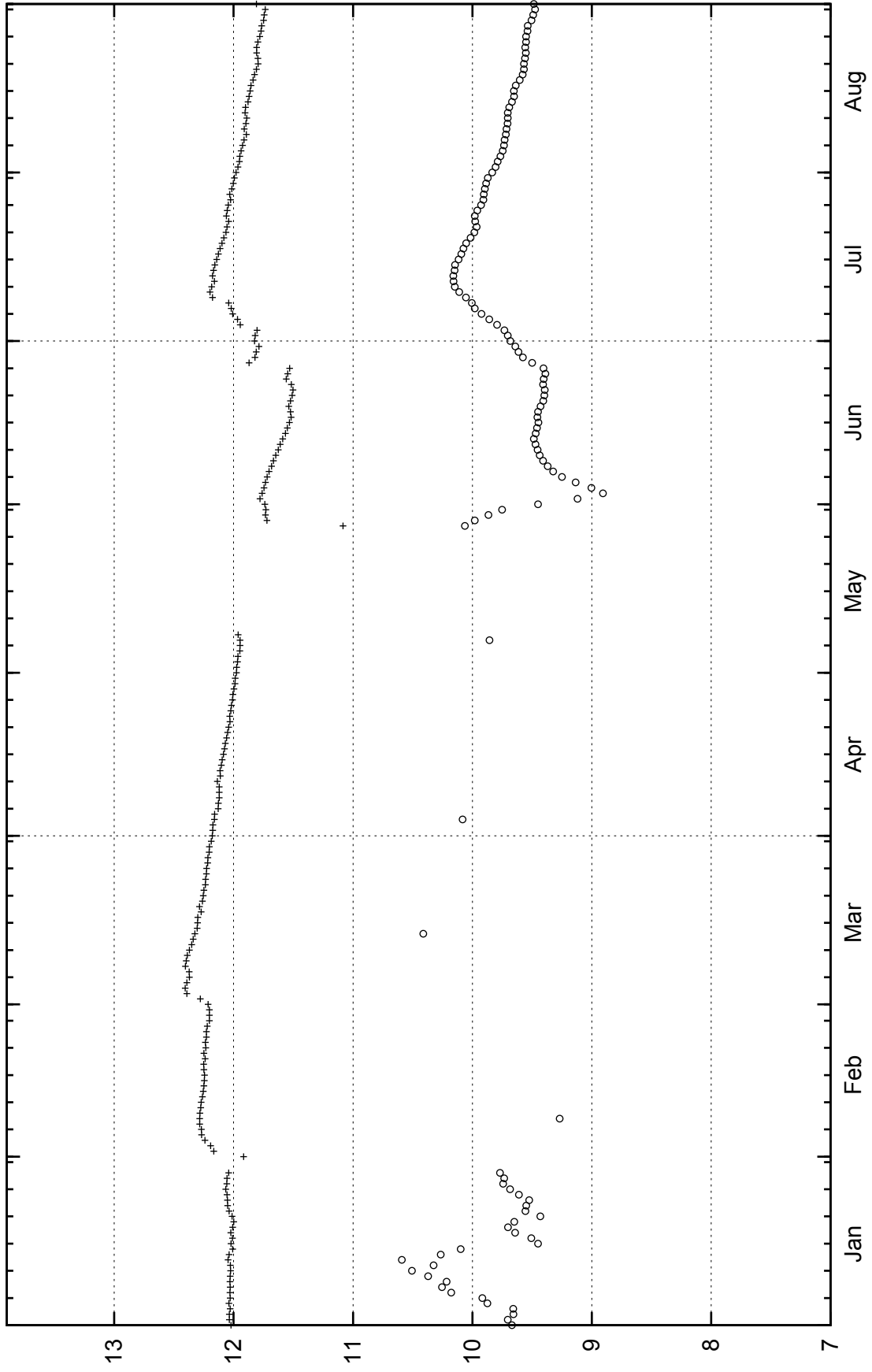
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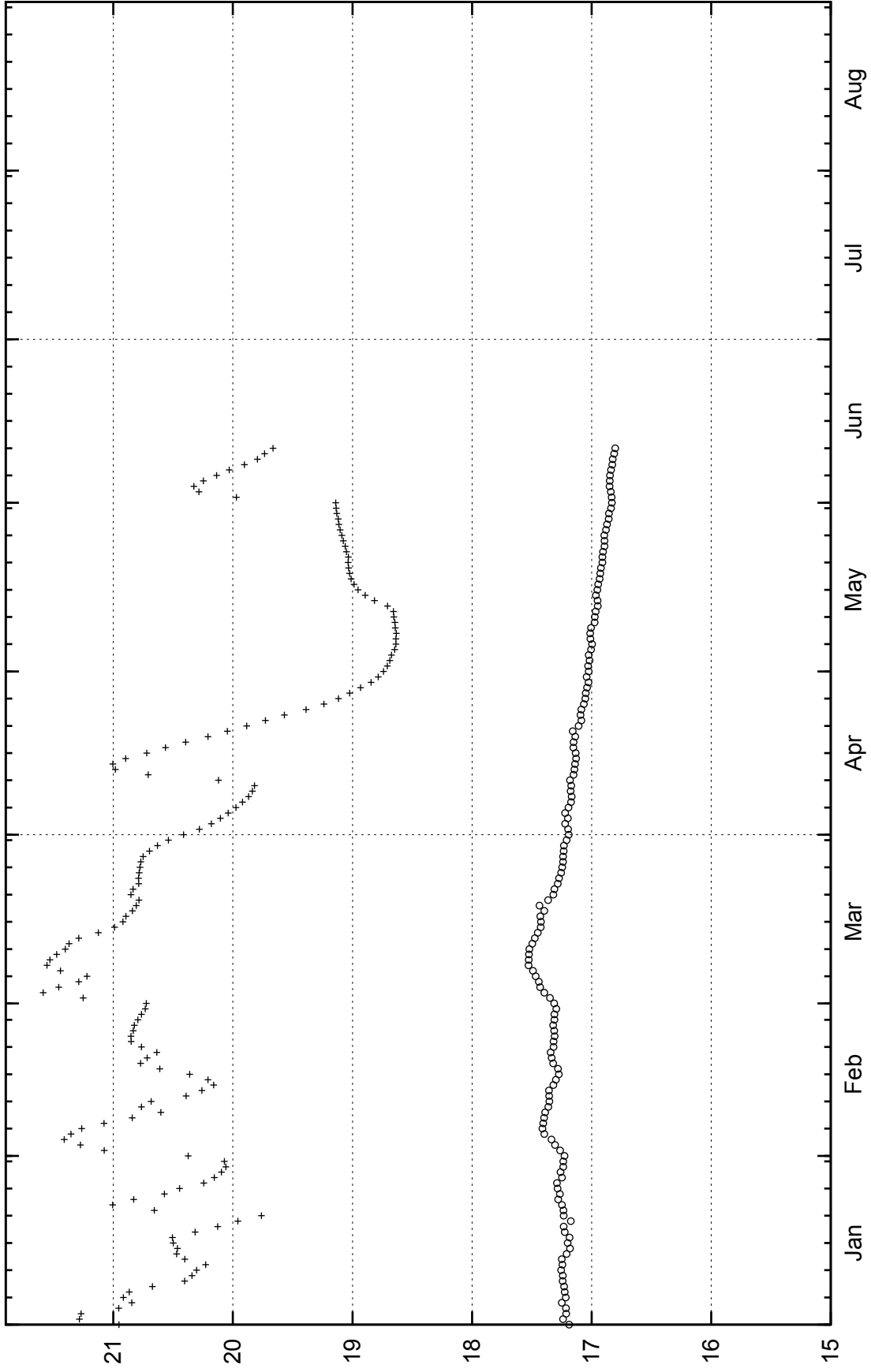
Start: 2007-01-01 month

HLX42



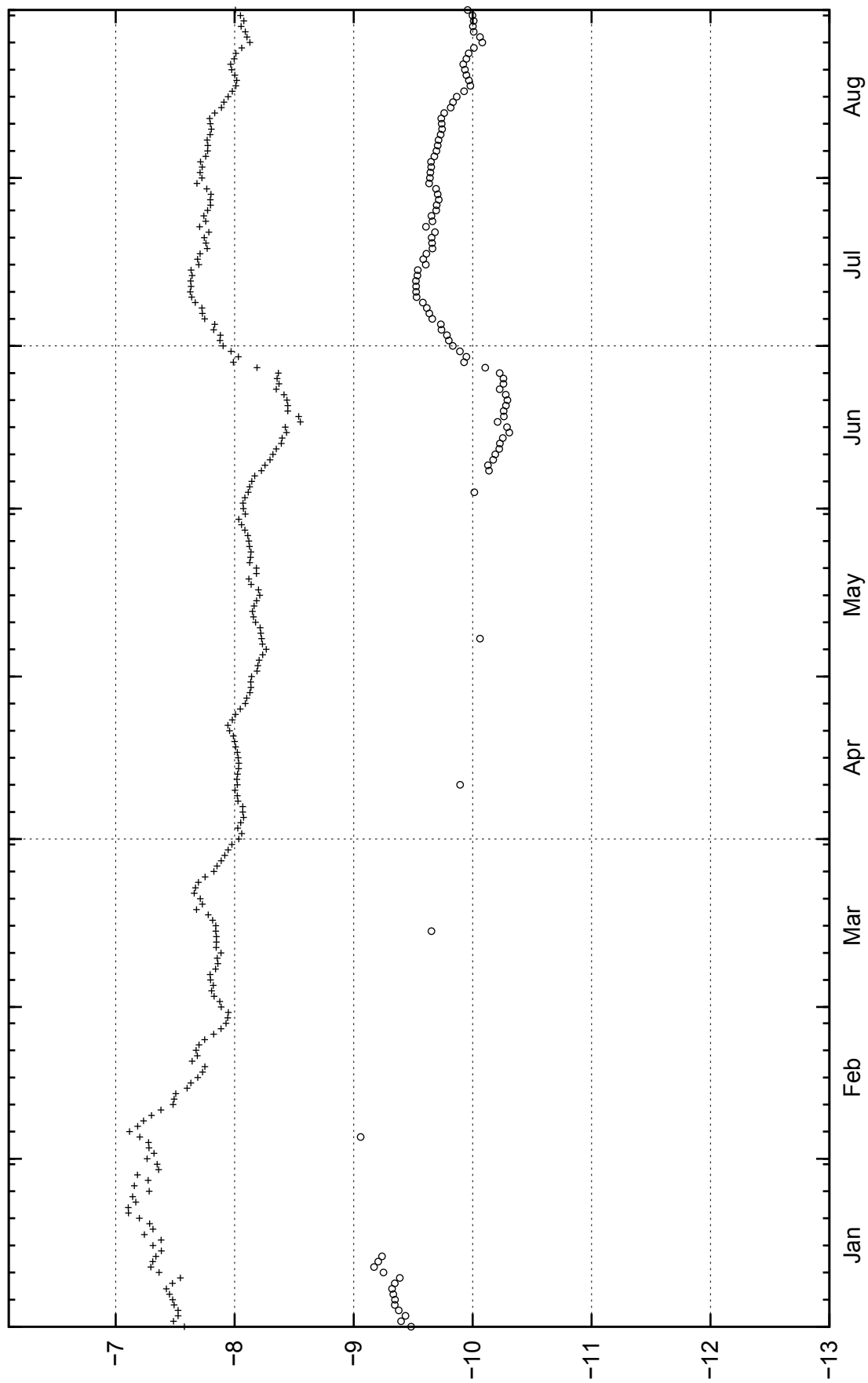
Start: 2007-01-01 month

HLX43



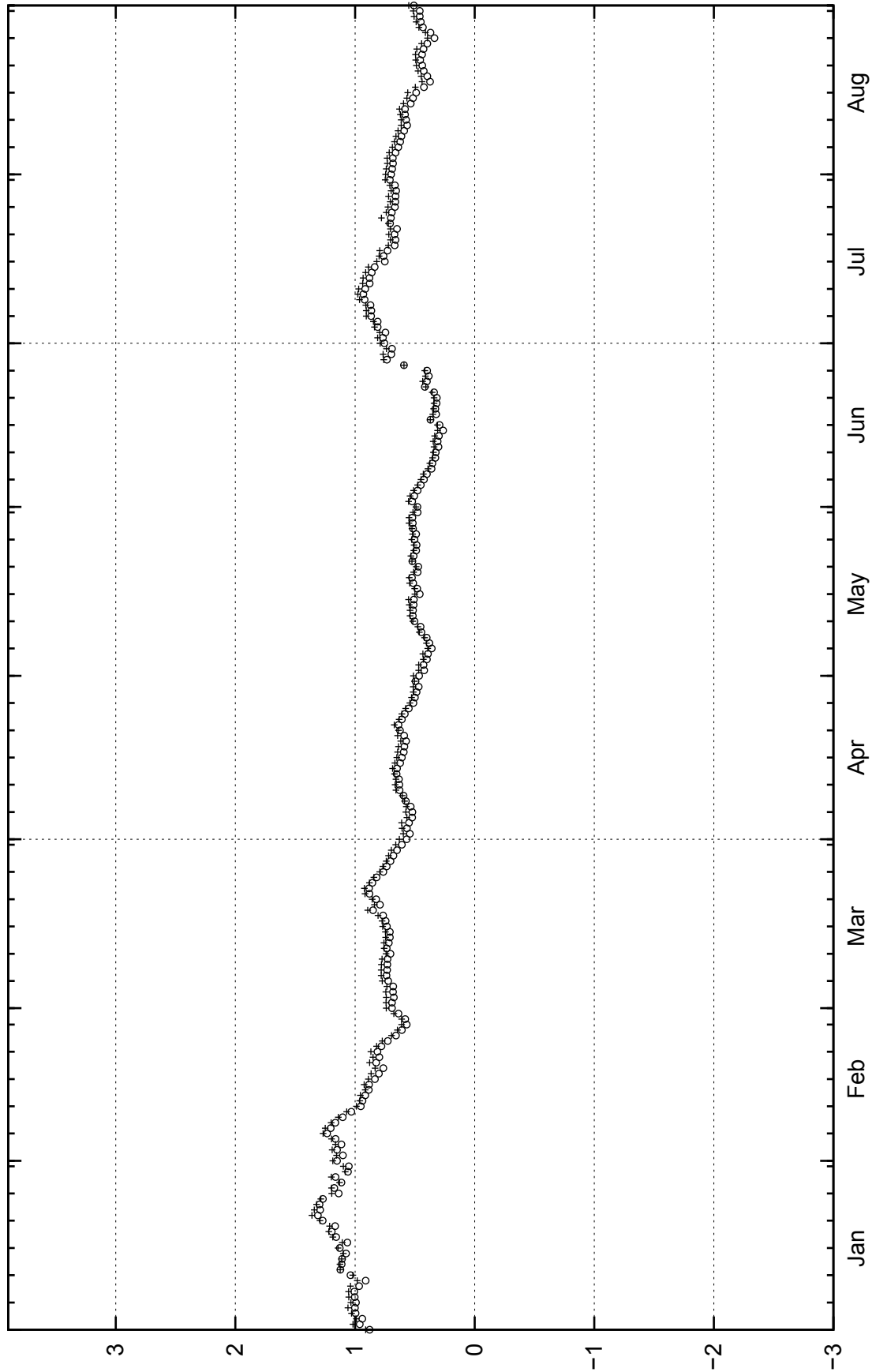
Start: 2007-01-01 month

HMJ01



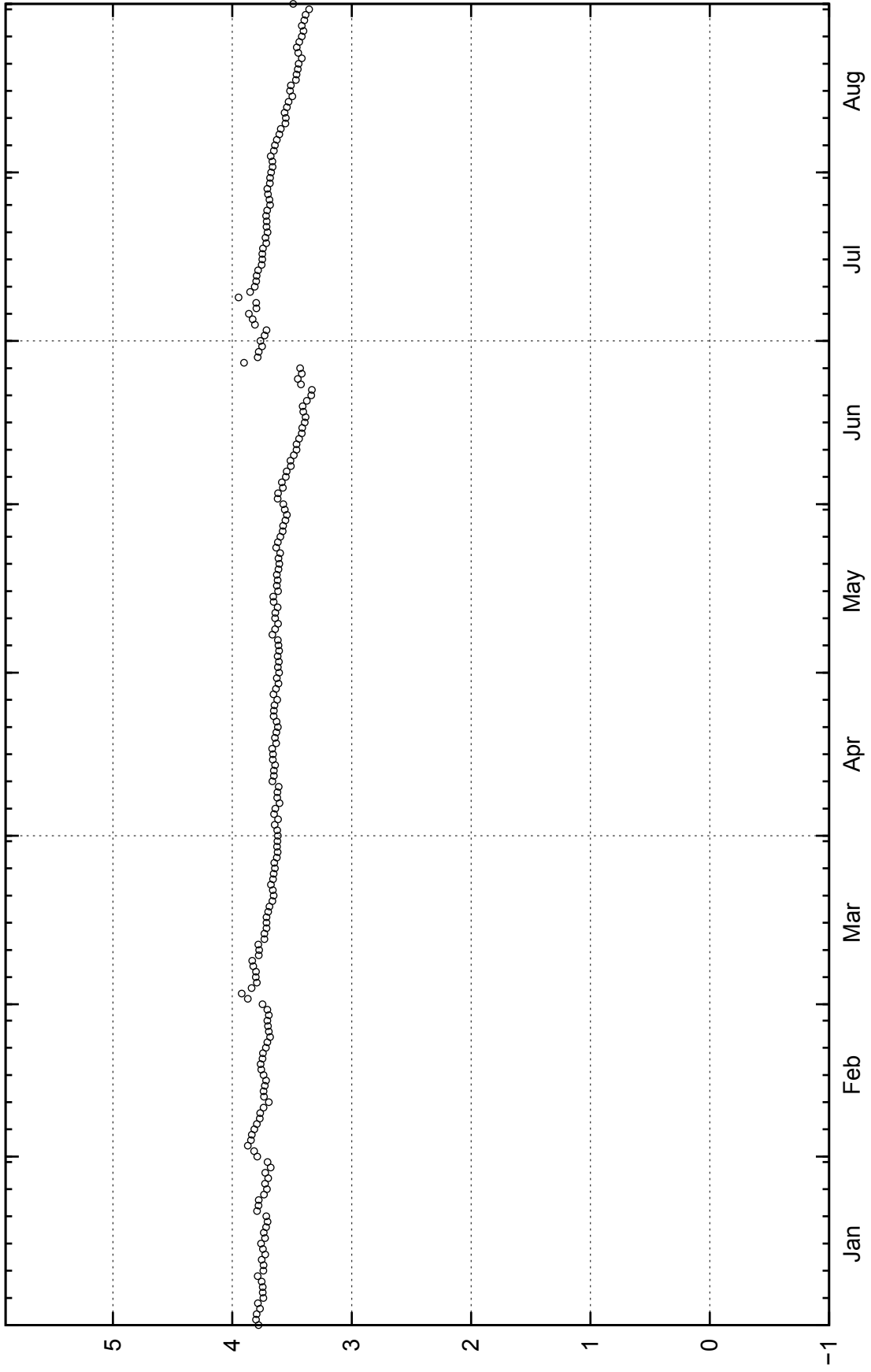
Start: 2007-01-01 month

HSH01



Start: 2007-01-01 month

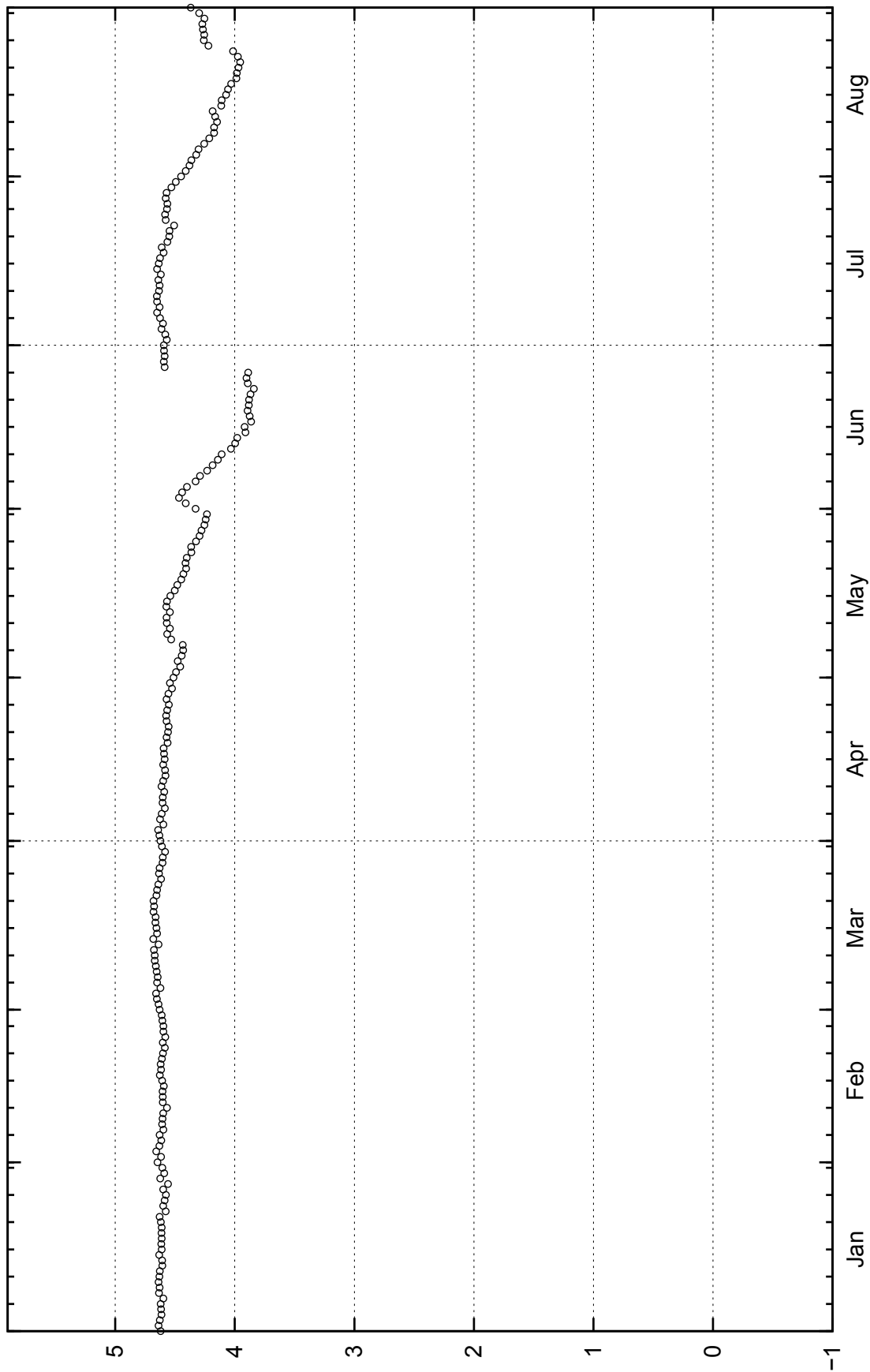
HSI04



Start: 2007-01-01 month

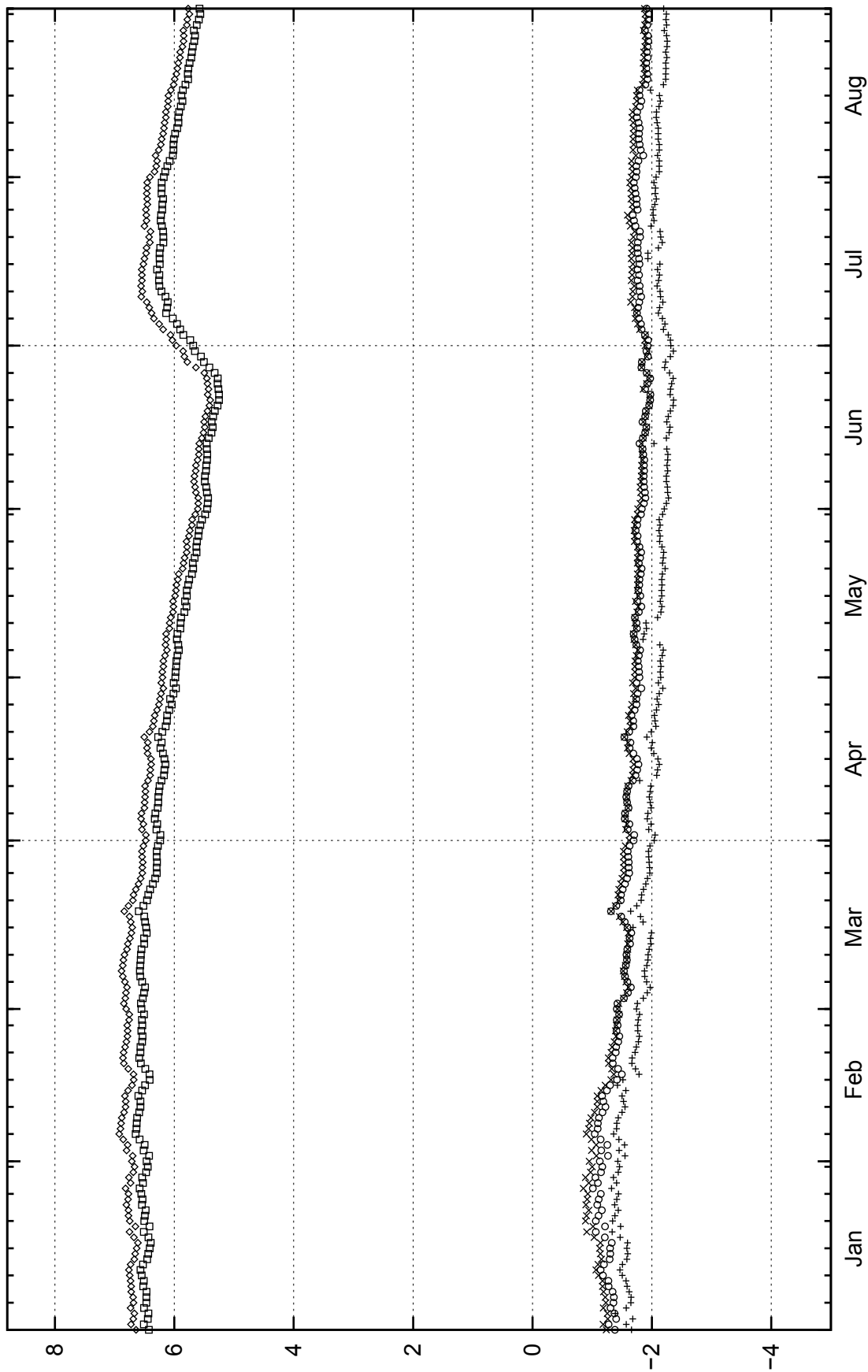
masl

HSI13



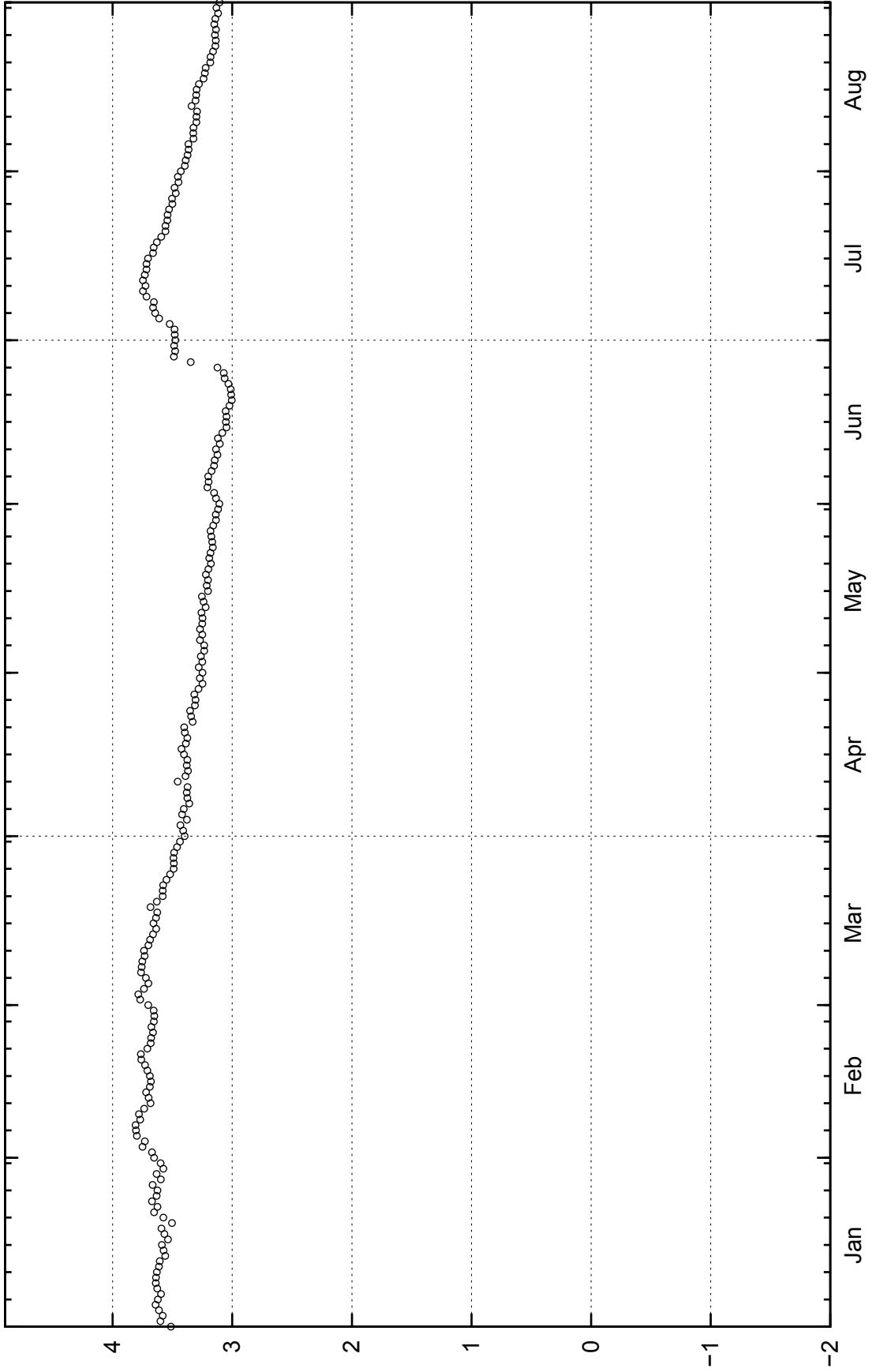
Start: 2007-01-01 month

KAV01



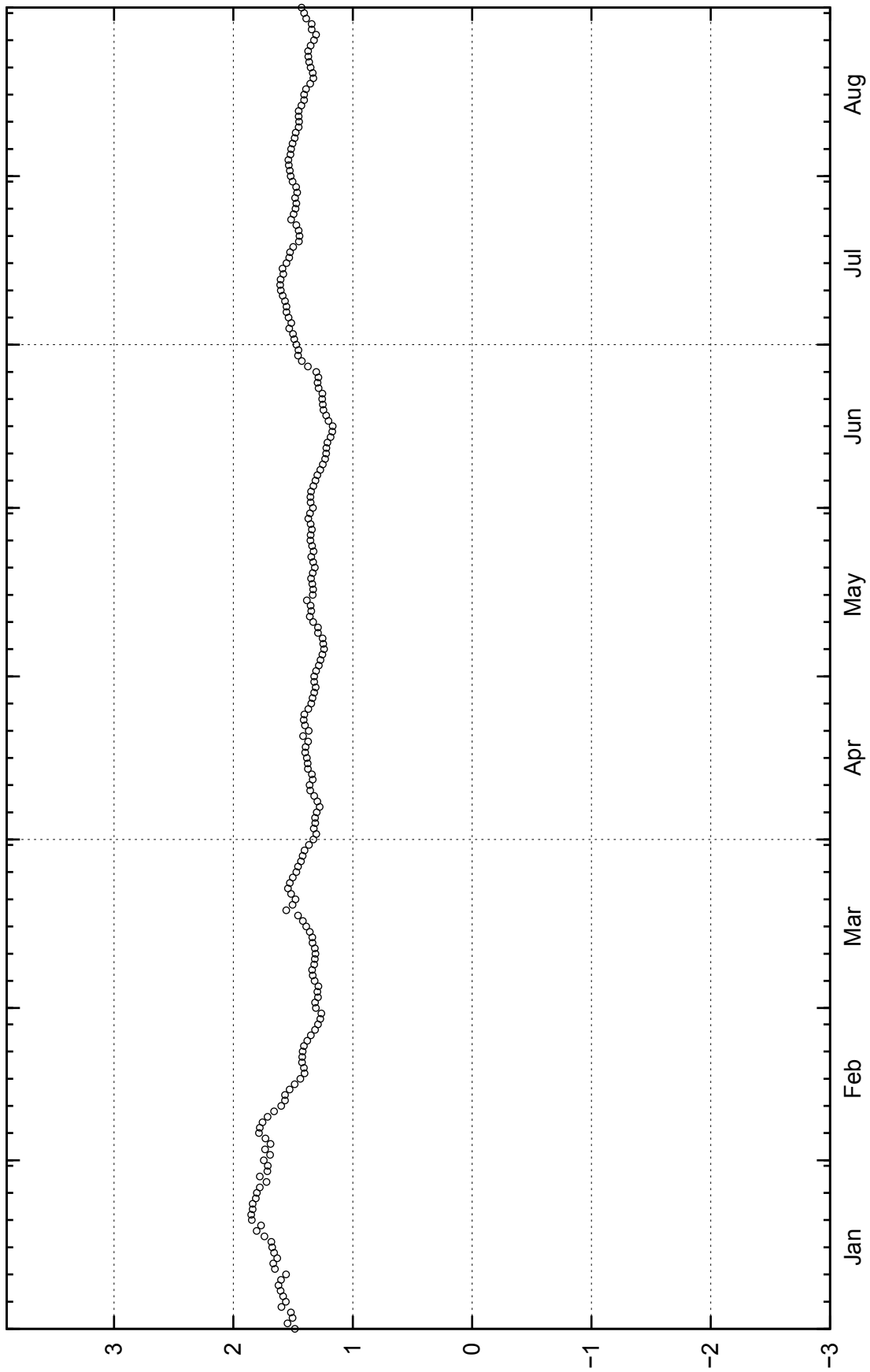
Start: 2007-01-01 month

KAV02



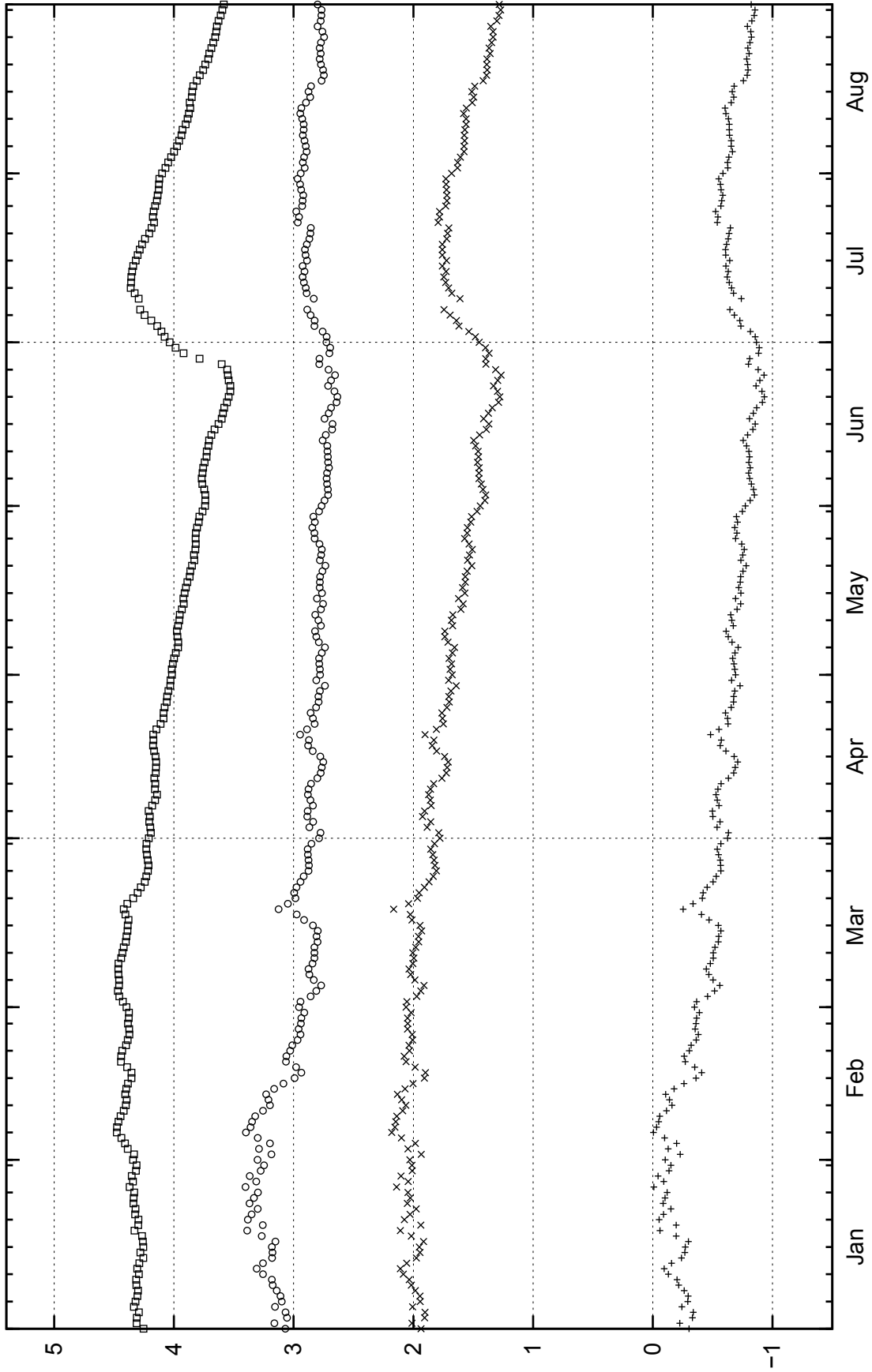
Start: 2007-01-01 month

KAV03



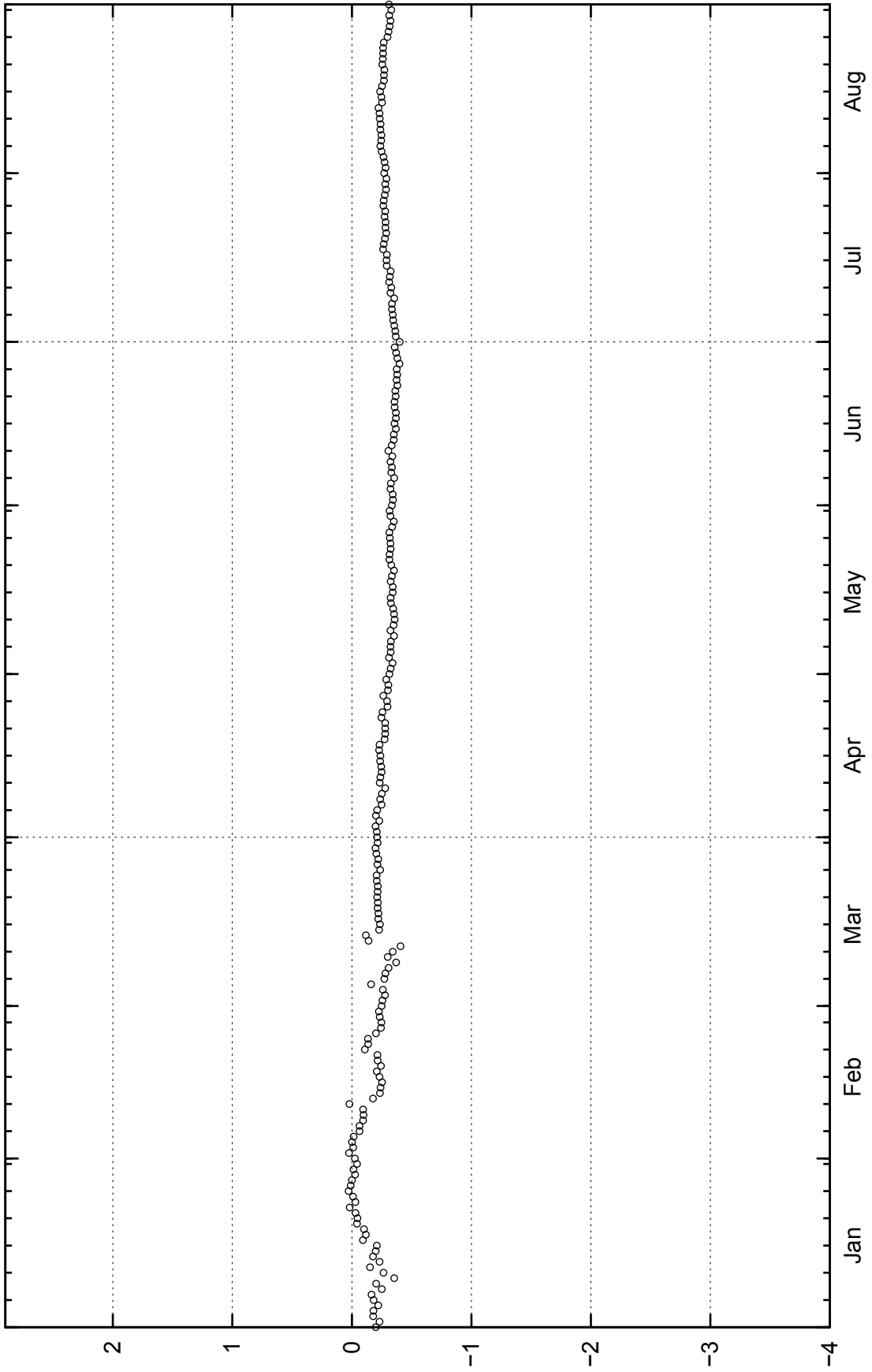
Start: 2007-01-01 month

KAV04A



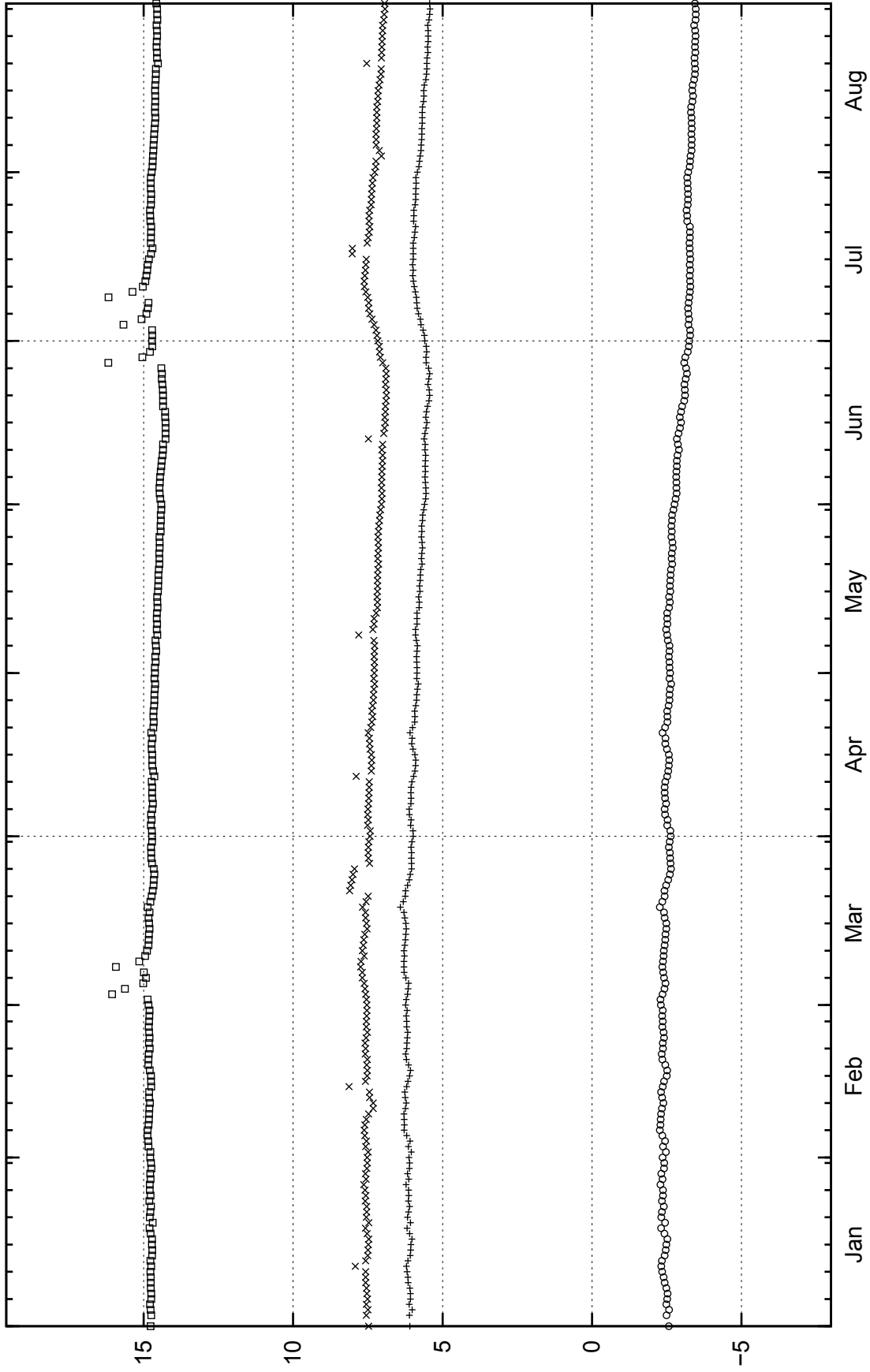
Start: 2007-01-01 month

KBH03



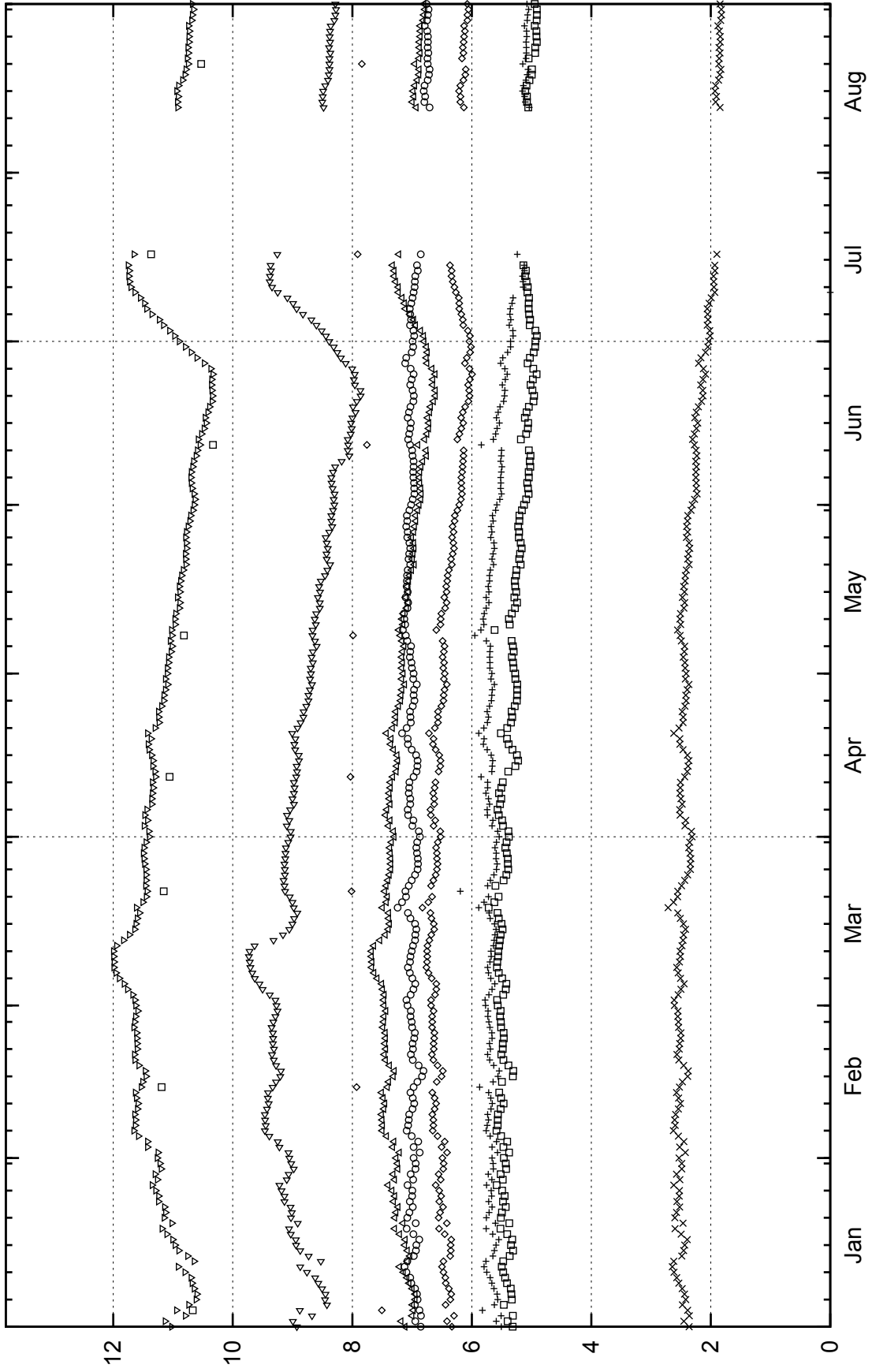
Start: 2007-01-01 month

KLX01



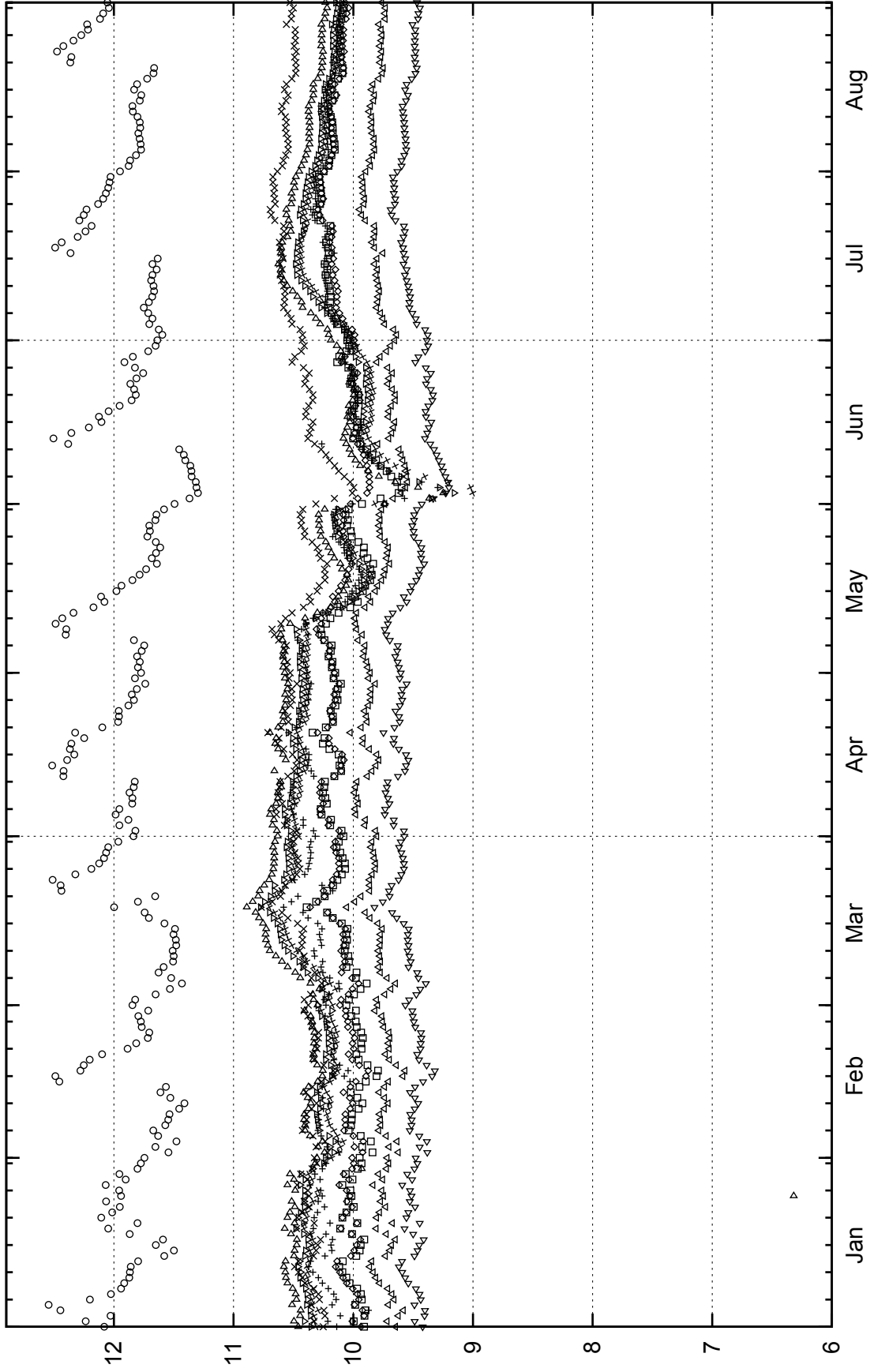
Start: 2007-01-01 month

KLX02



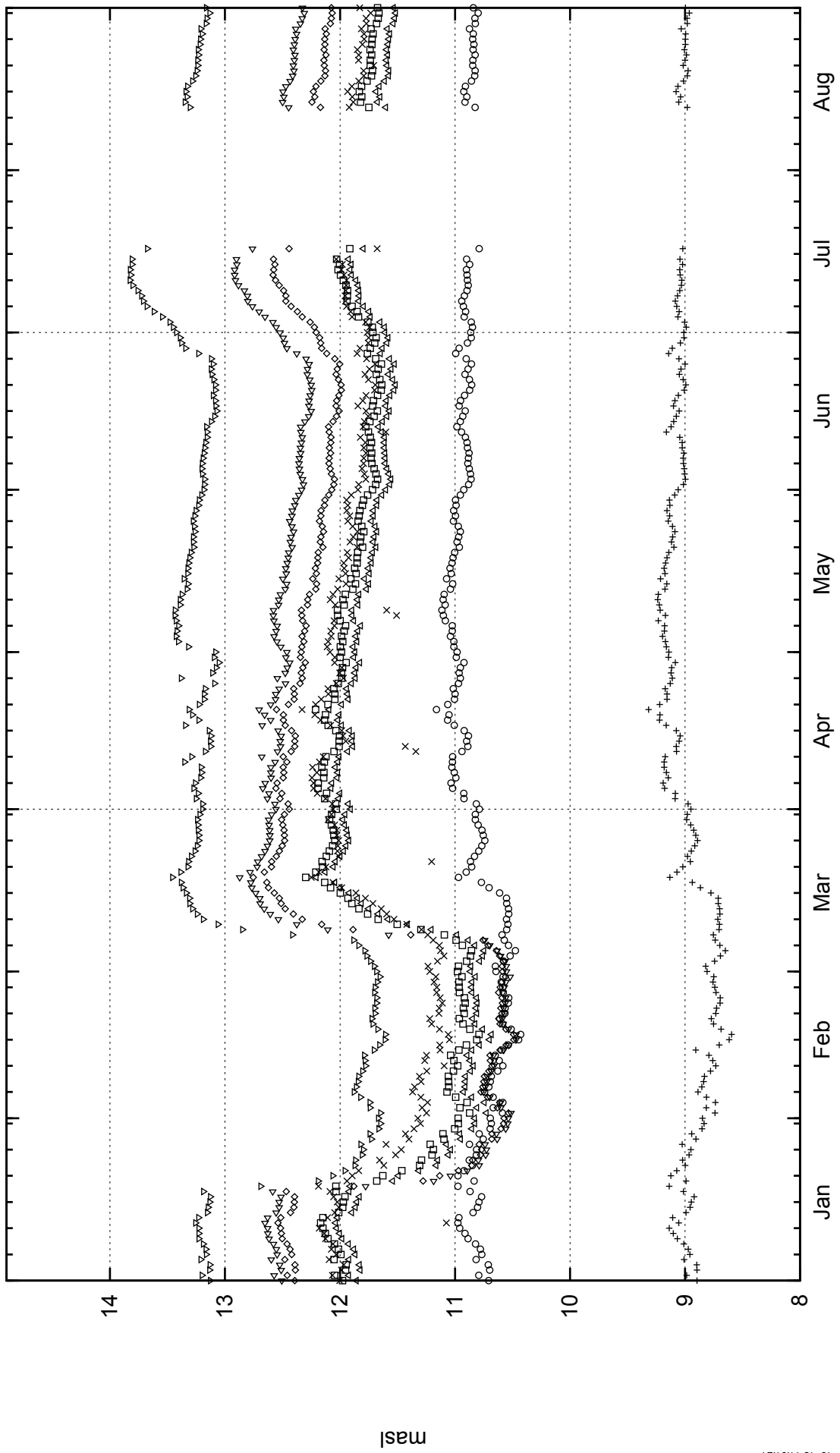
Start: 2007-01-01 month

KLX03

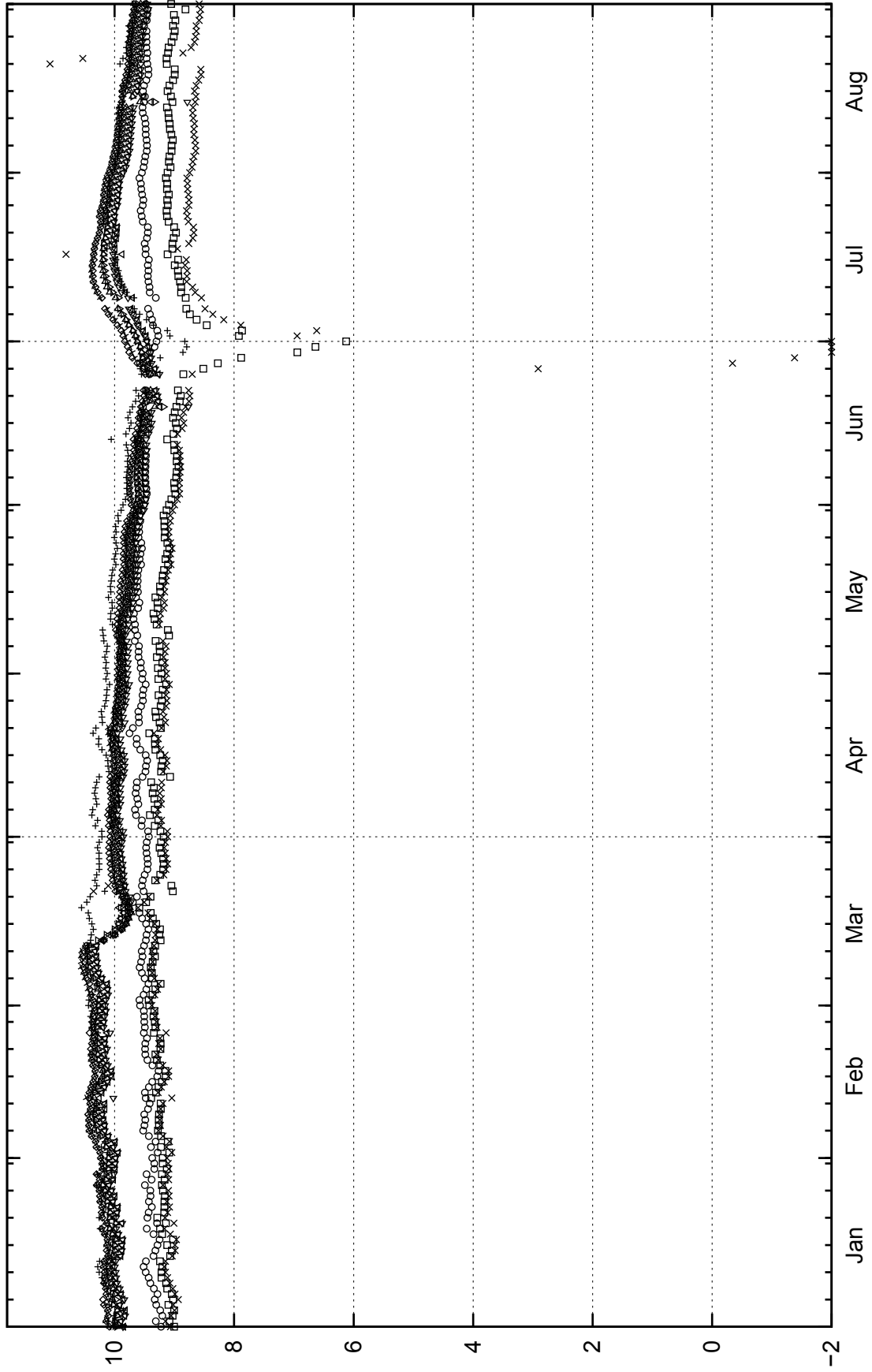


Start: 2007-01-01 month

KLX04

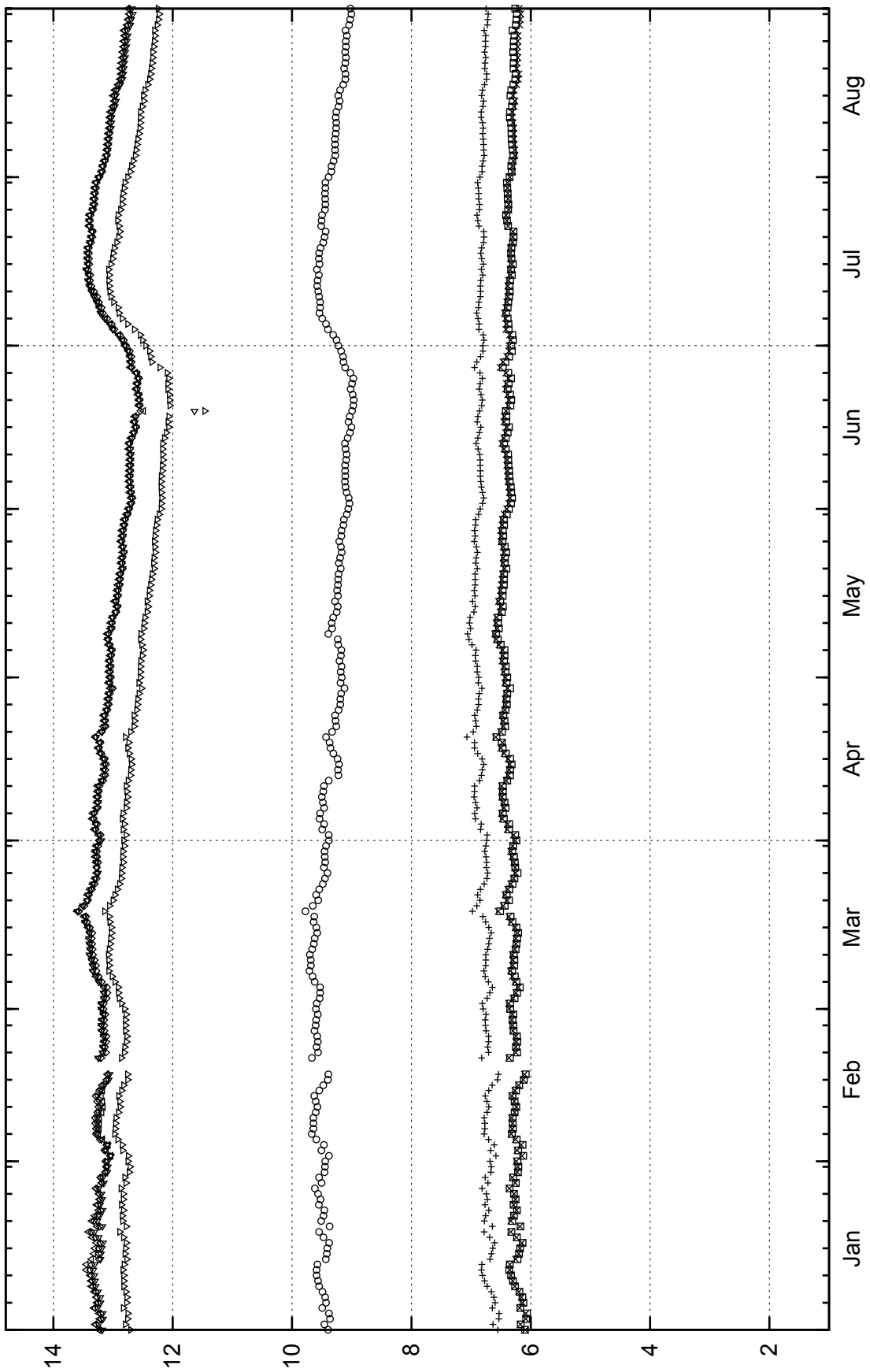


KLX05



masl

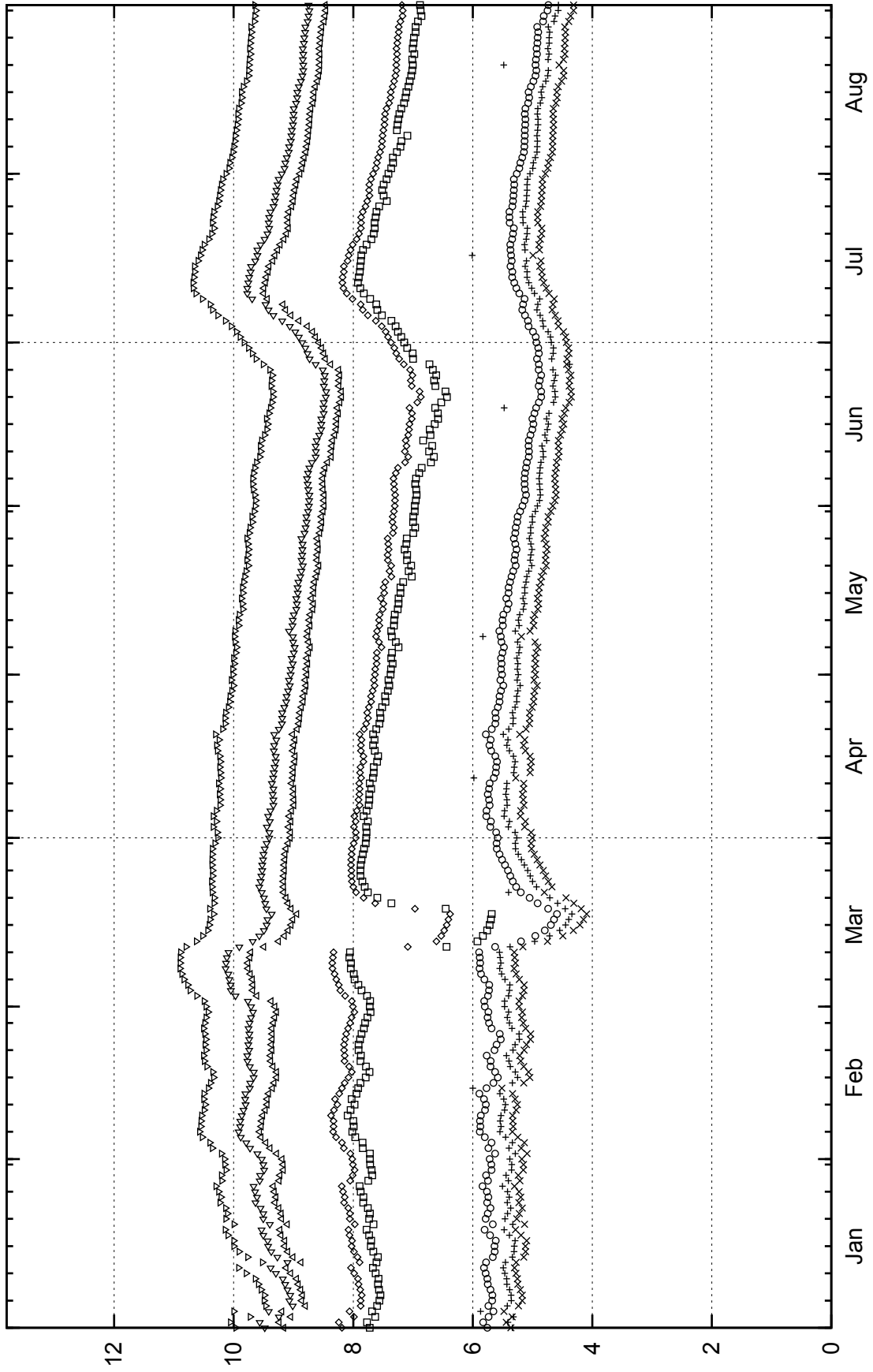
KLX06



Start: 2007-01-01 month

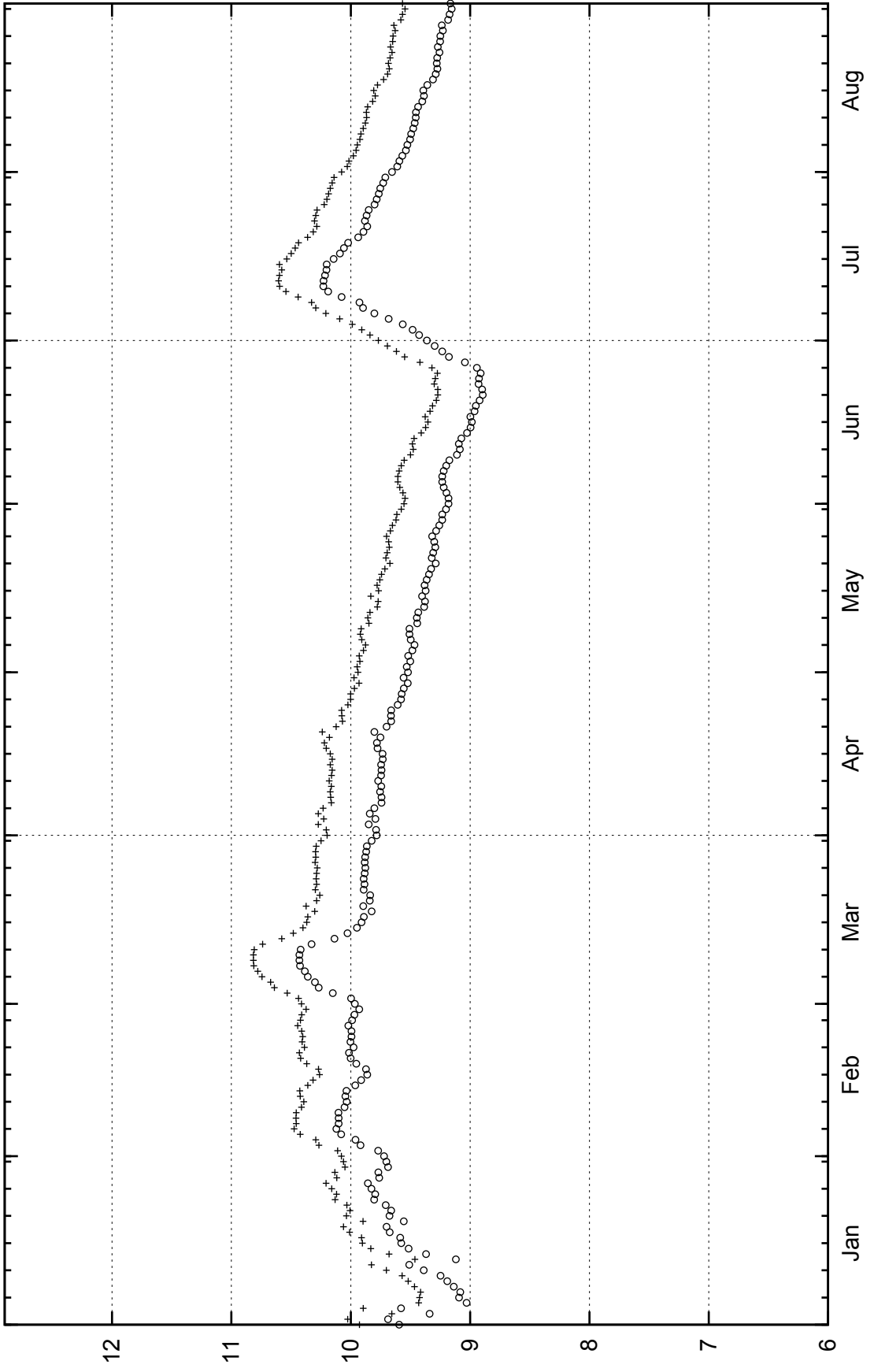
Jan Feb Mar Apr May Jun Jul Aug

KLX07A



Start: 2007-01-01 month

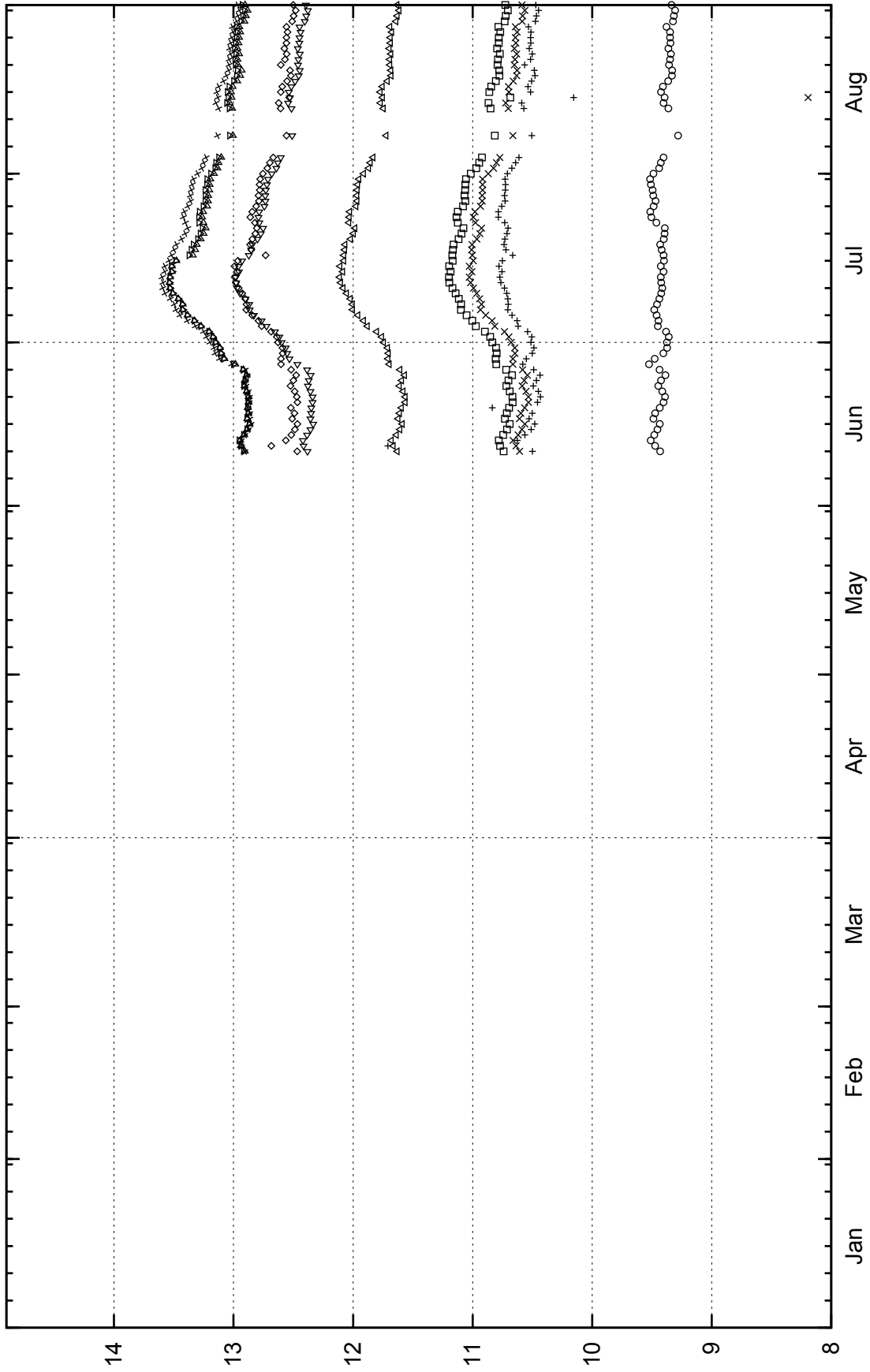
KLX07B



Start: 2007-01-01 month

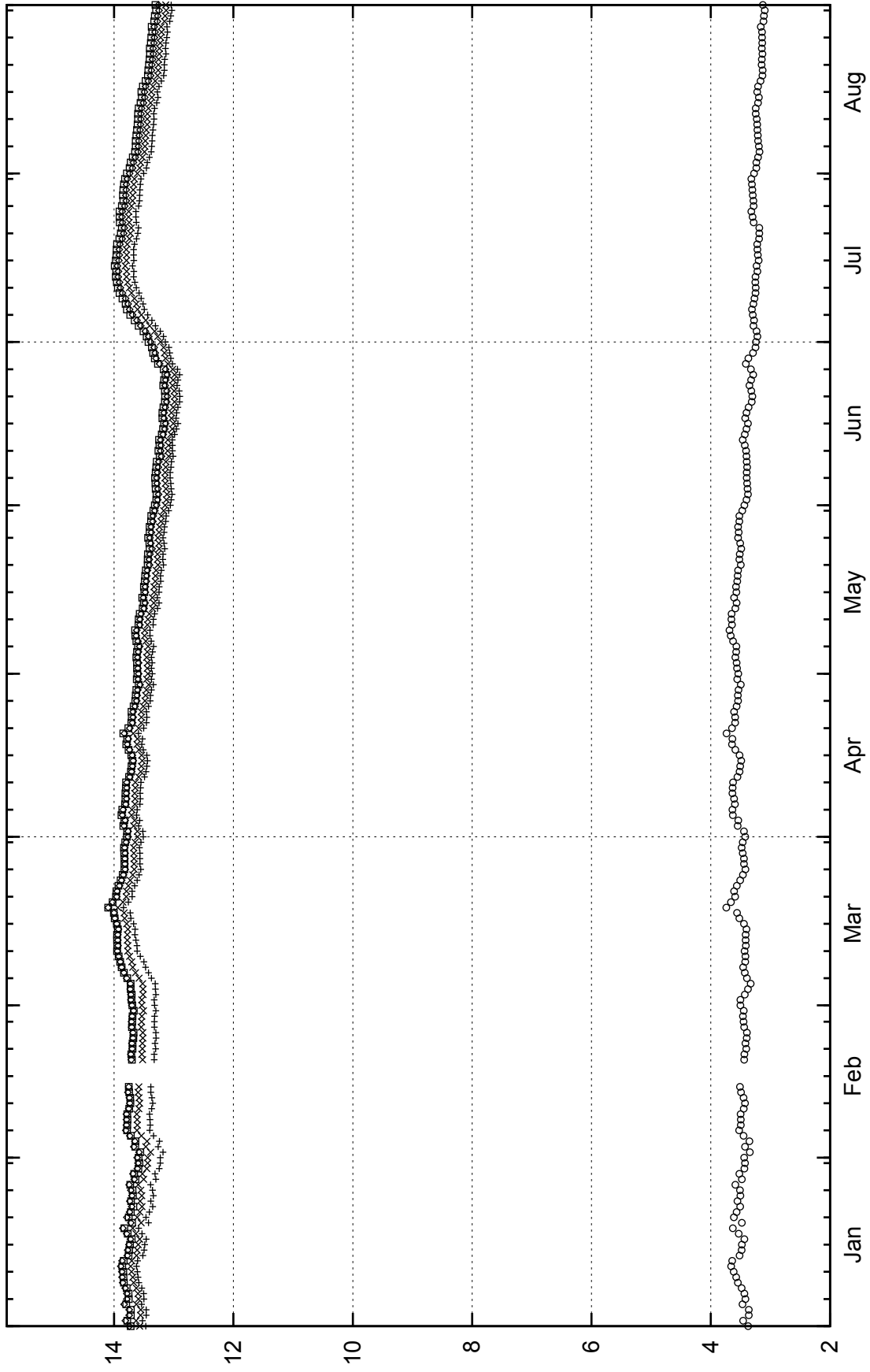
masl

KLX08



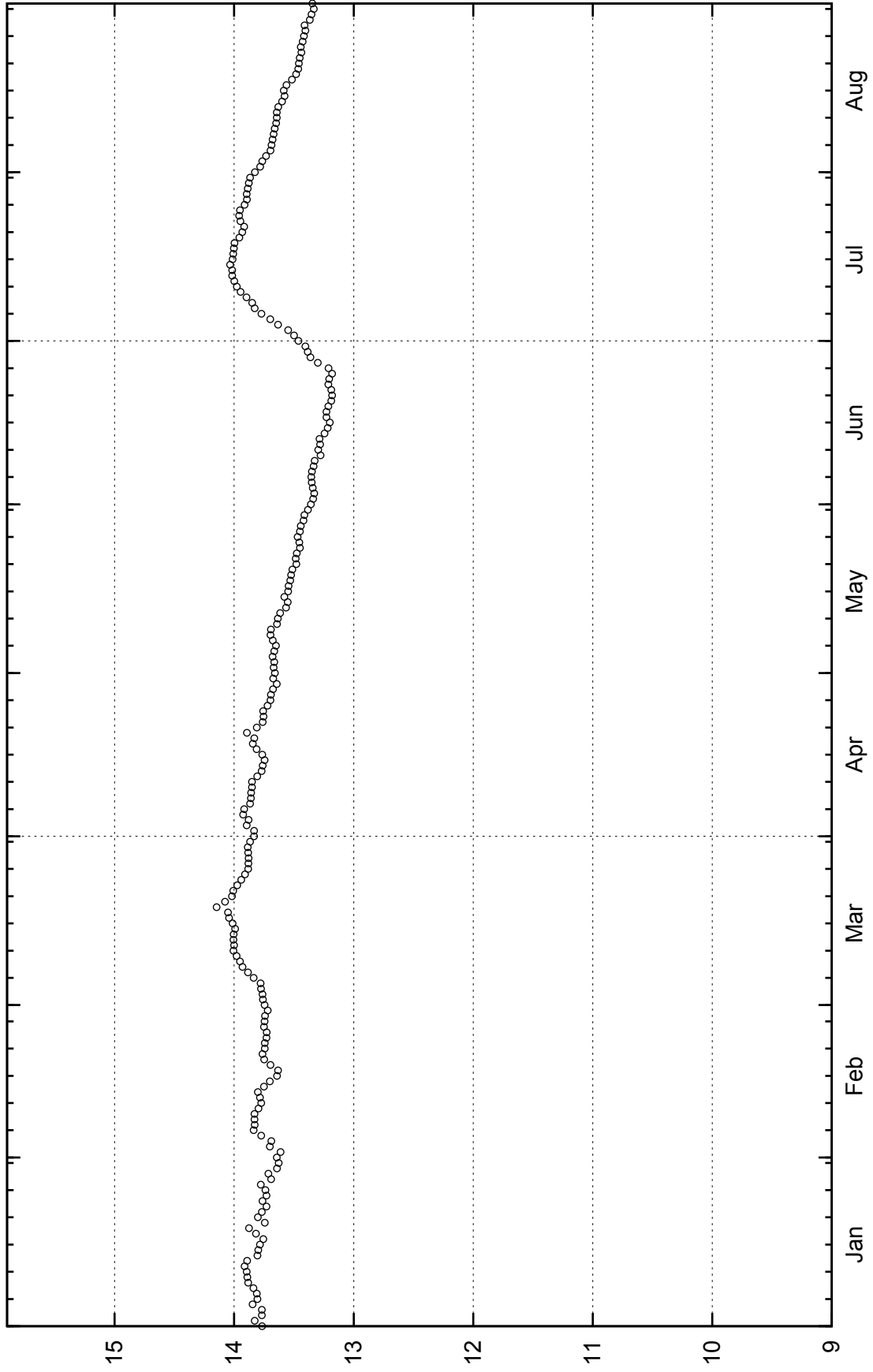
Start: 2007-01-01 month

KLX09



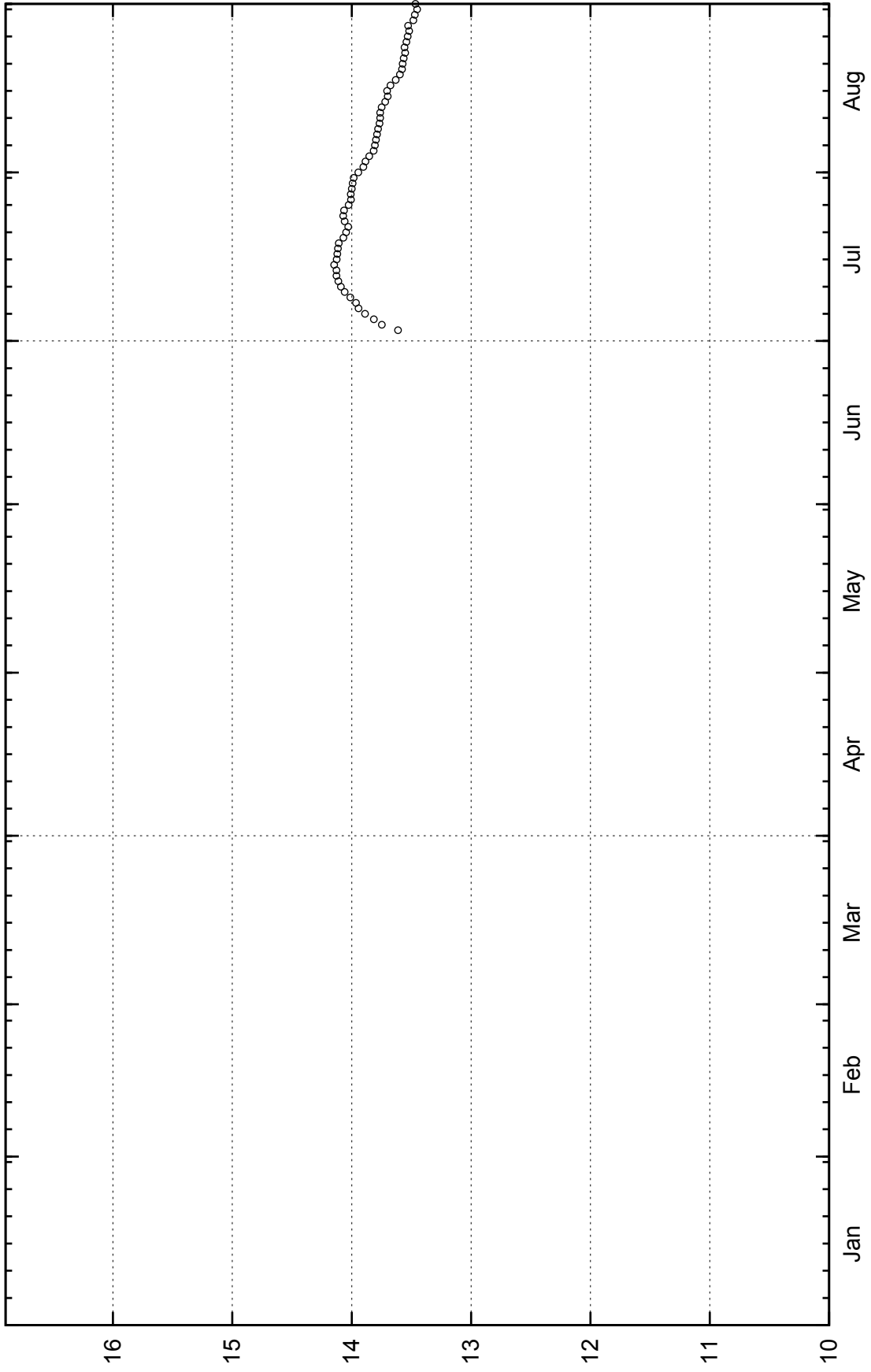
Start: 2007-01-01 month

KLX09F



Start: 2007-01-01 month

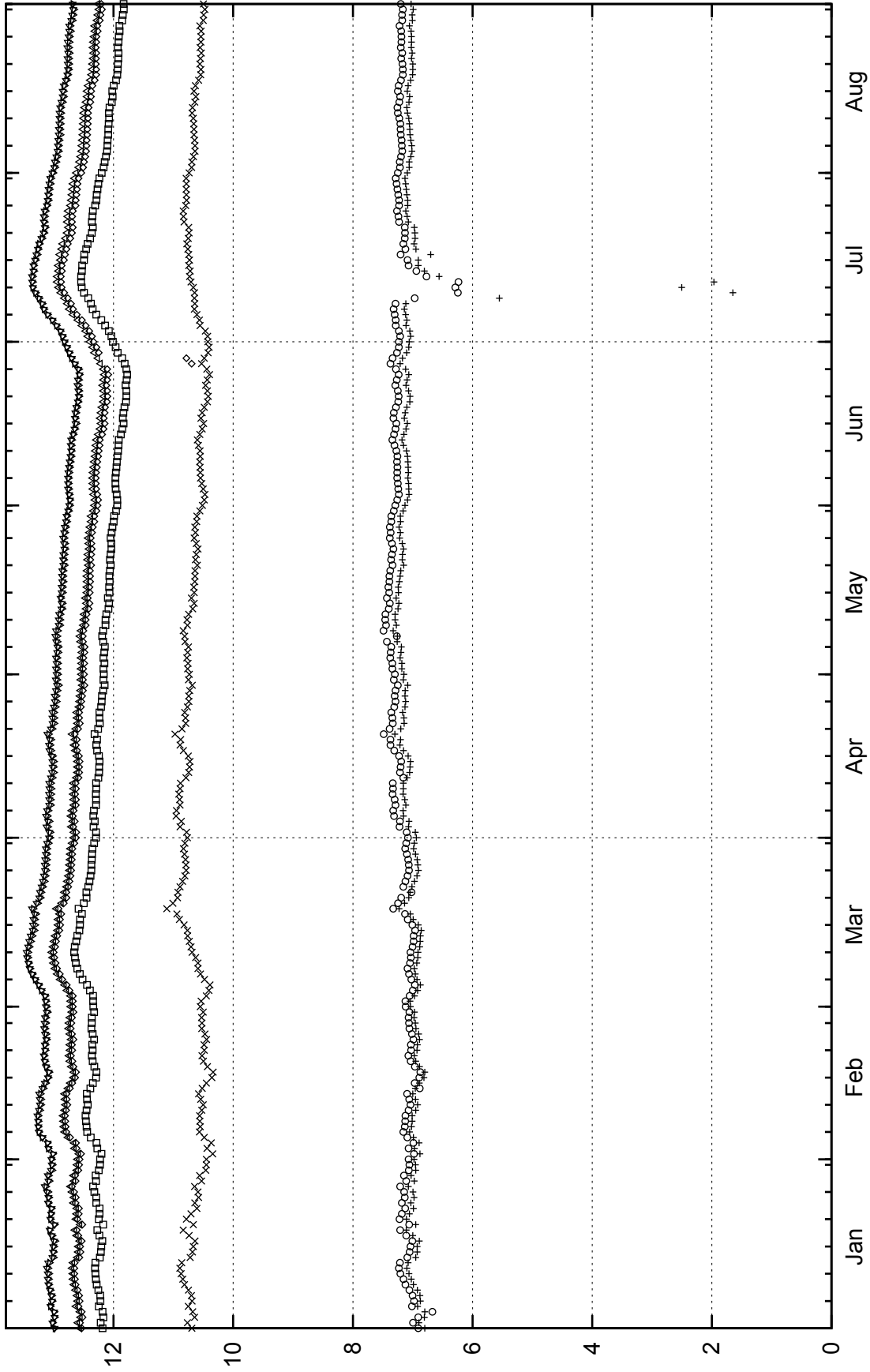
KLX09G



Start: 2007-01-01 month

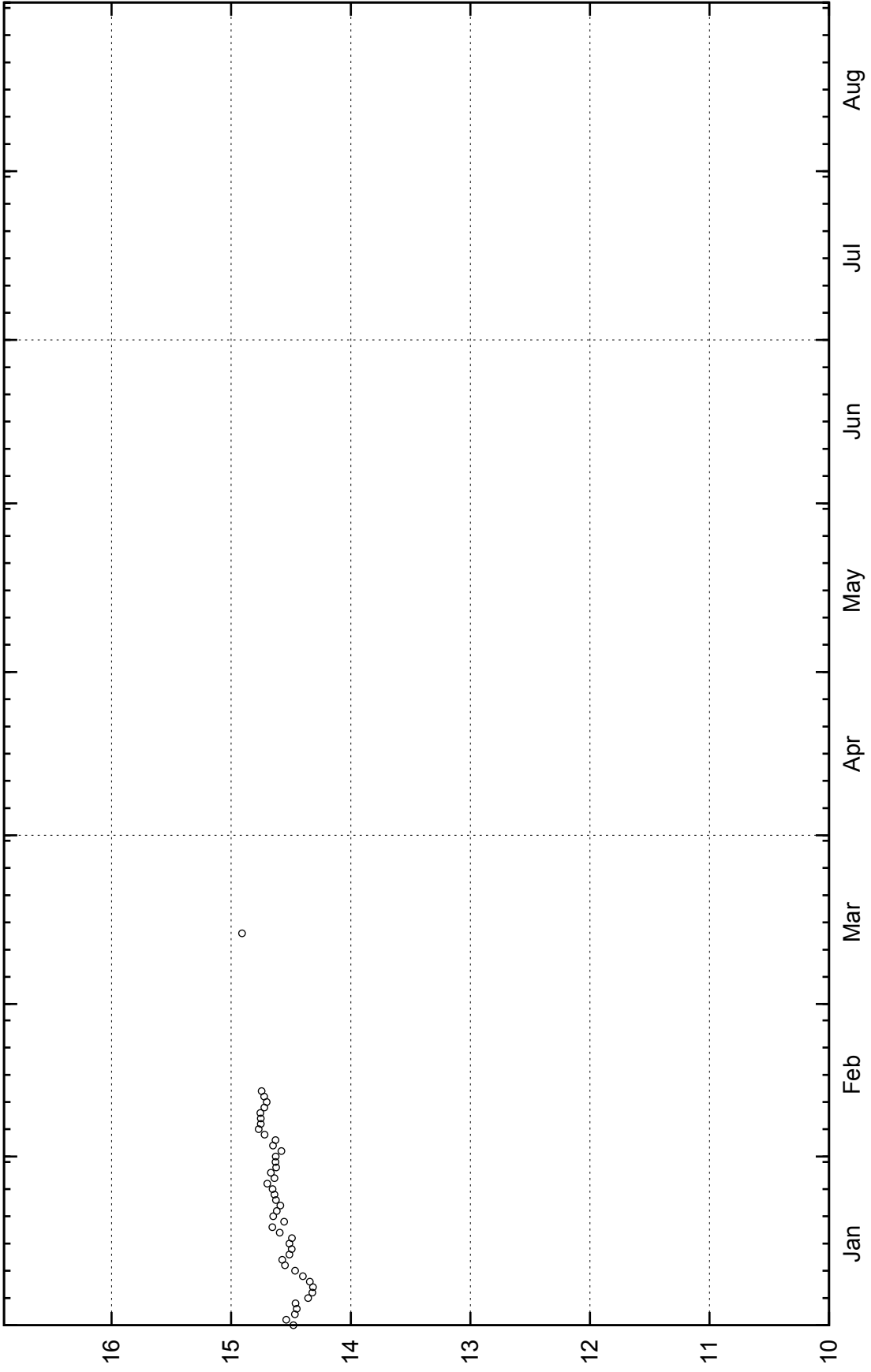
masl

KLX10



Start: 2007-01-01 month

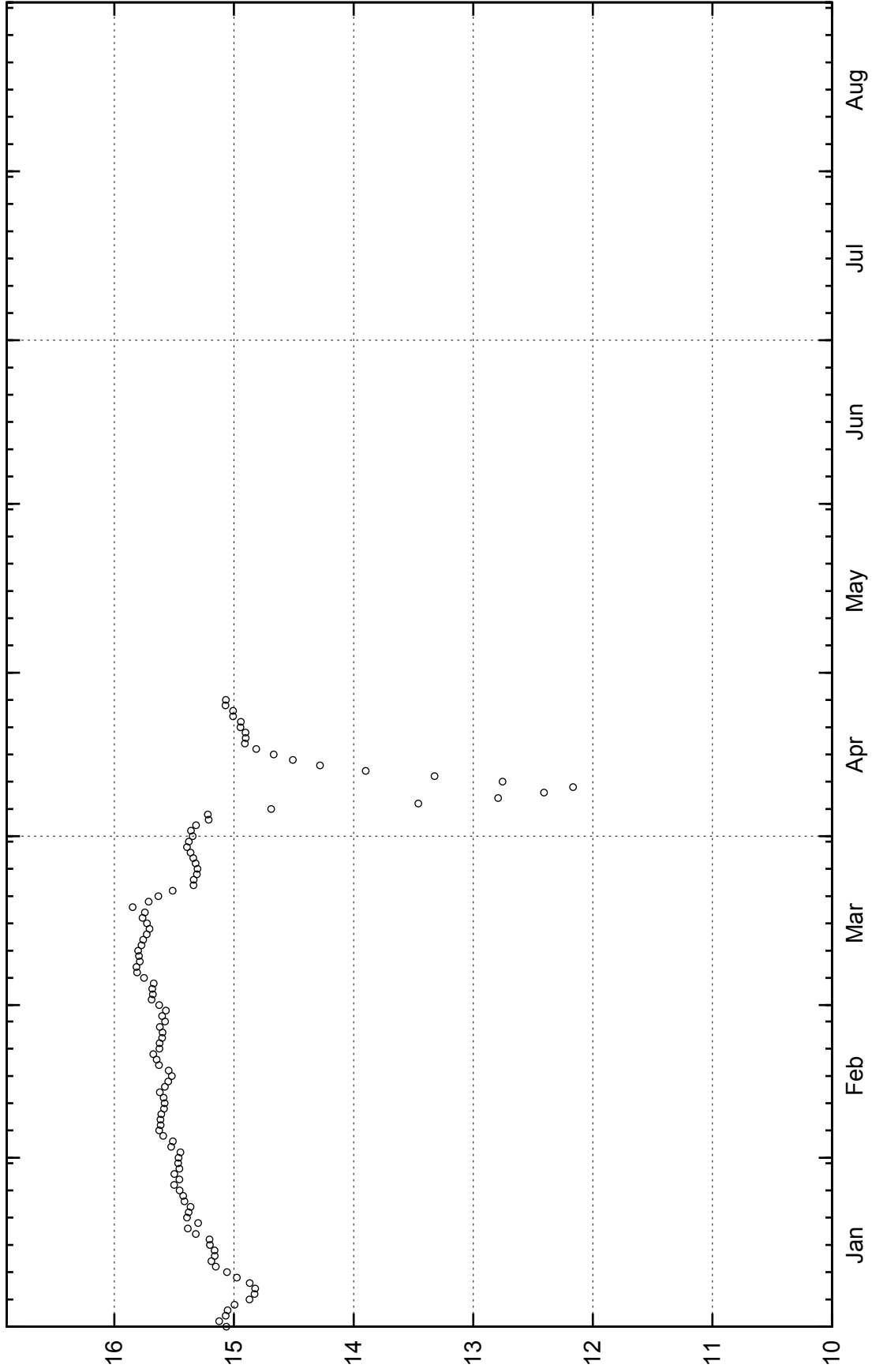
KLX11A



Start: 2007-01-01 month

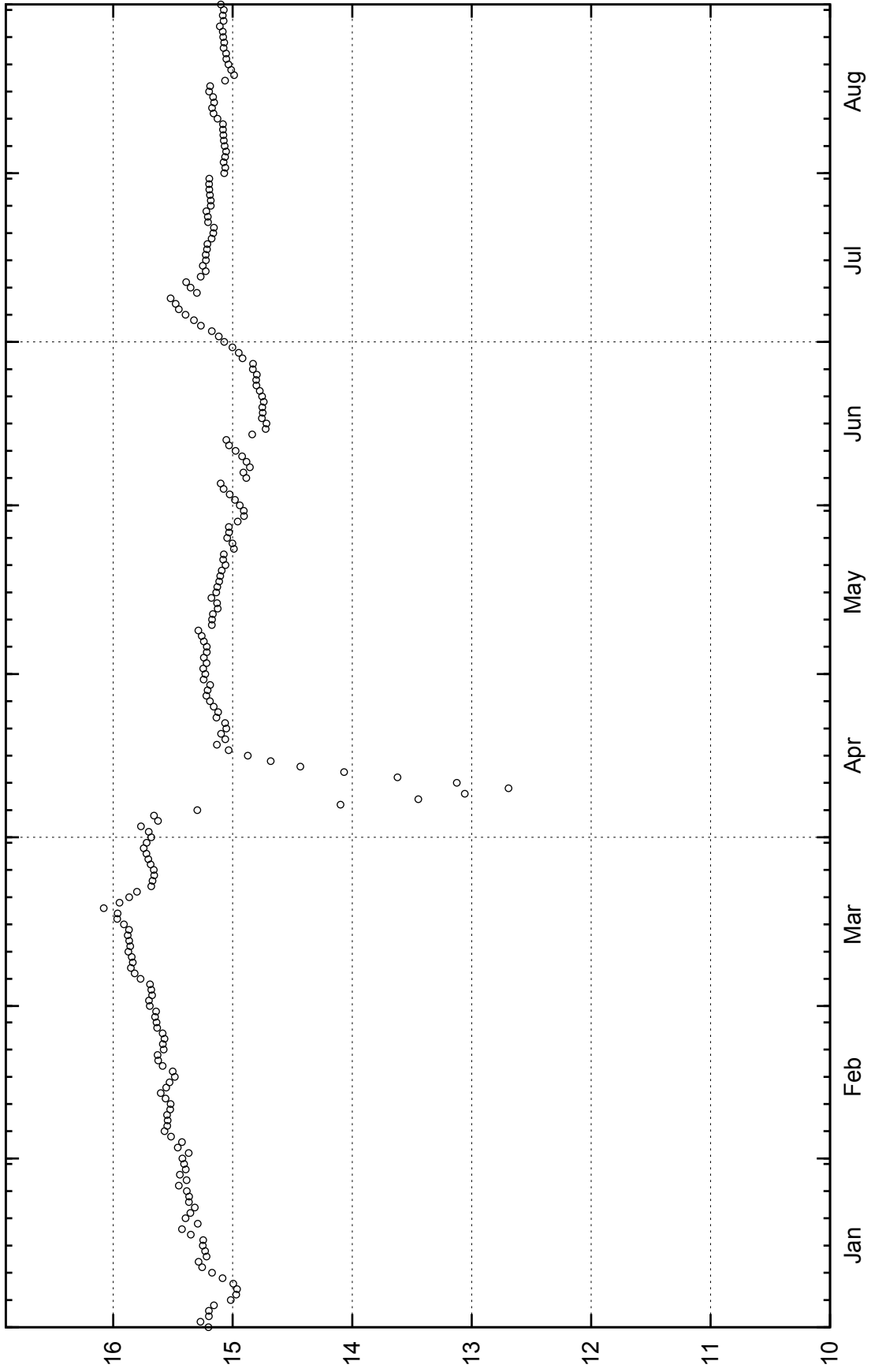
masl

KLX11B



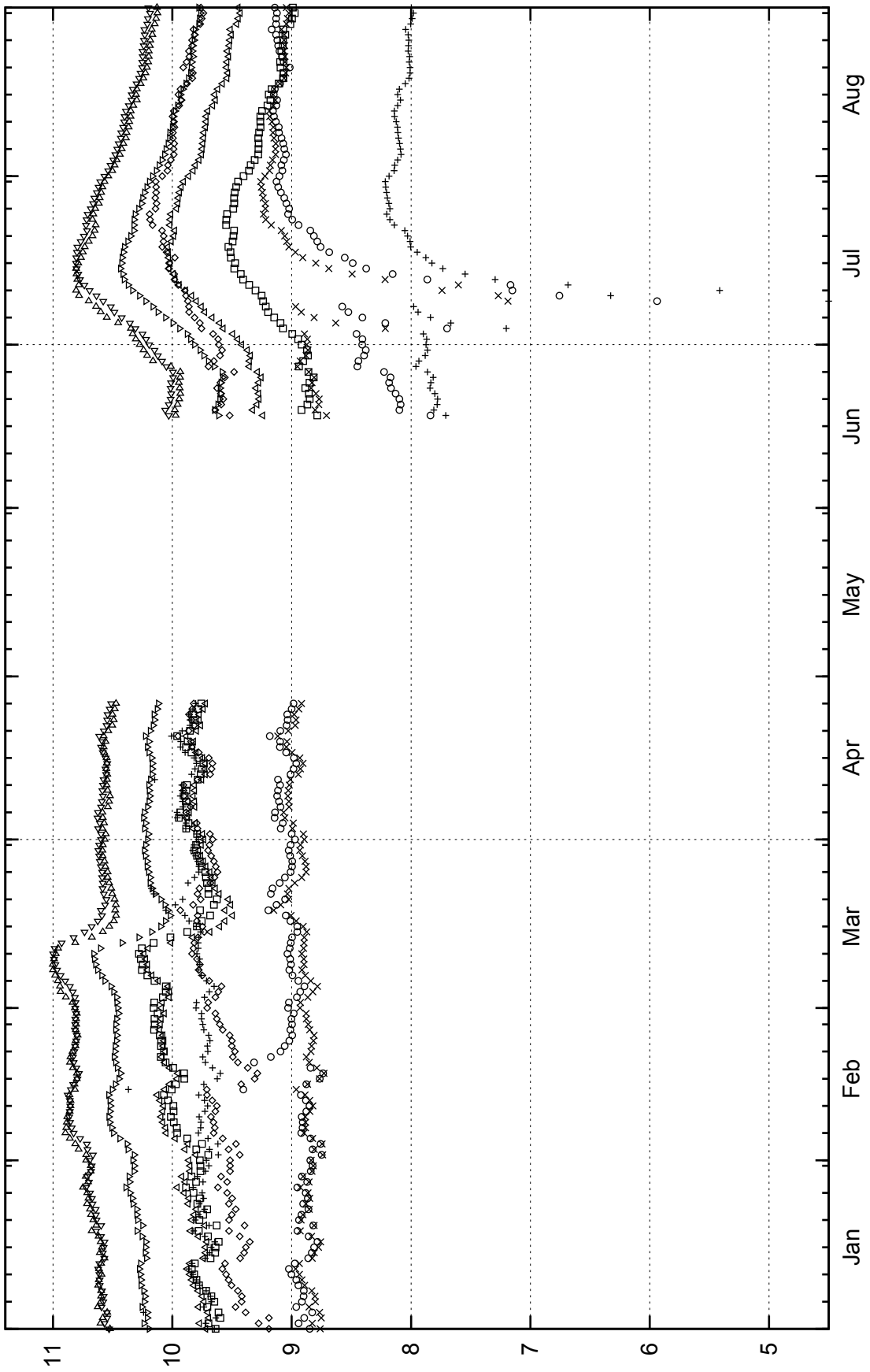
Start: 2007-01-01 month

KLX11E



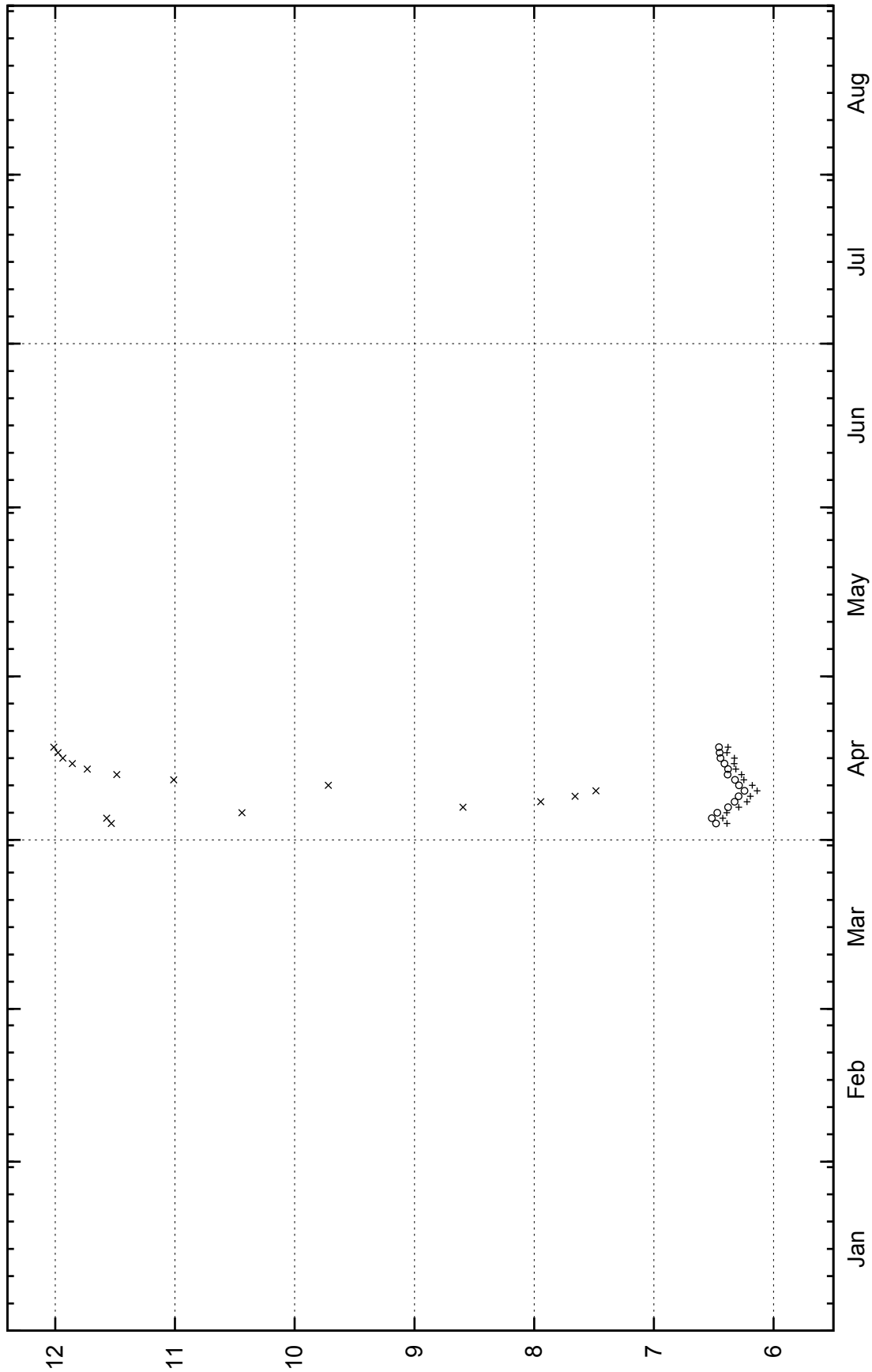
Start: 2007-01-01 month

KLX12A



Start: 2007-01-01 month

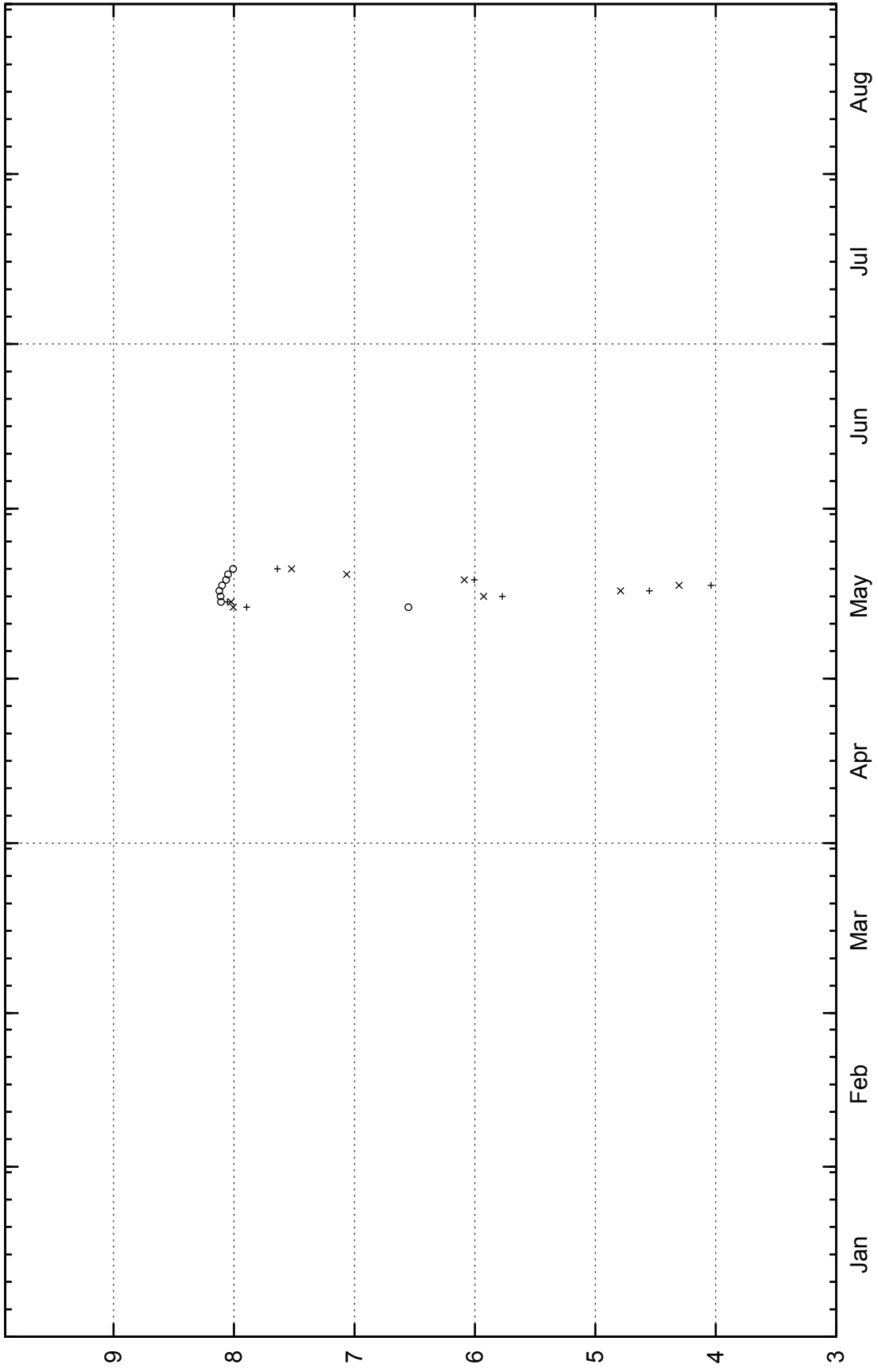
KLX14A



Start: 2007-01-01 month

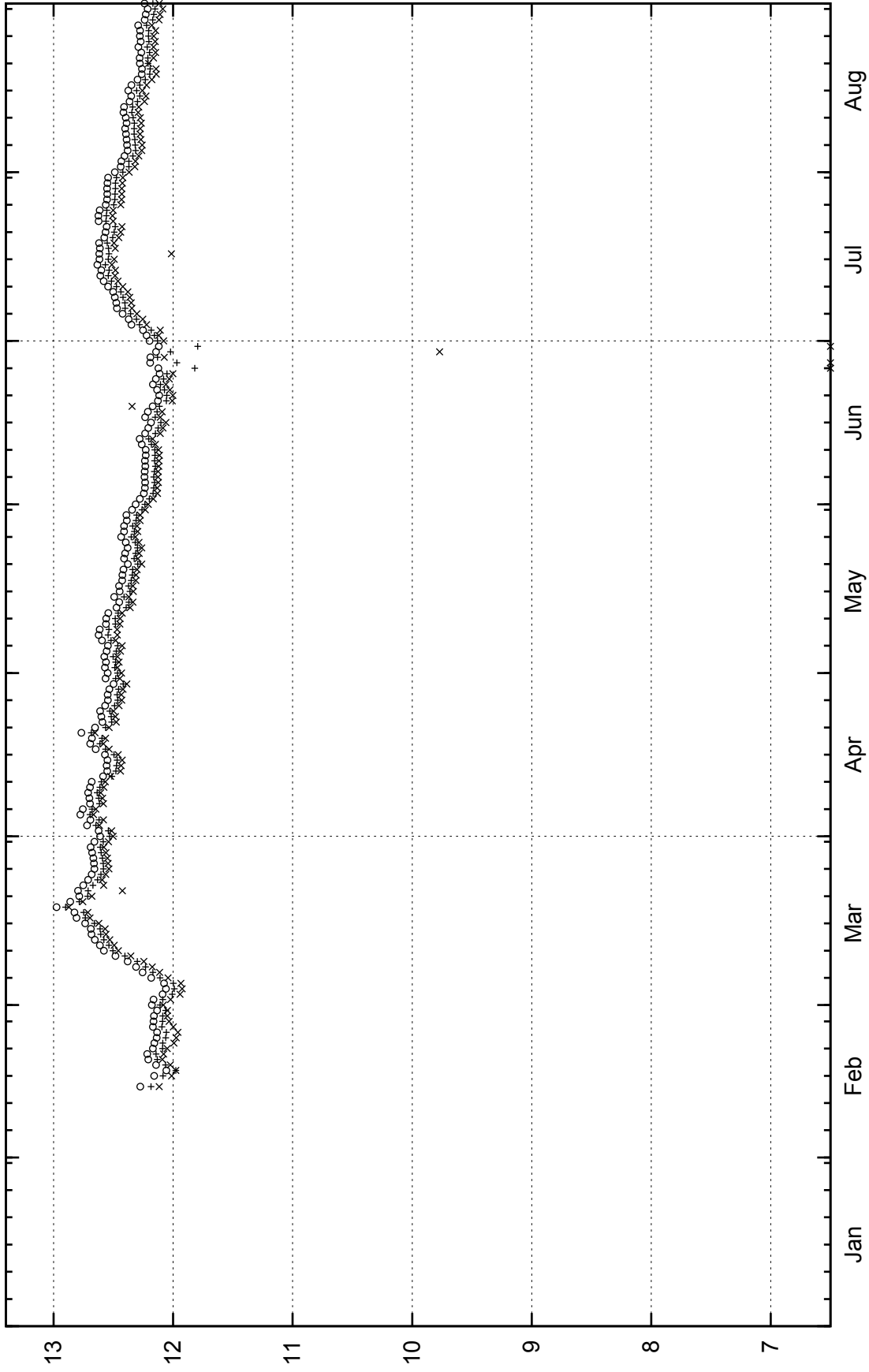
masl

KLX16A



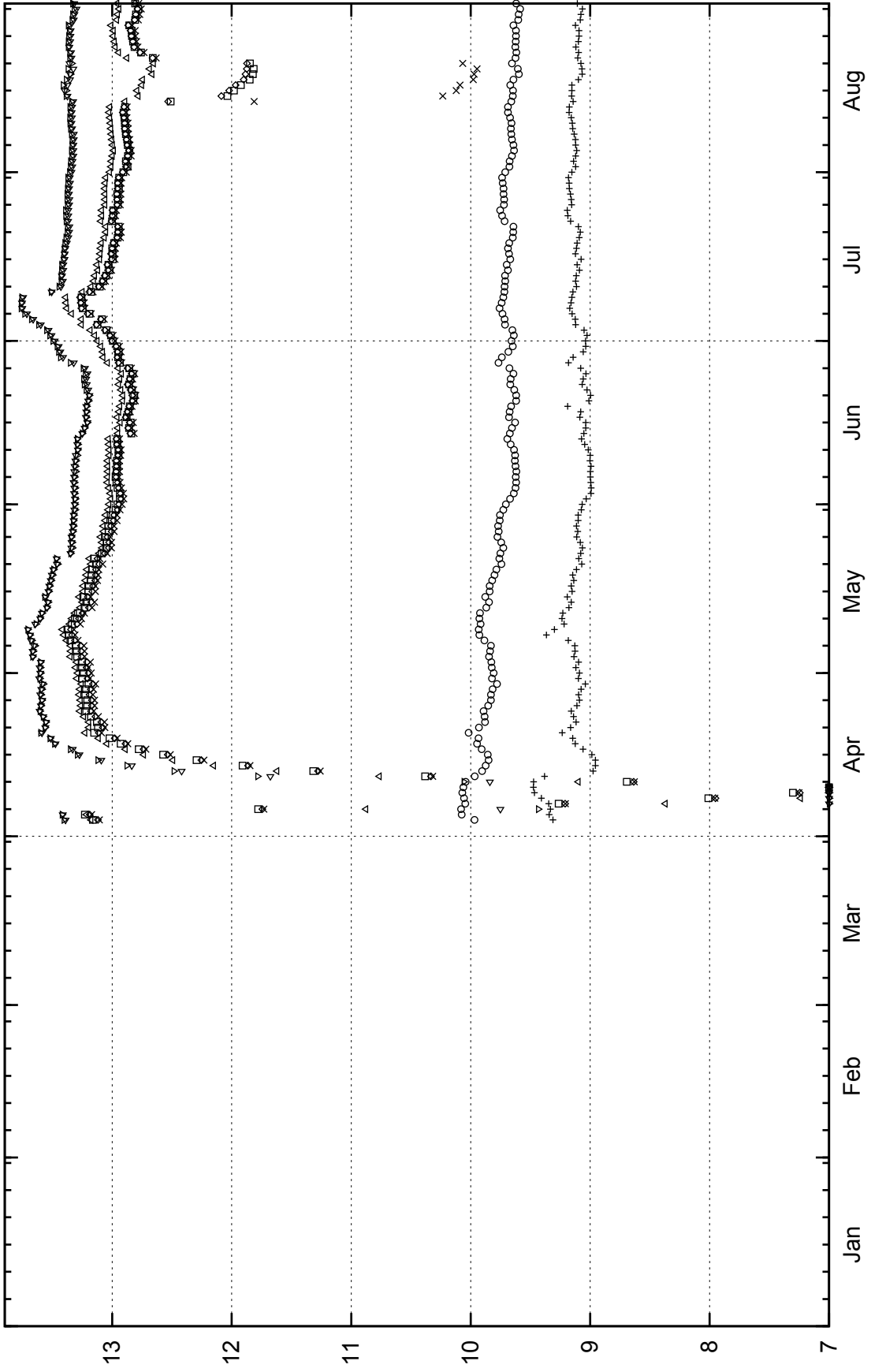
Start: 2007-01-01 month

KLX18A



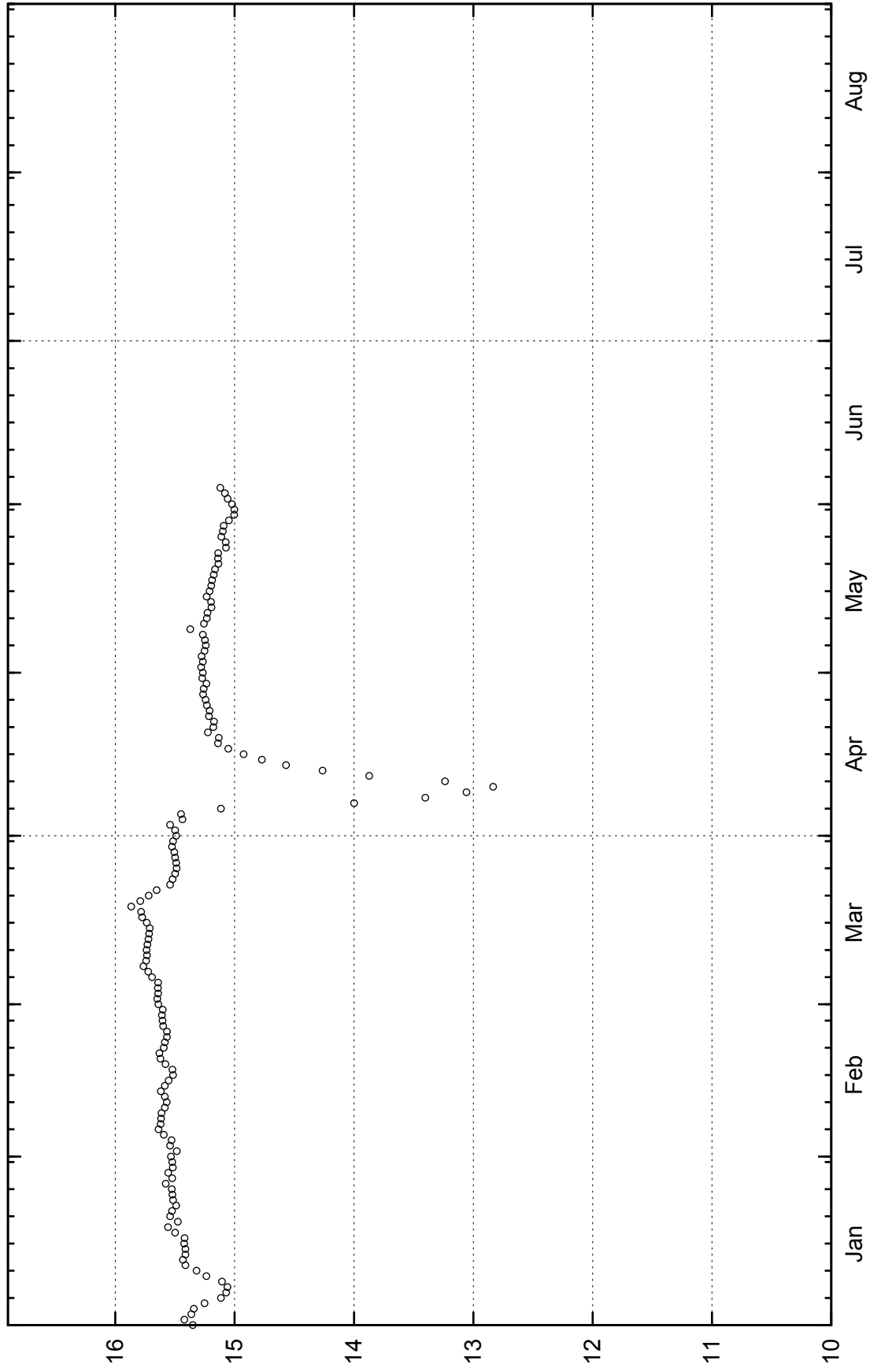
Start: 2007-01-01 month

KLX19A



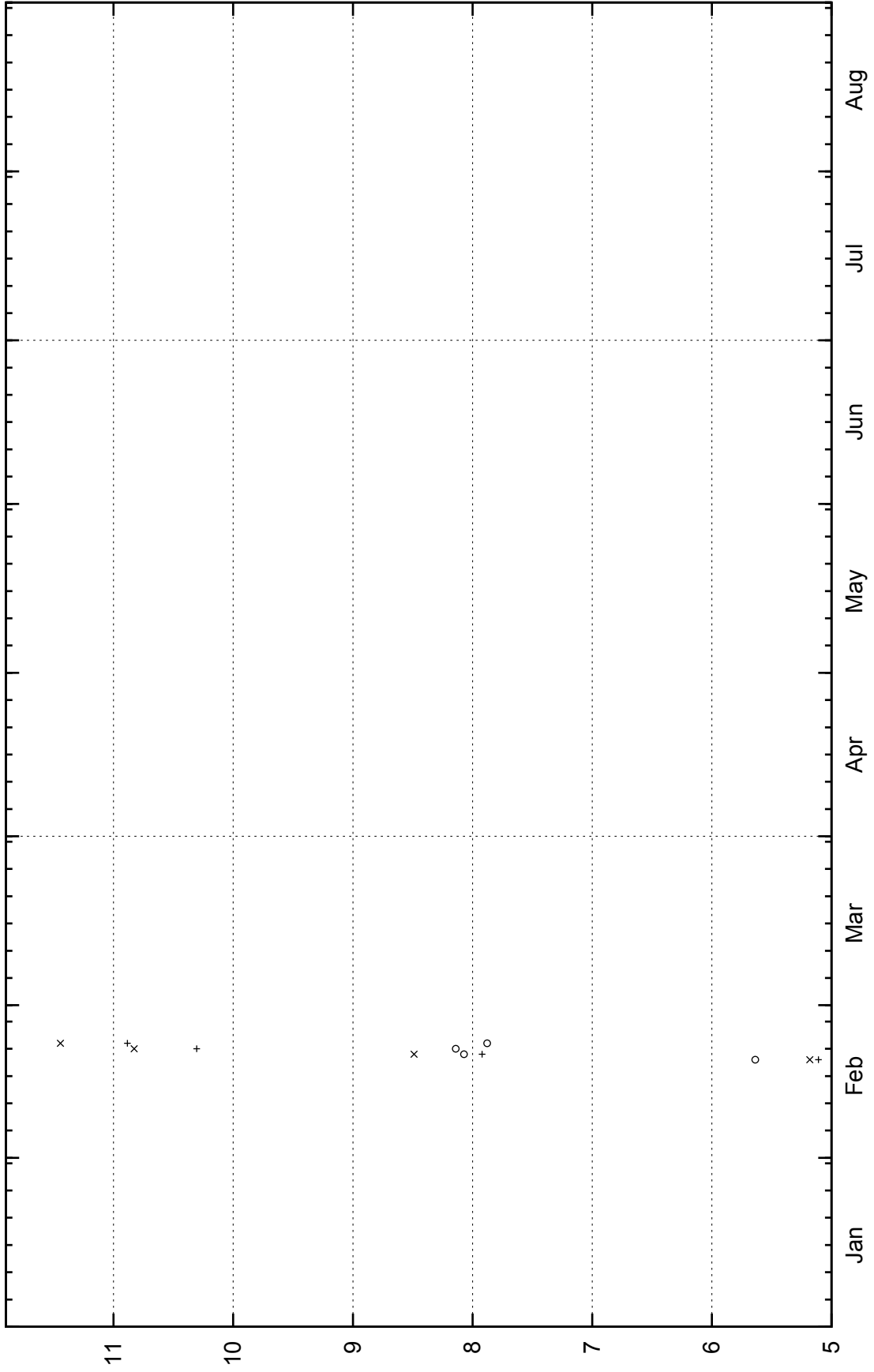
Start: 2007-01-01 month

KLX20A



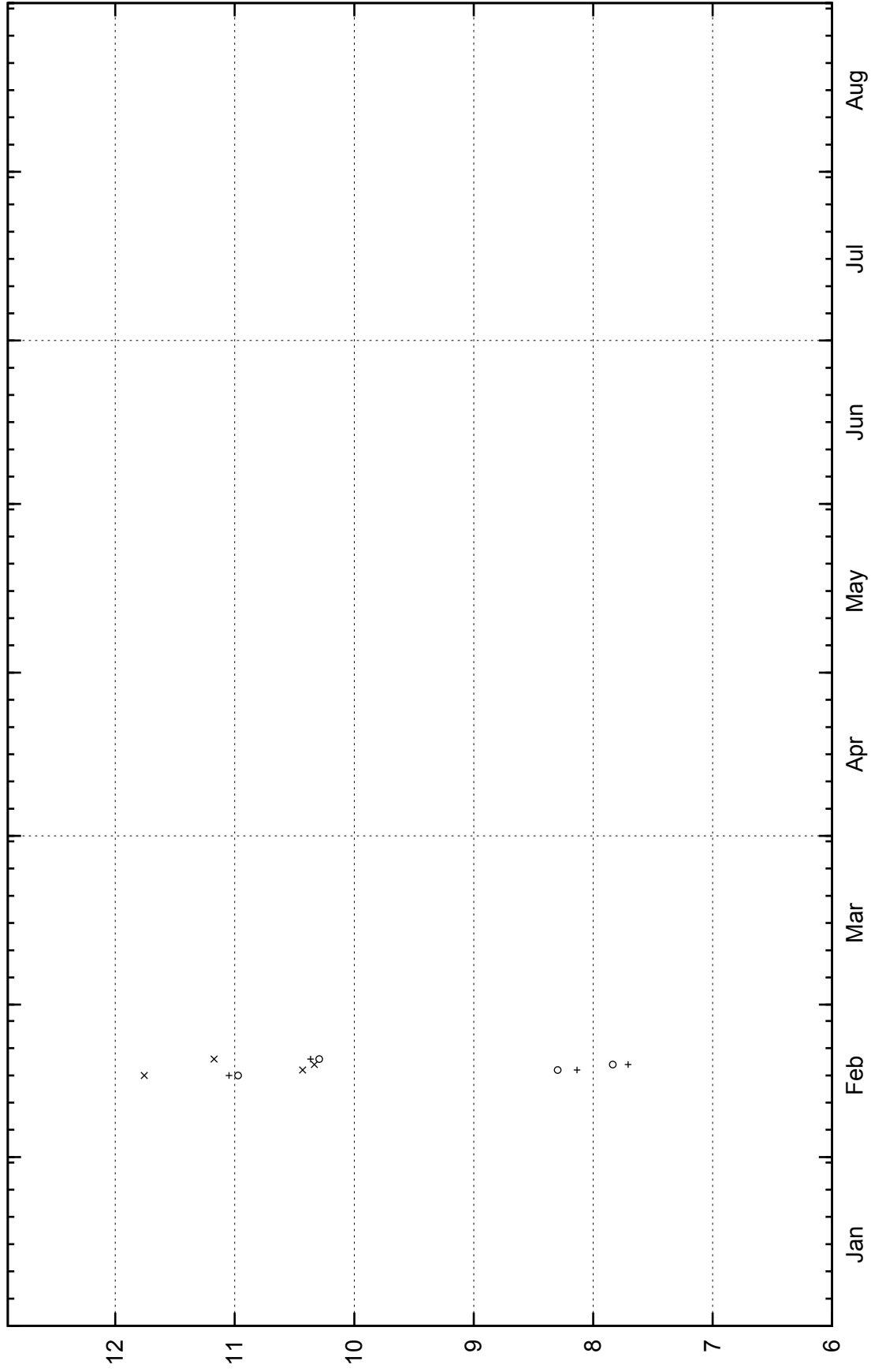
Start: 2007-01-01 month

KLX26A



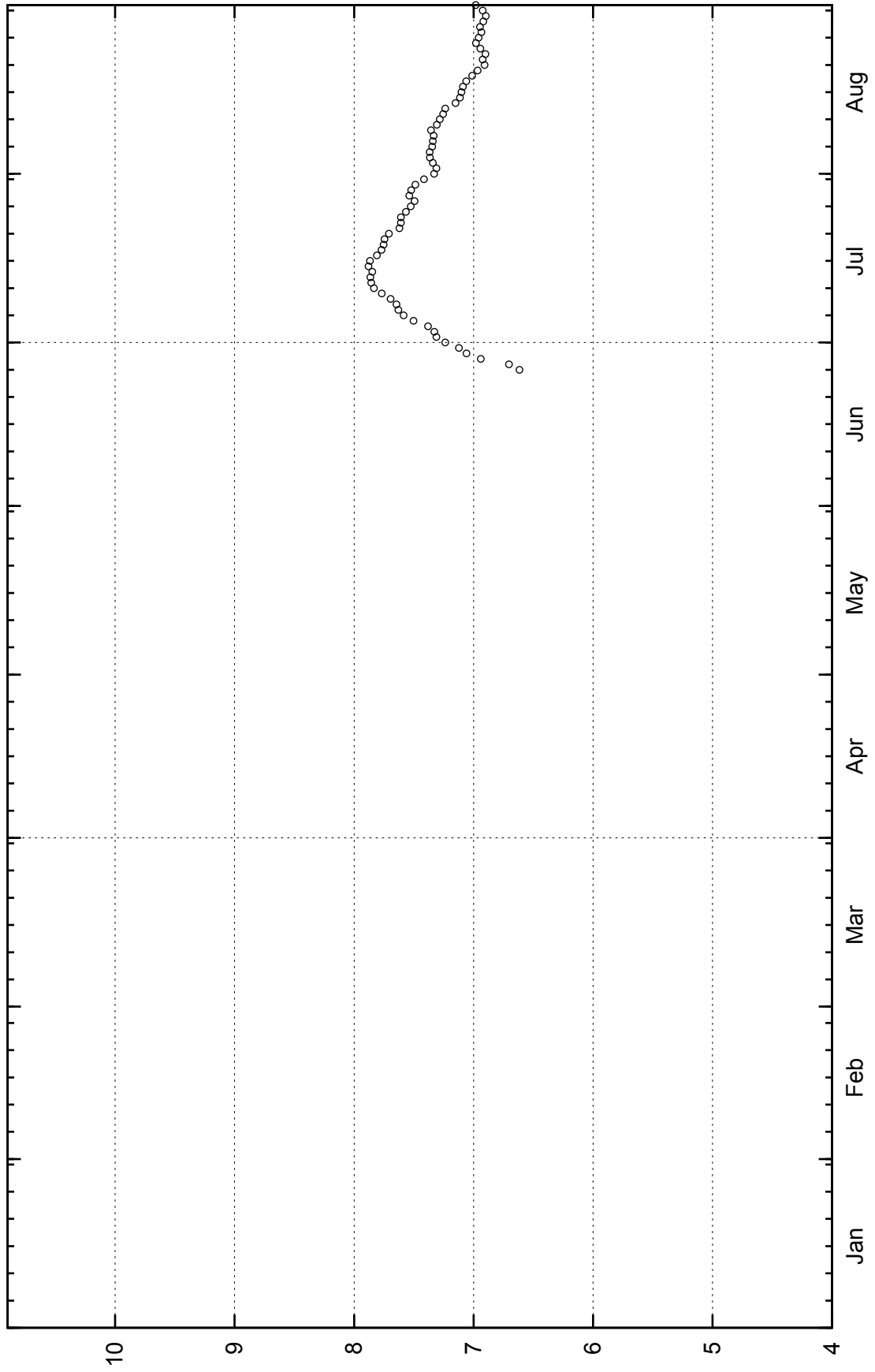
Start: 2007-01-01 month

KLX26B



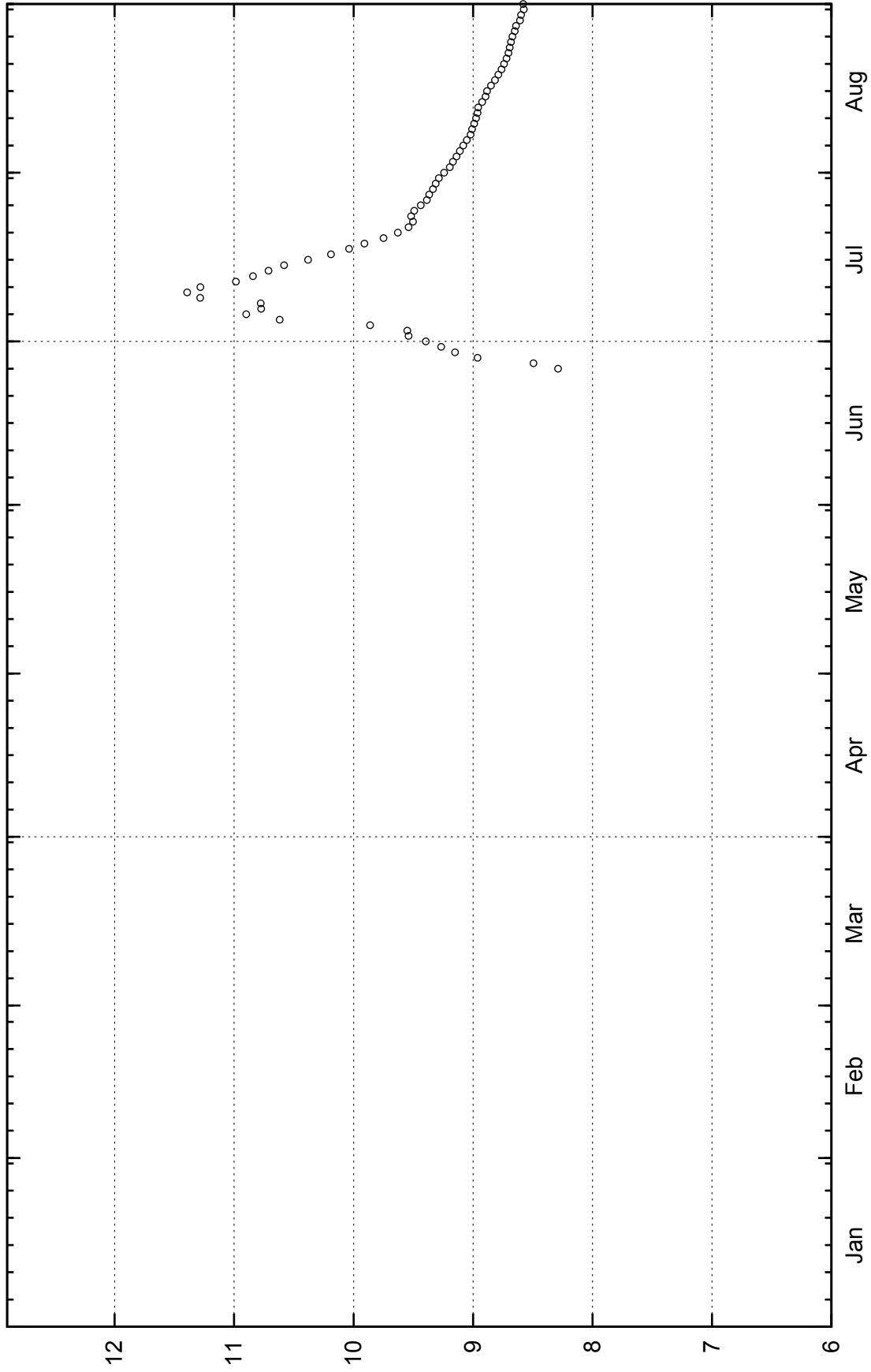
Start: 2007-01-01 month

KLX28A



Start: 2007-01-01 month

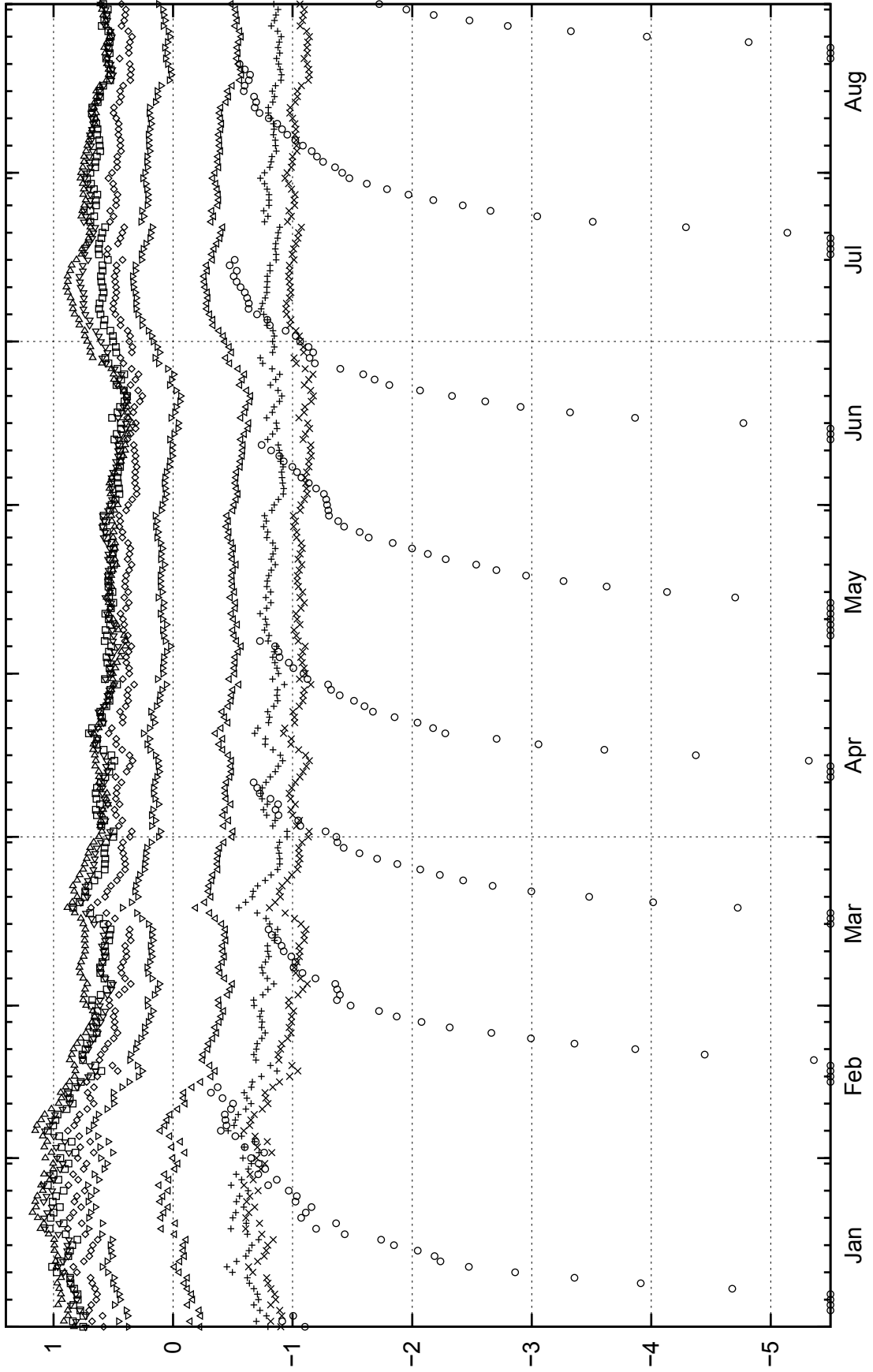
KLX29A



Start: 2007-01-01 month

masl

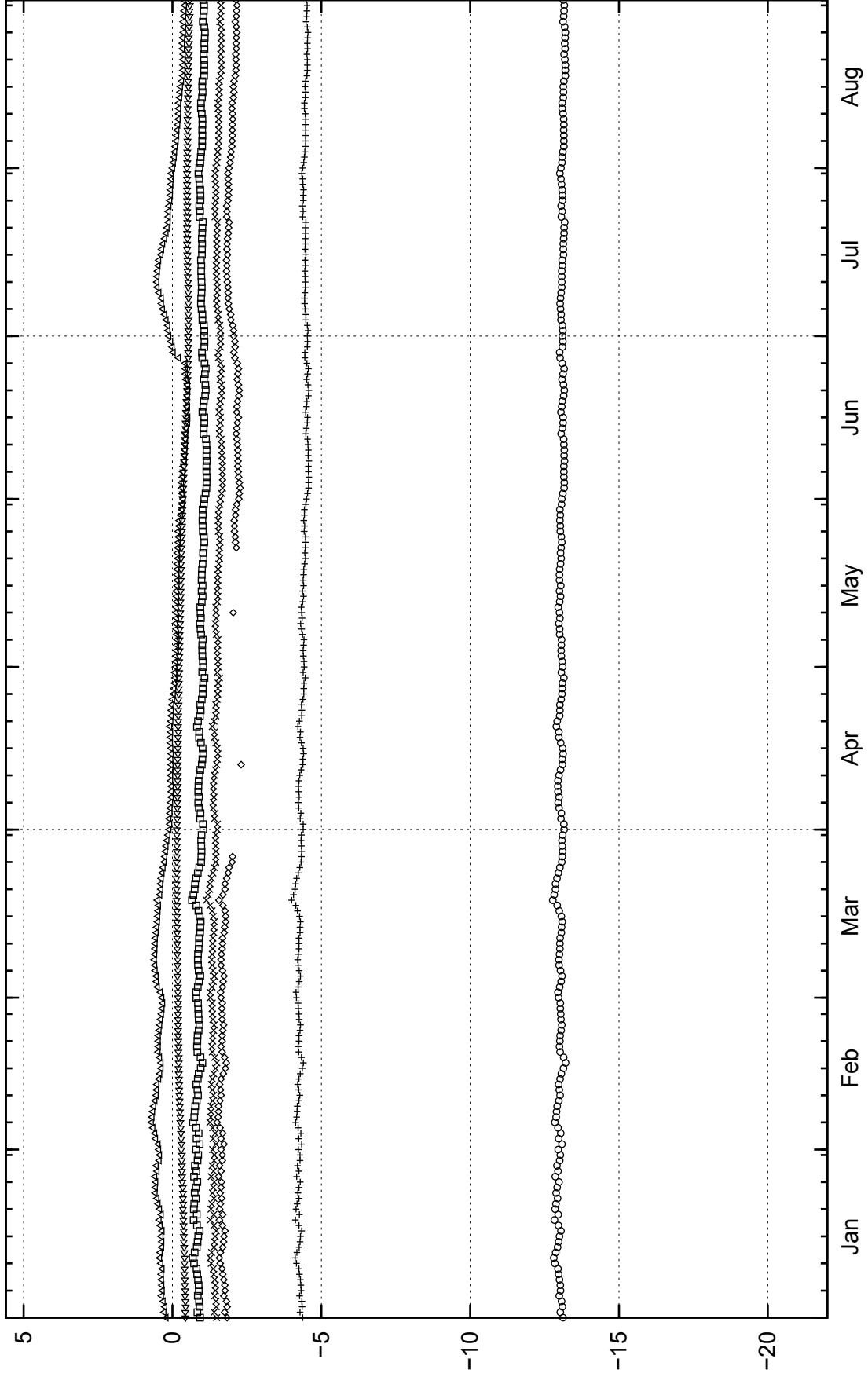
KSH01A



Start: 2007-01-01 month

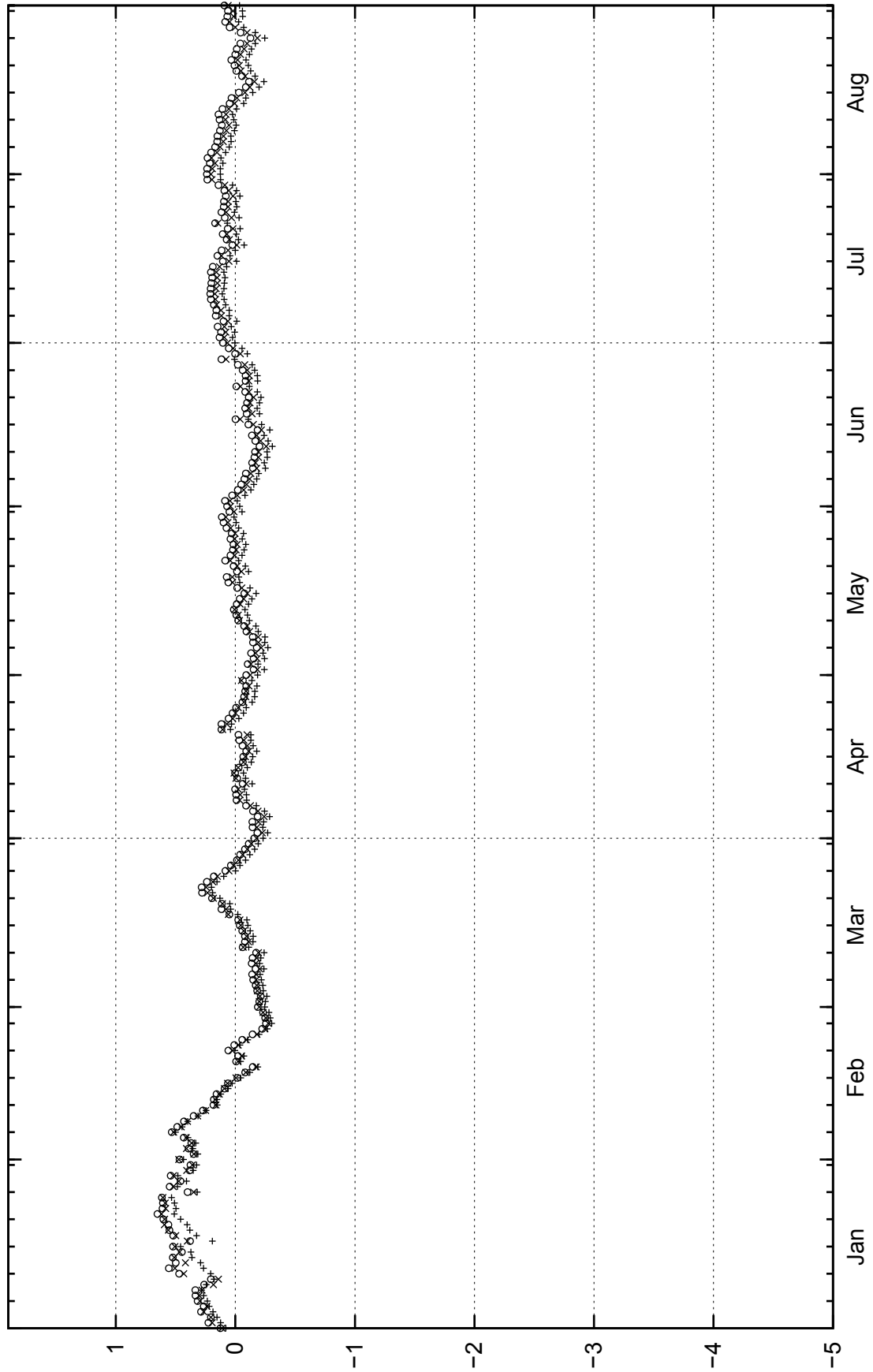
mas

KSH02



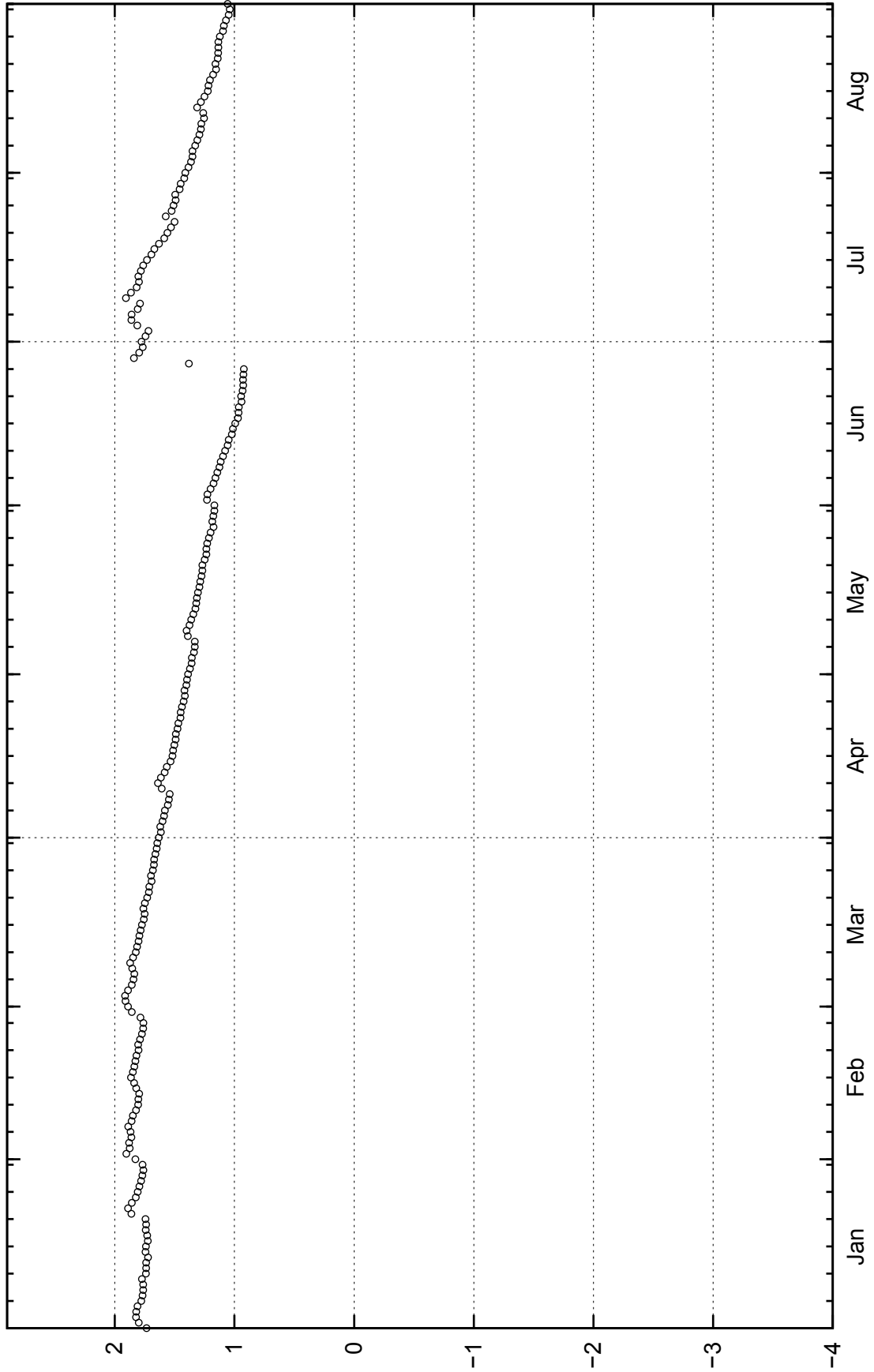
Start: 2007-01-01 month

KSH03A



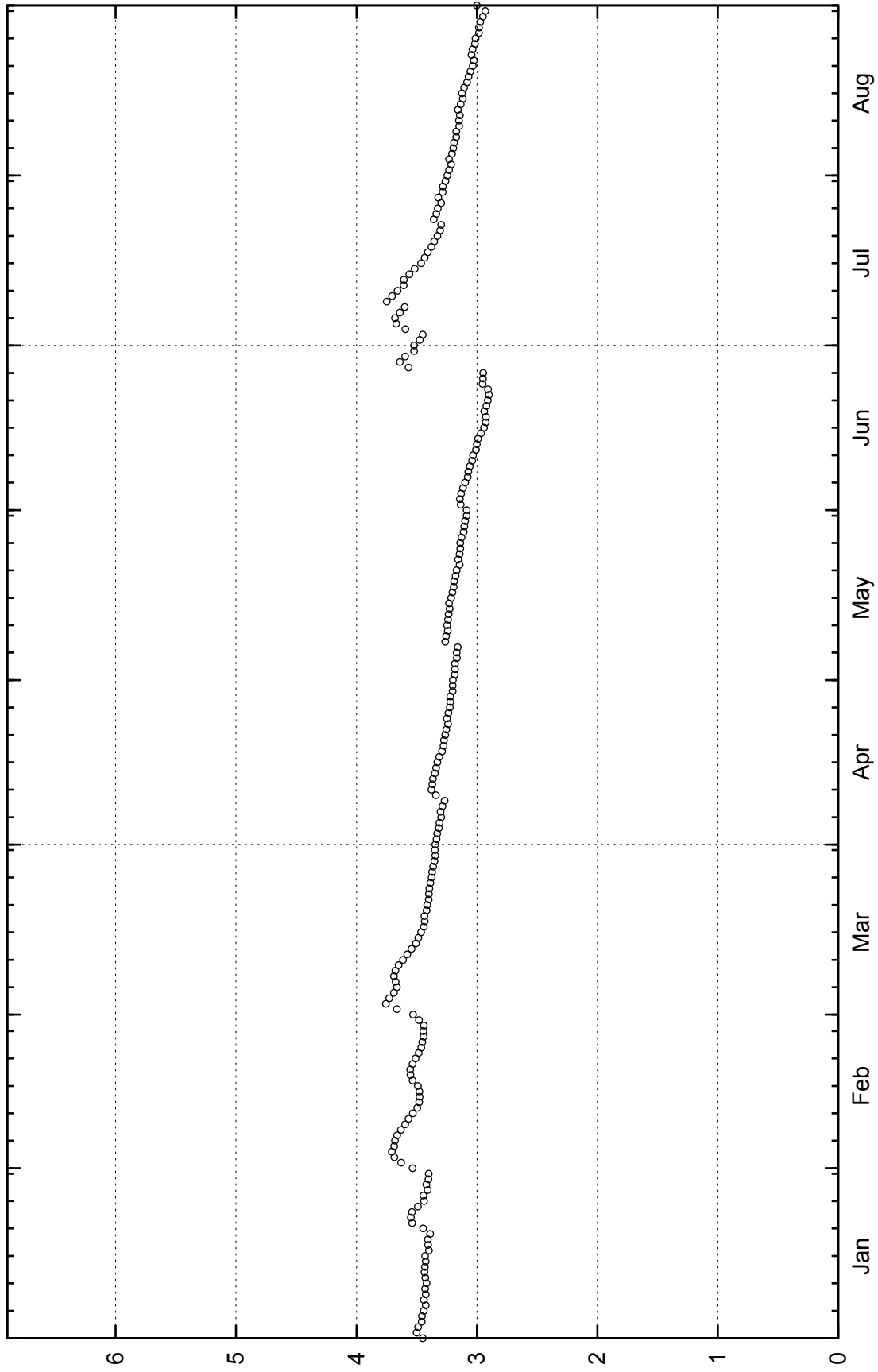
Start: 2007-01-01 month

SSM000001



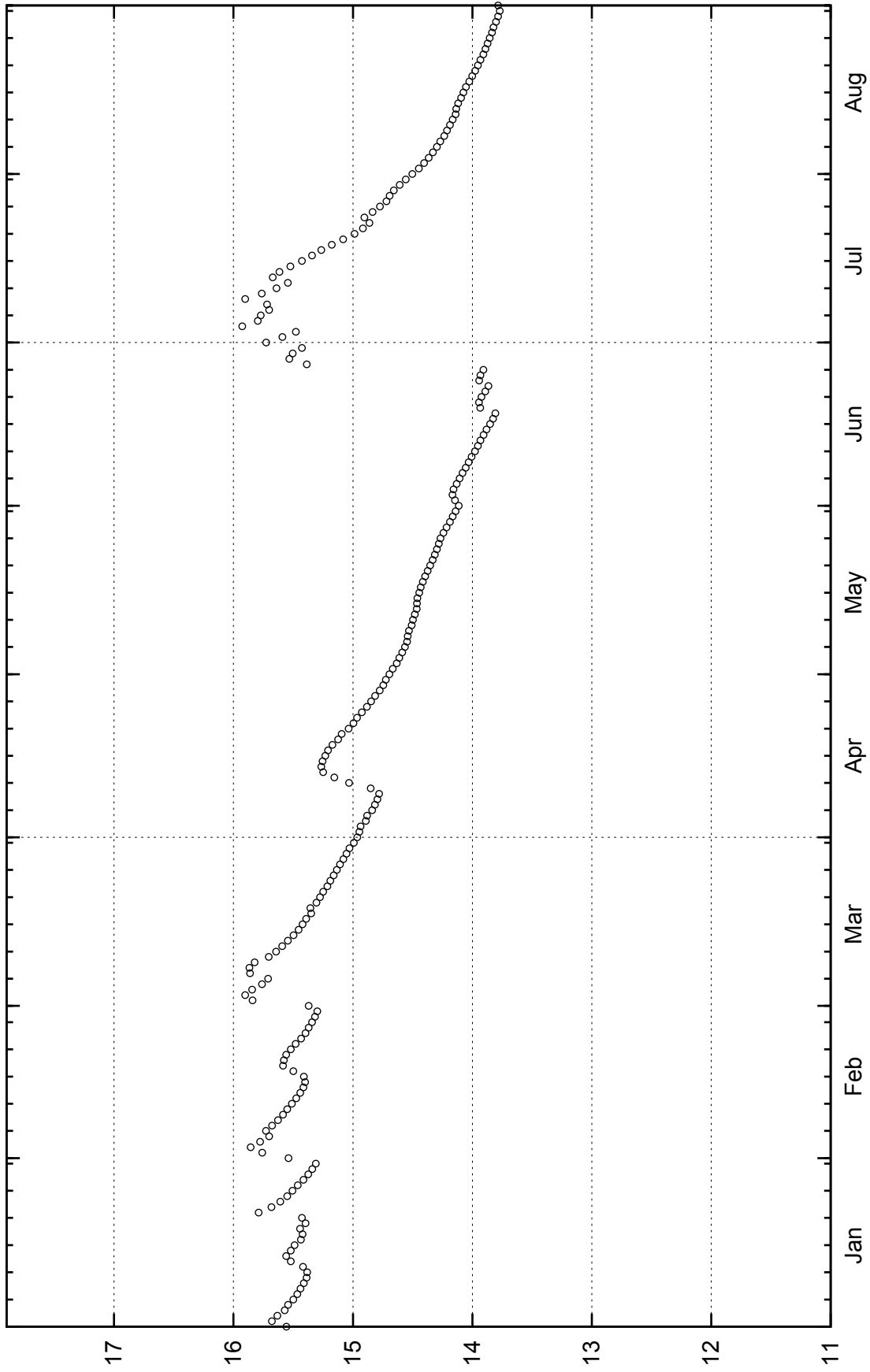
Start: 2007-01-01 month

SSM000008



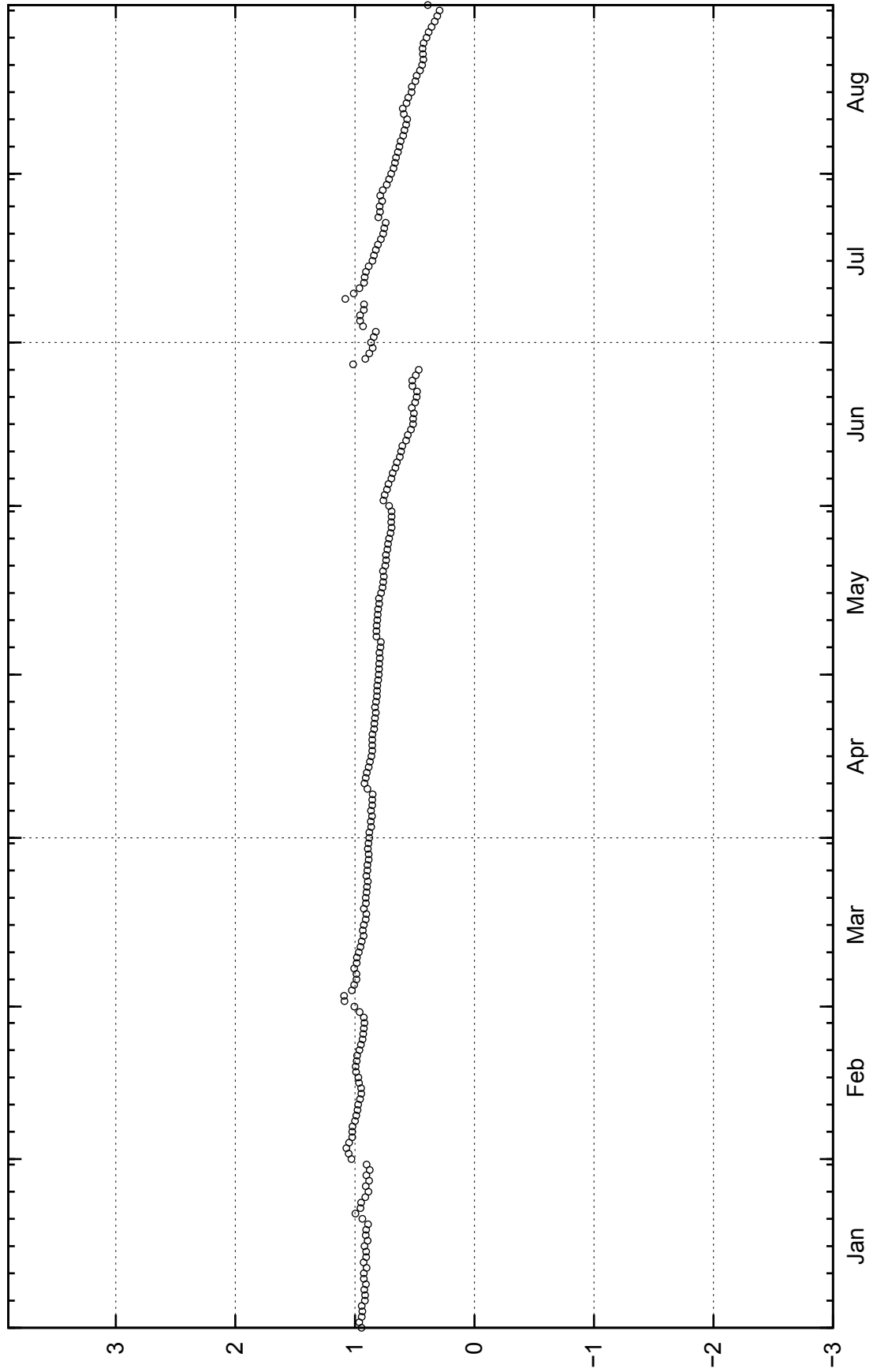
Start: 2007-01-01 month

SSM000011



Start: 2007-01-01 month

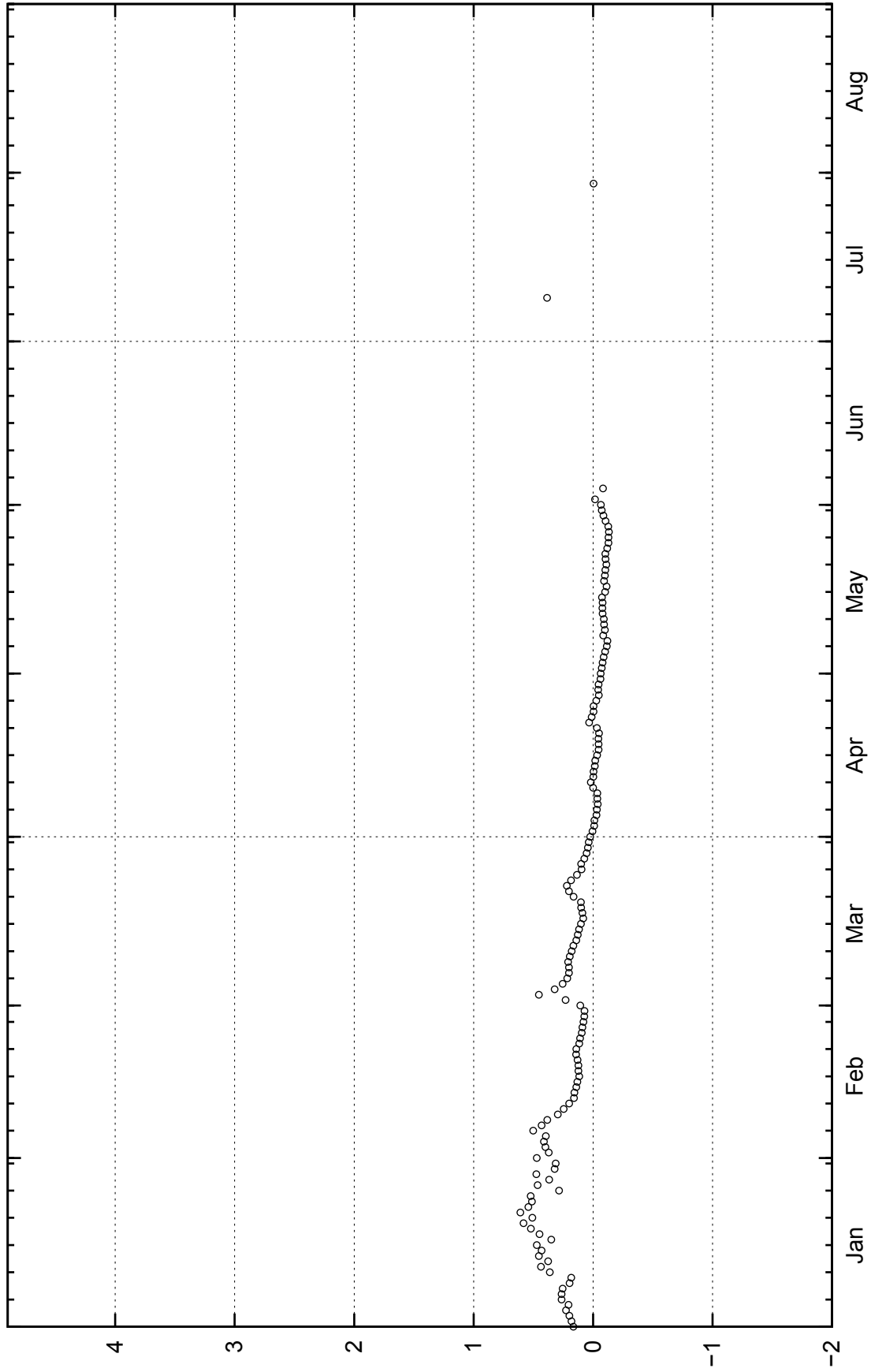
SSM000012



Start: 2007-01-01 month

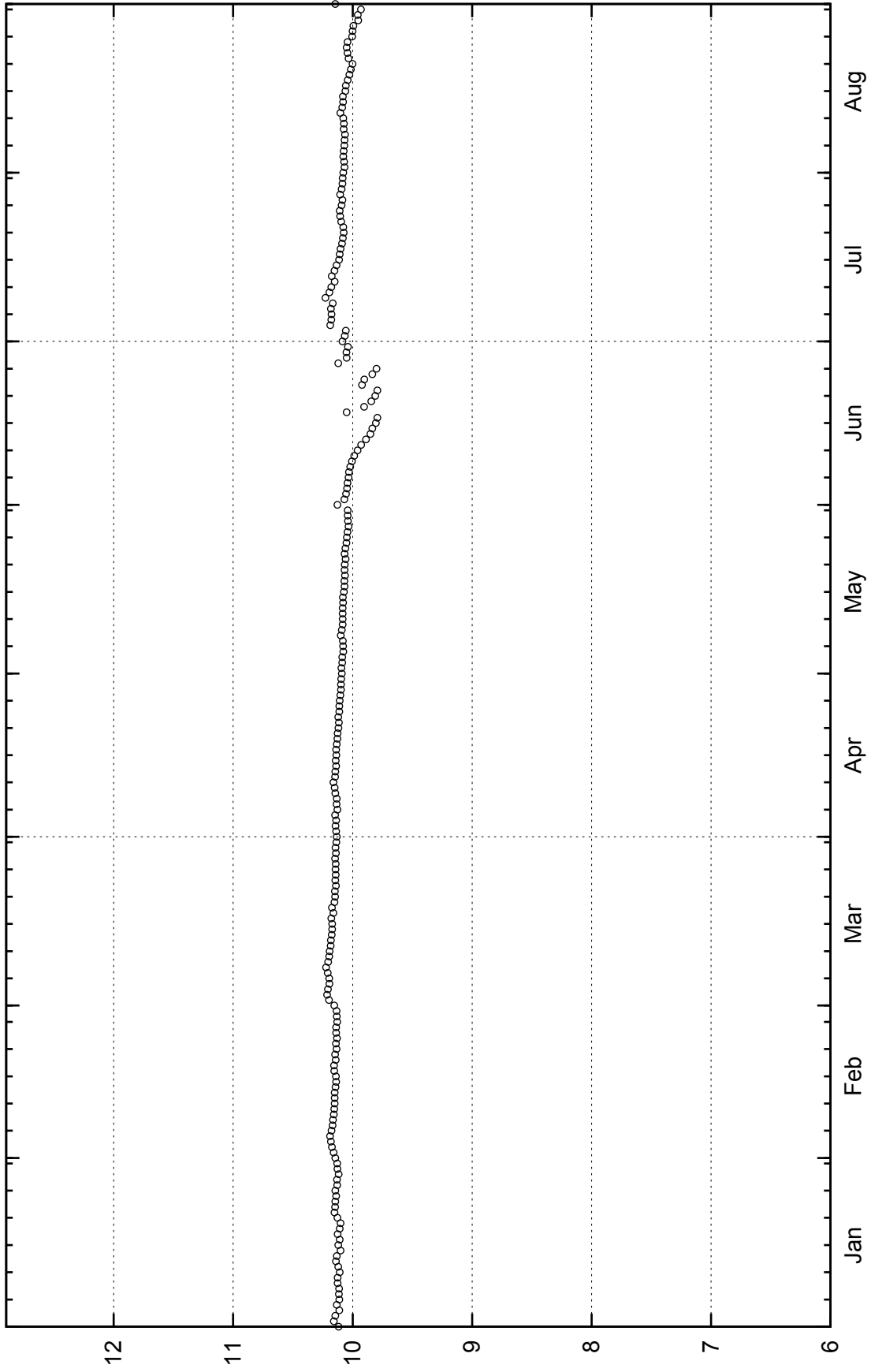
masl

SSM000014



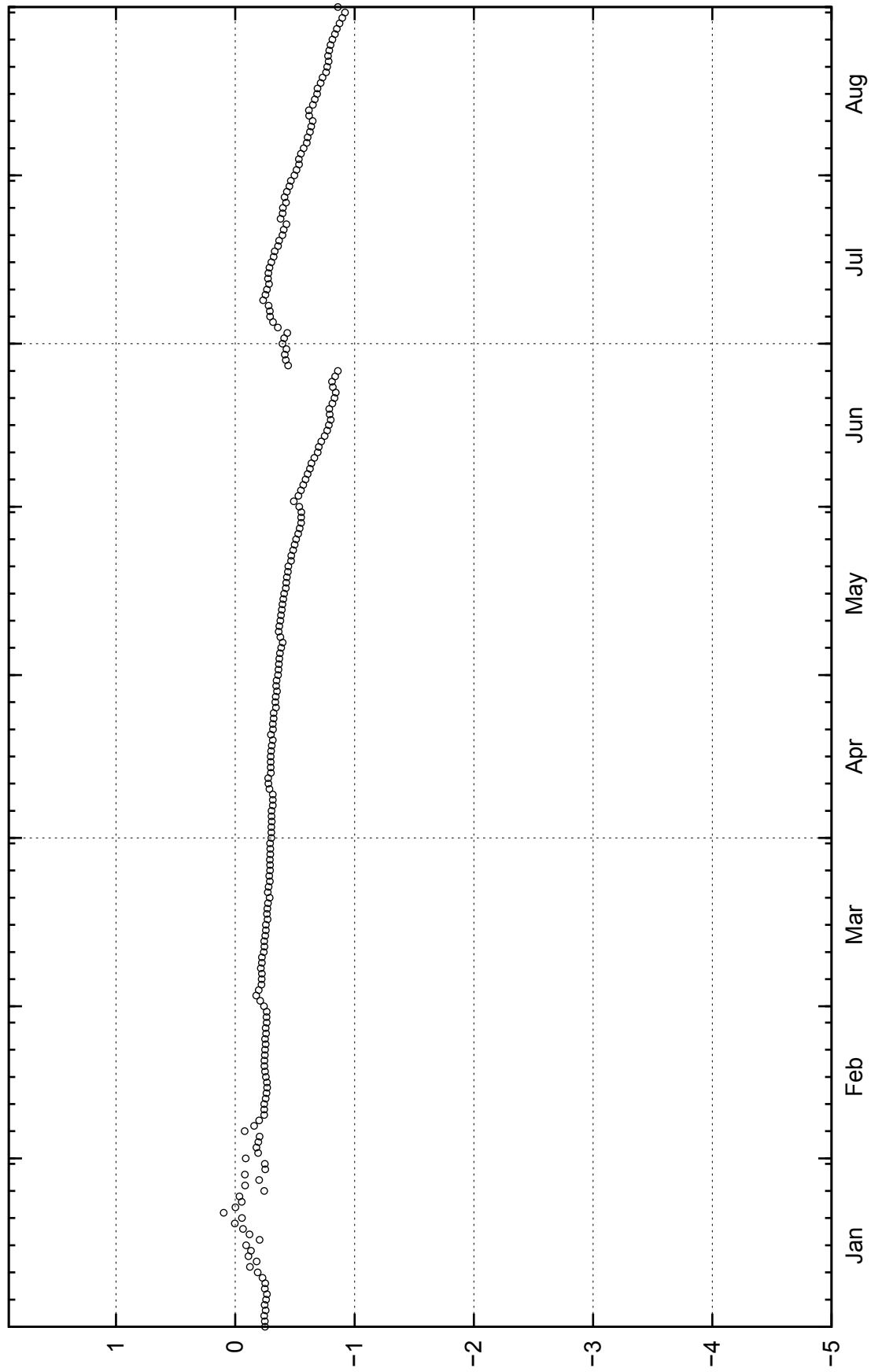
Start: 2007-01-01 month

SSM000017



Start: 2007-01-01 month

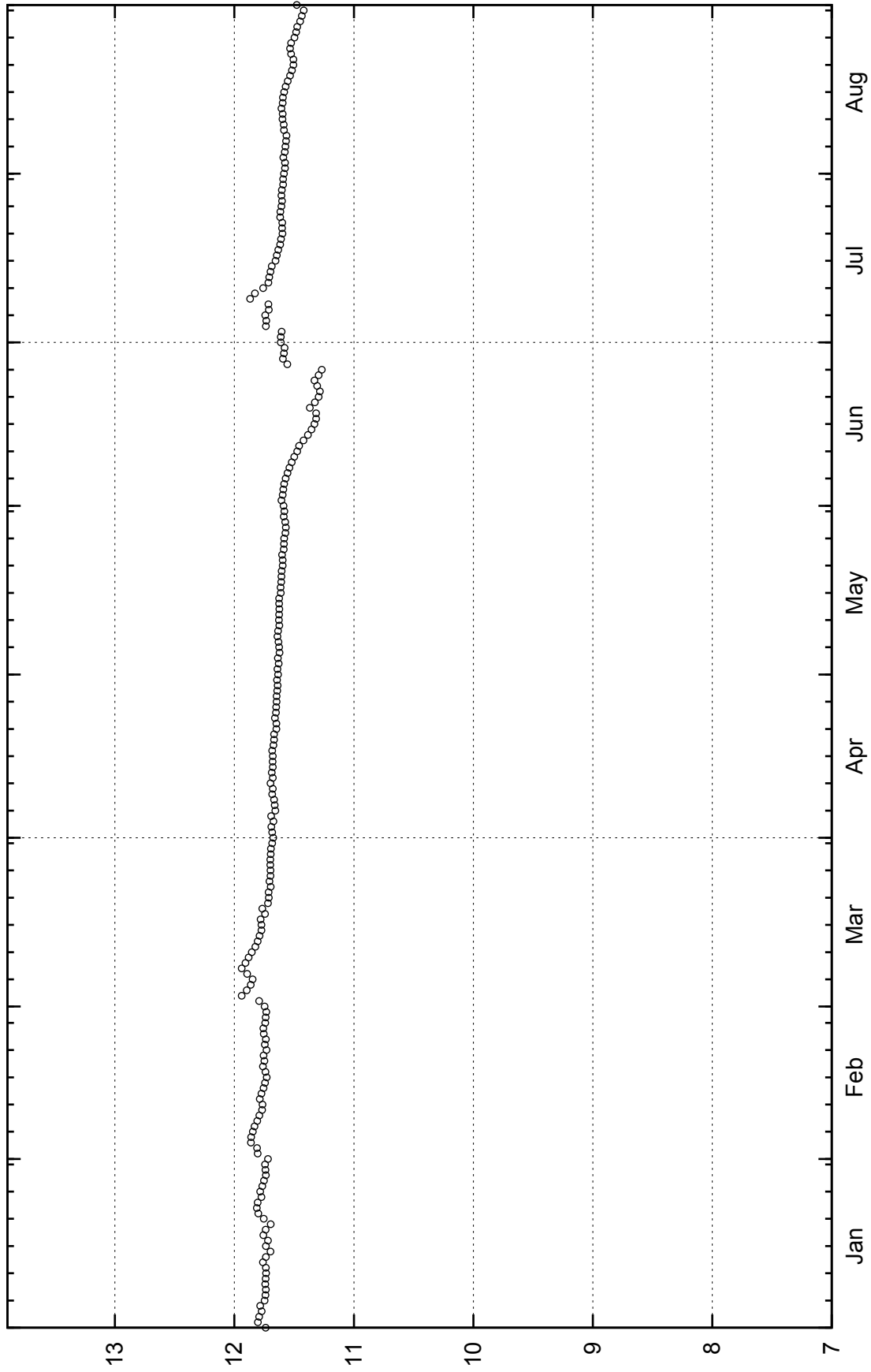
SSM000018



masl

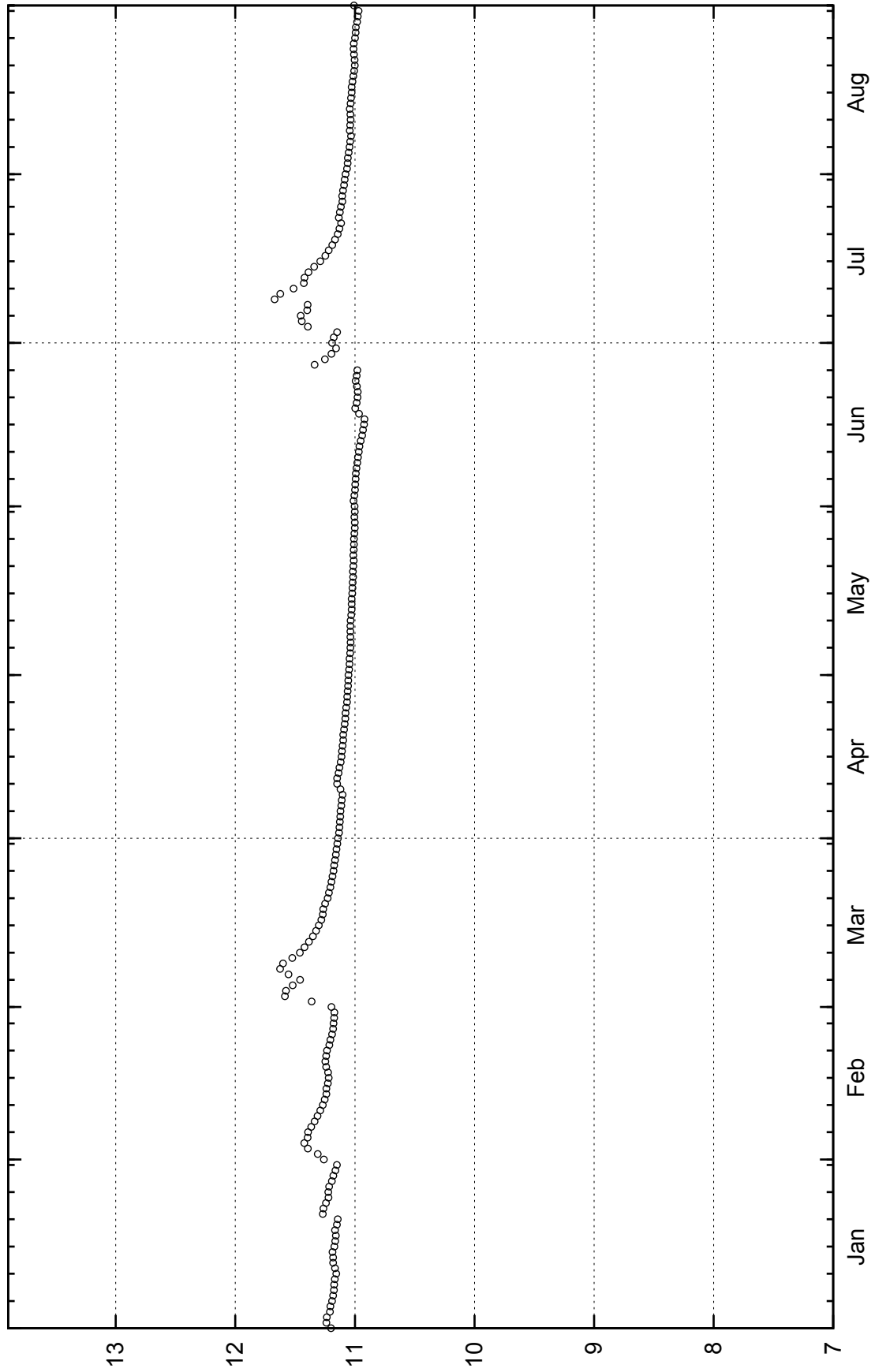
Start: 2007-01-01 month

SSM0000019



Start: 2007-01-01 month

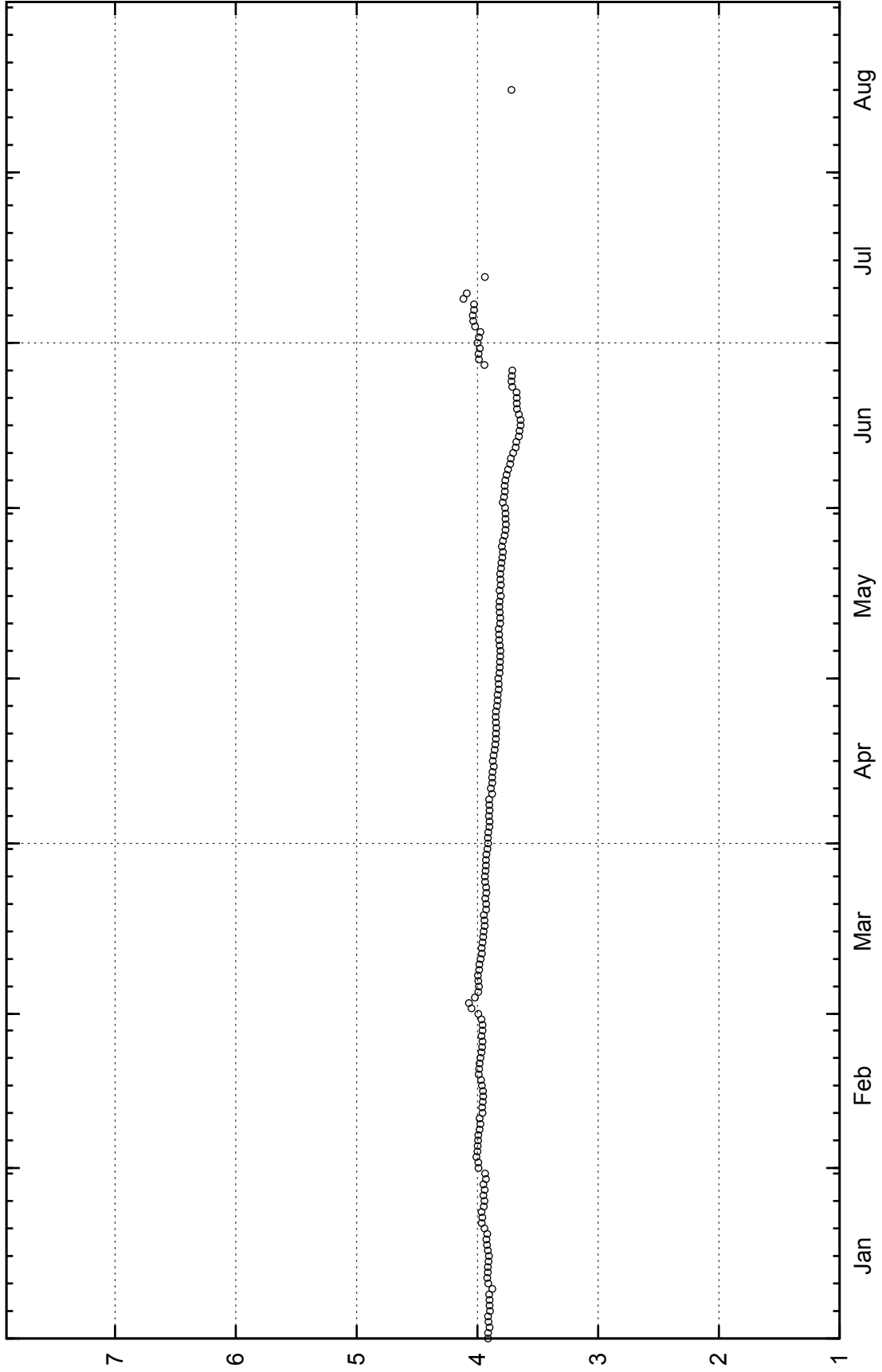
SSM000021



Start: 2007-01-01 month

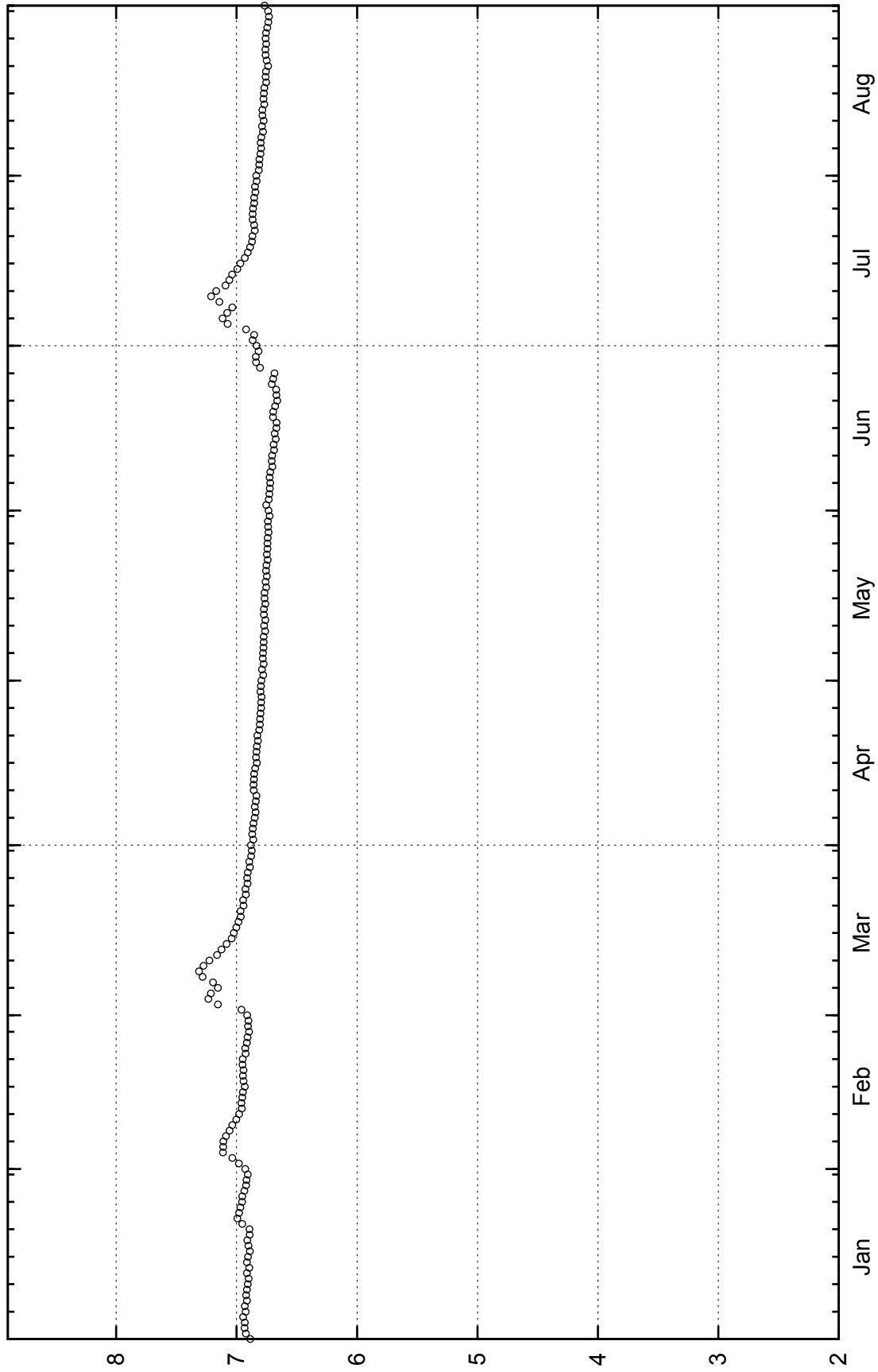
masl

SSM000022



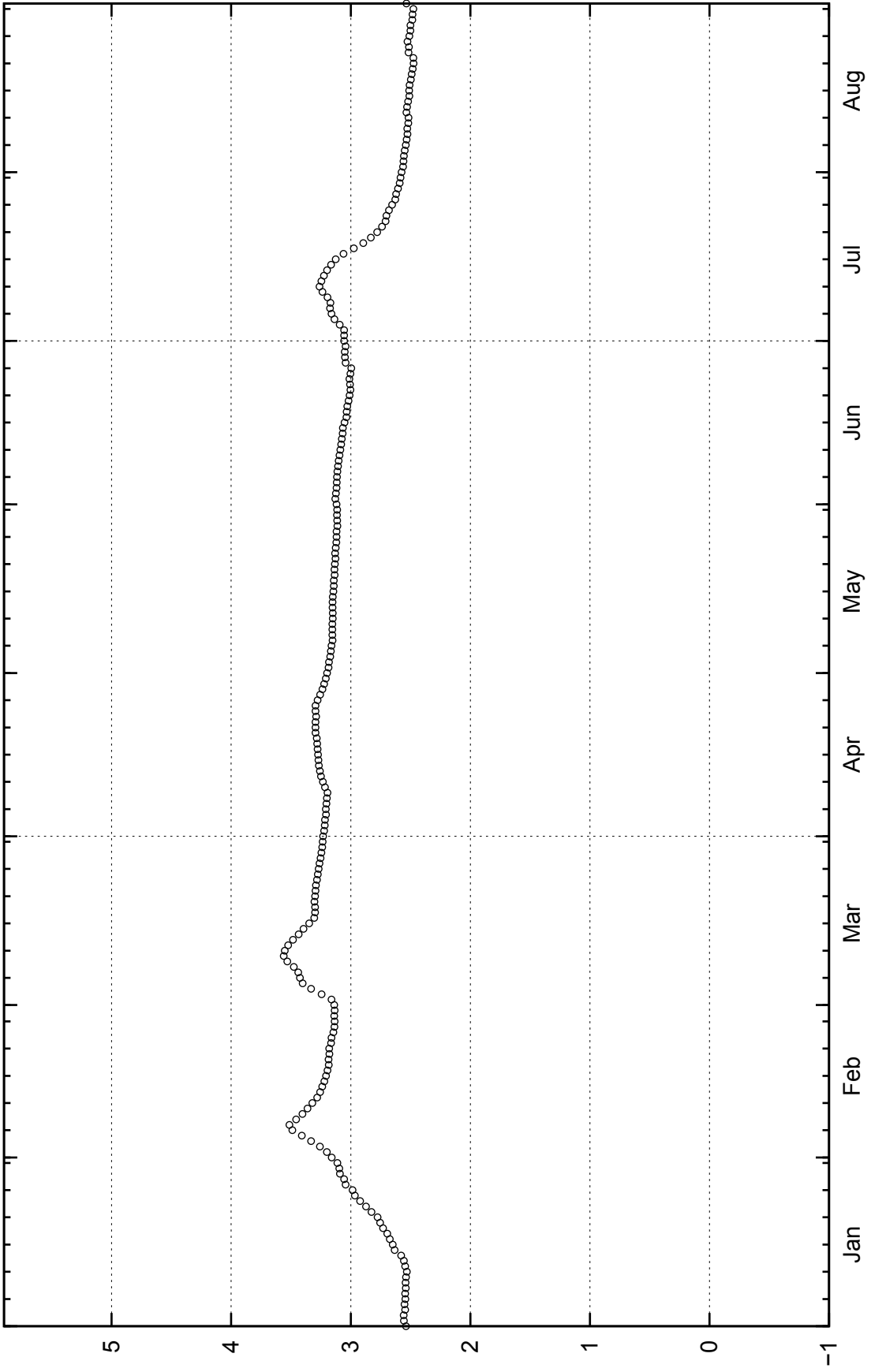
Start: 2007-01-01 month

SSM000027



Start: 2007-01-01 month

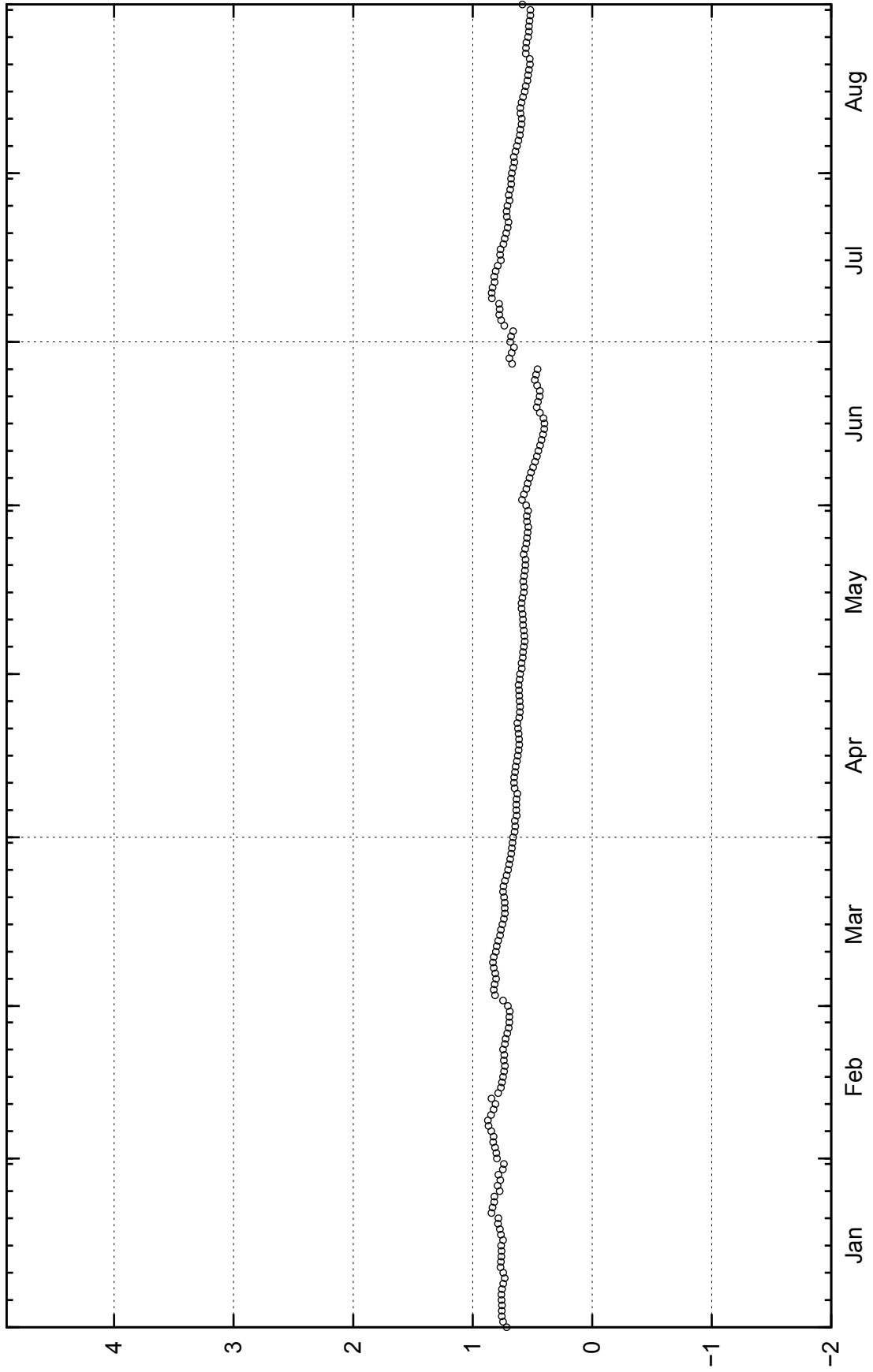
SSM000028



Start: 2007-01-01 month

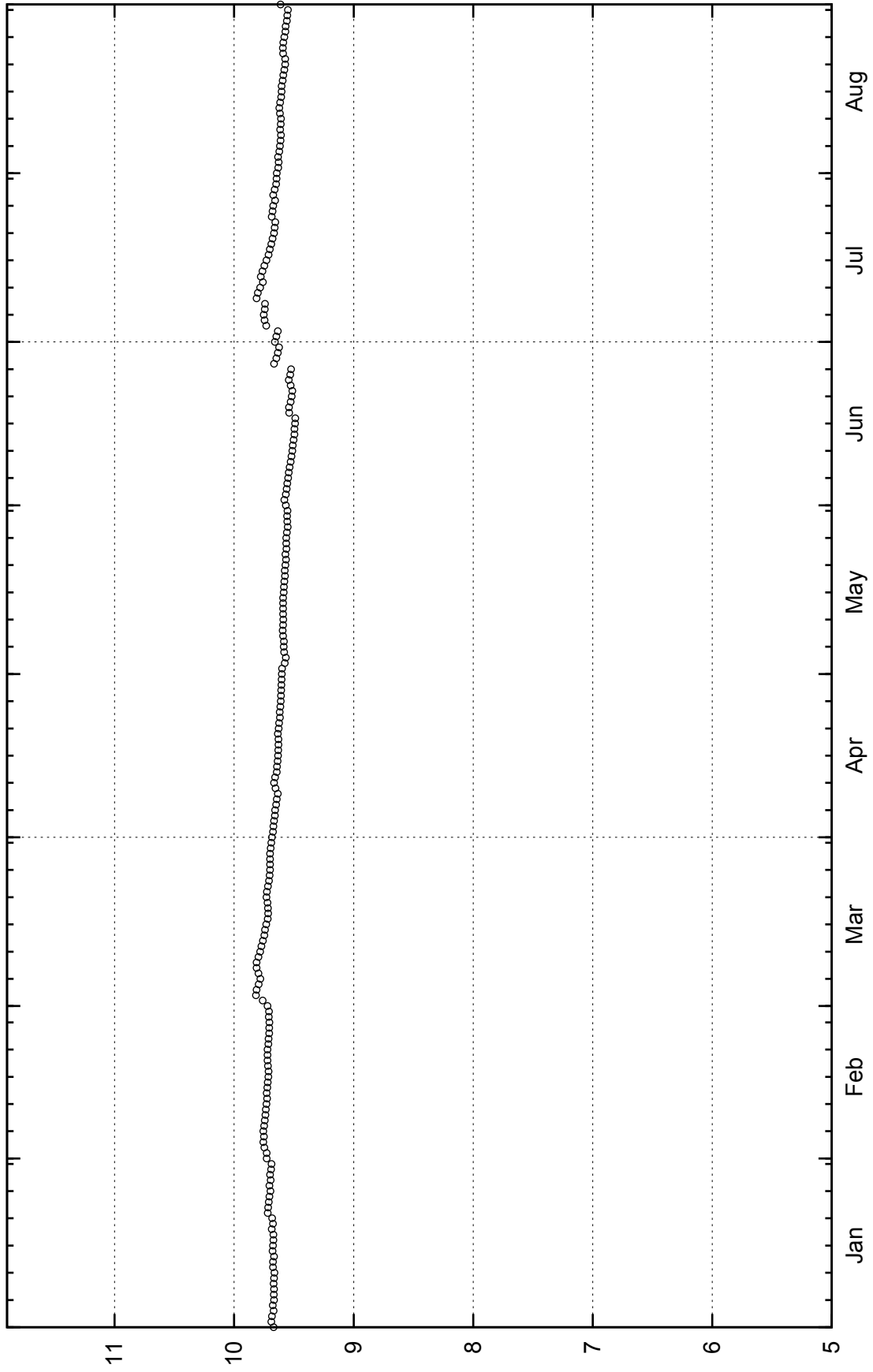
masl

SSM000029



Start: 2007-01-01 month

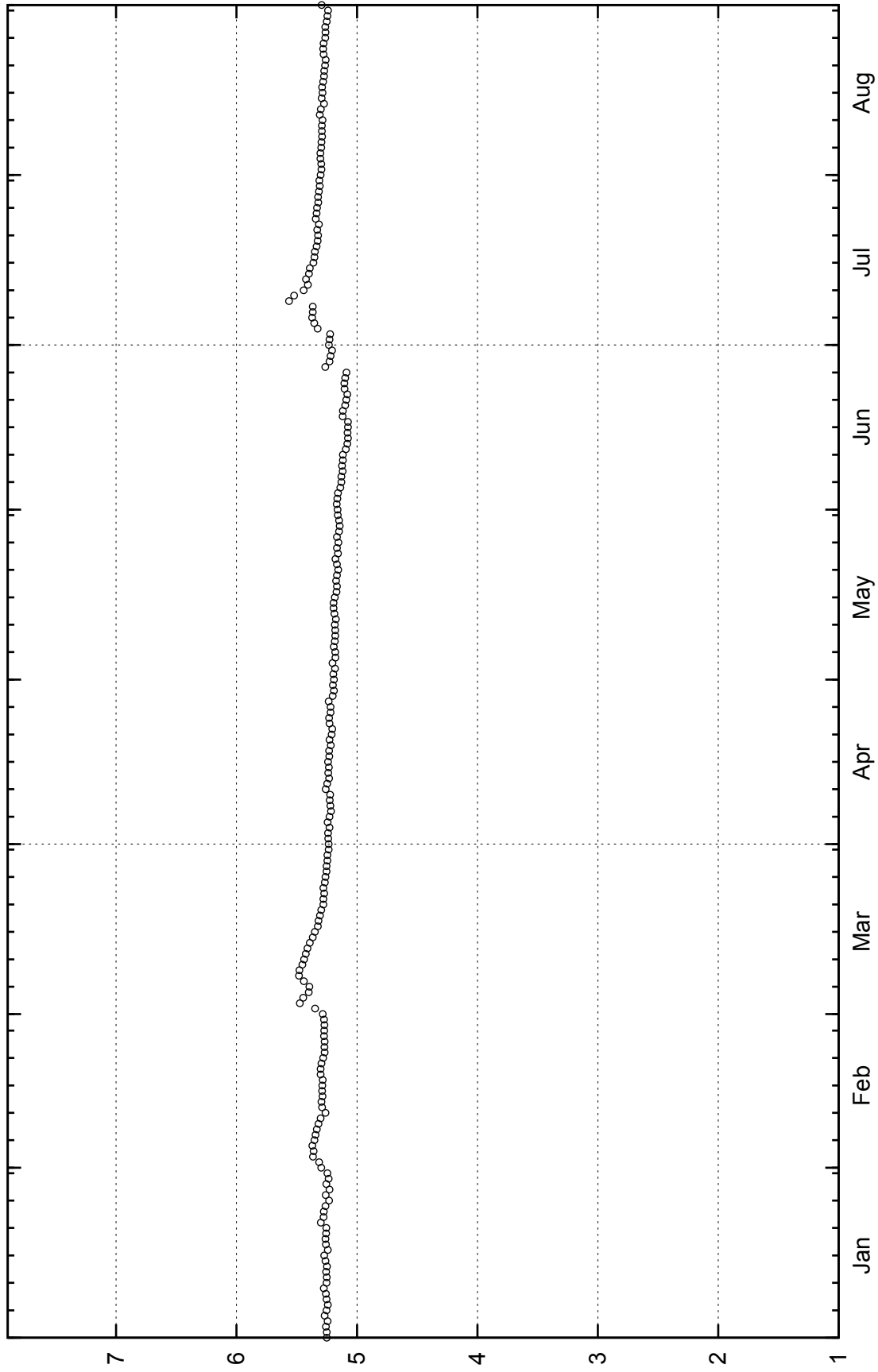
SSM000030



Start: 2007-01-01 month

masl

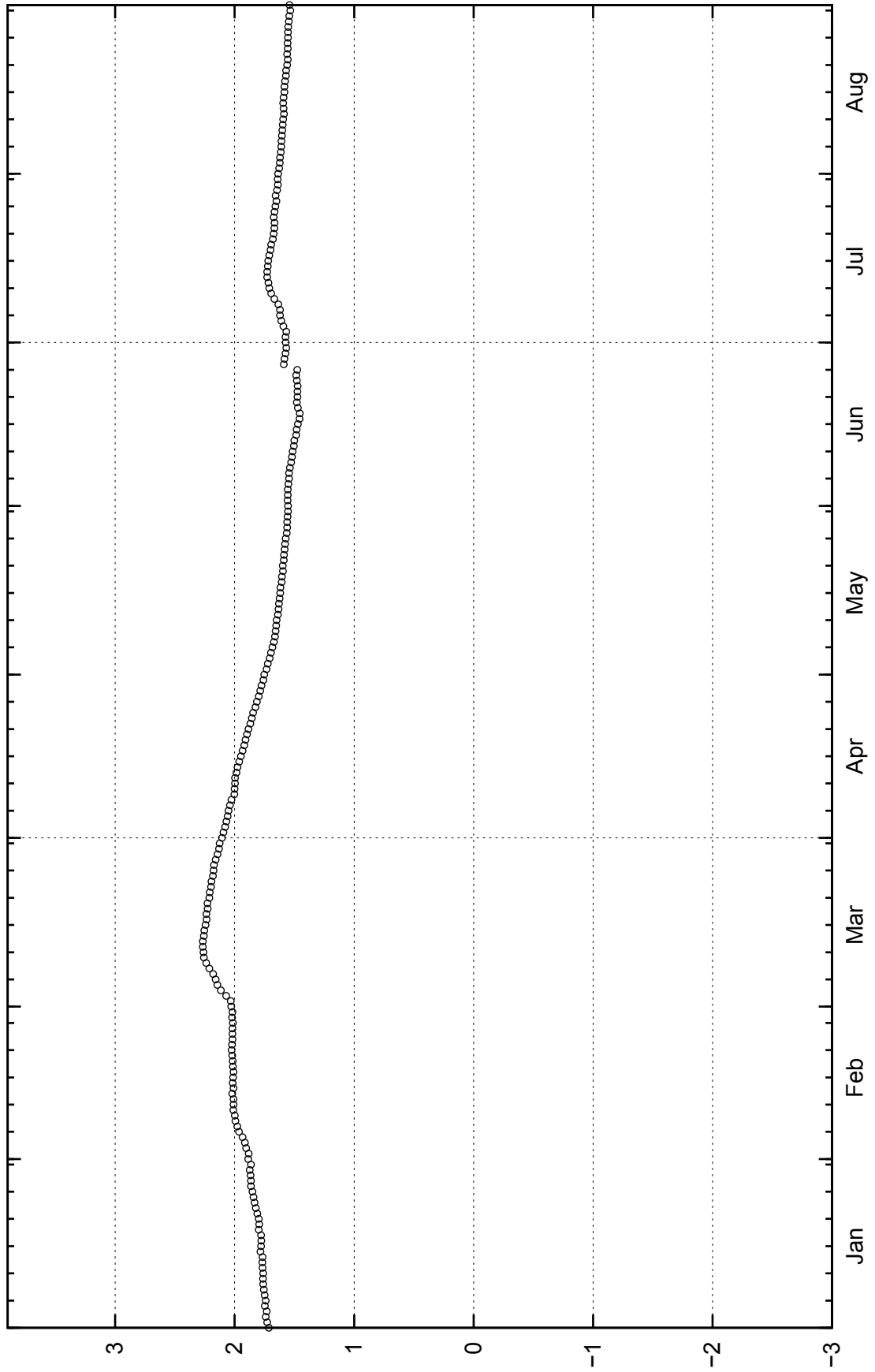
SSM000031



Start: 2007-01-01 month

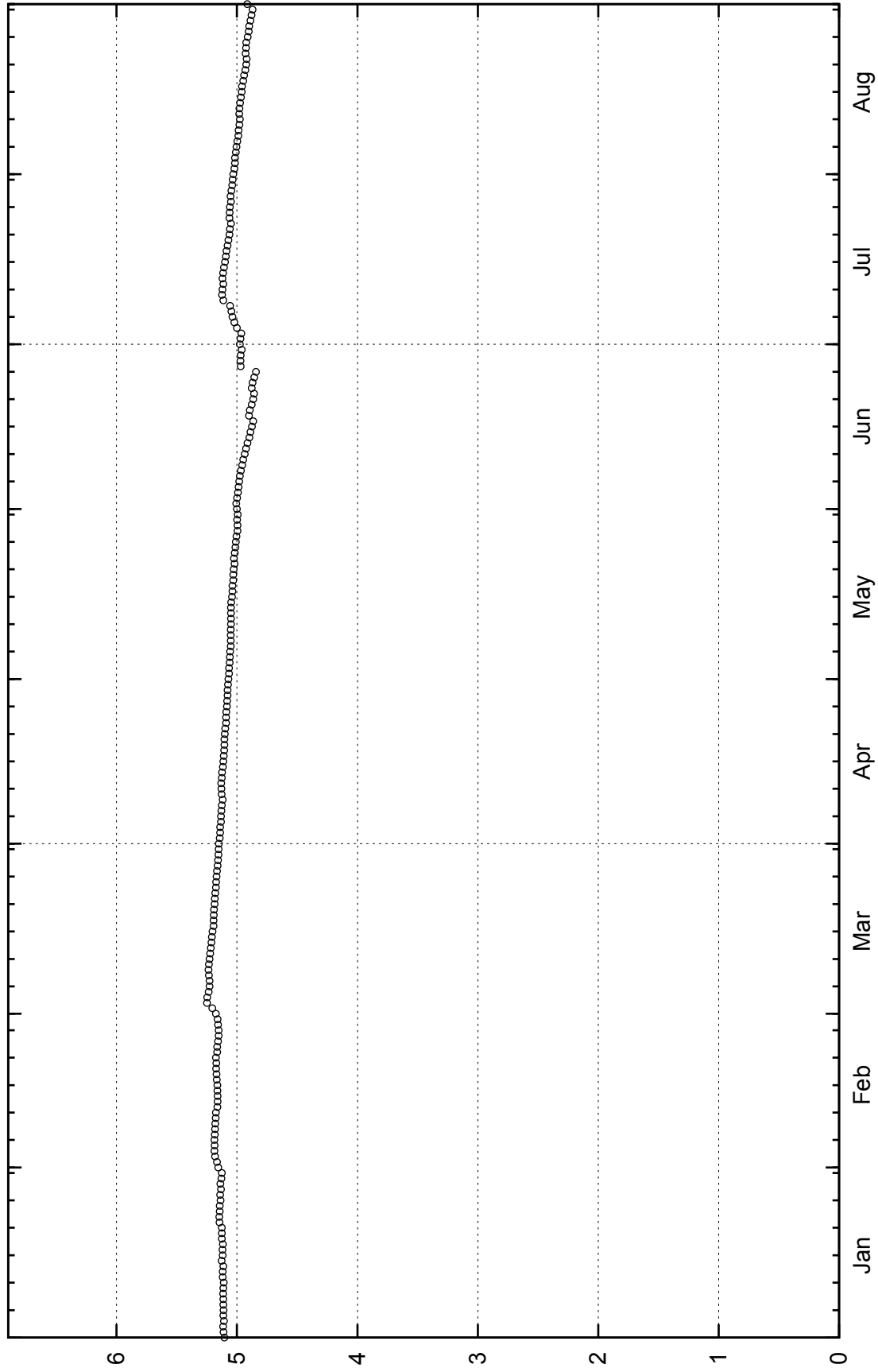
masl

SSM000032



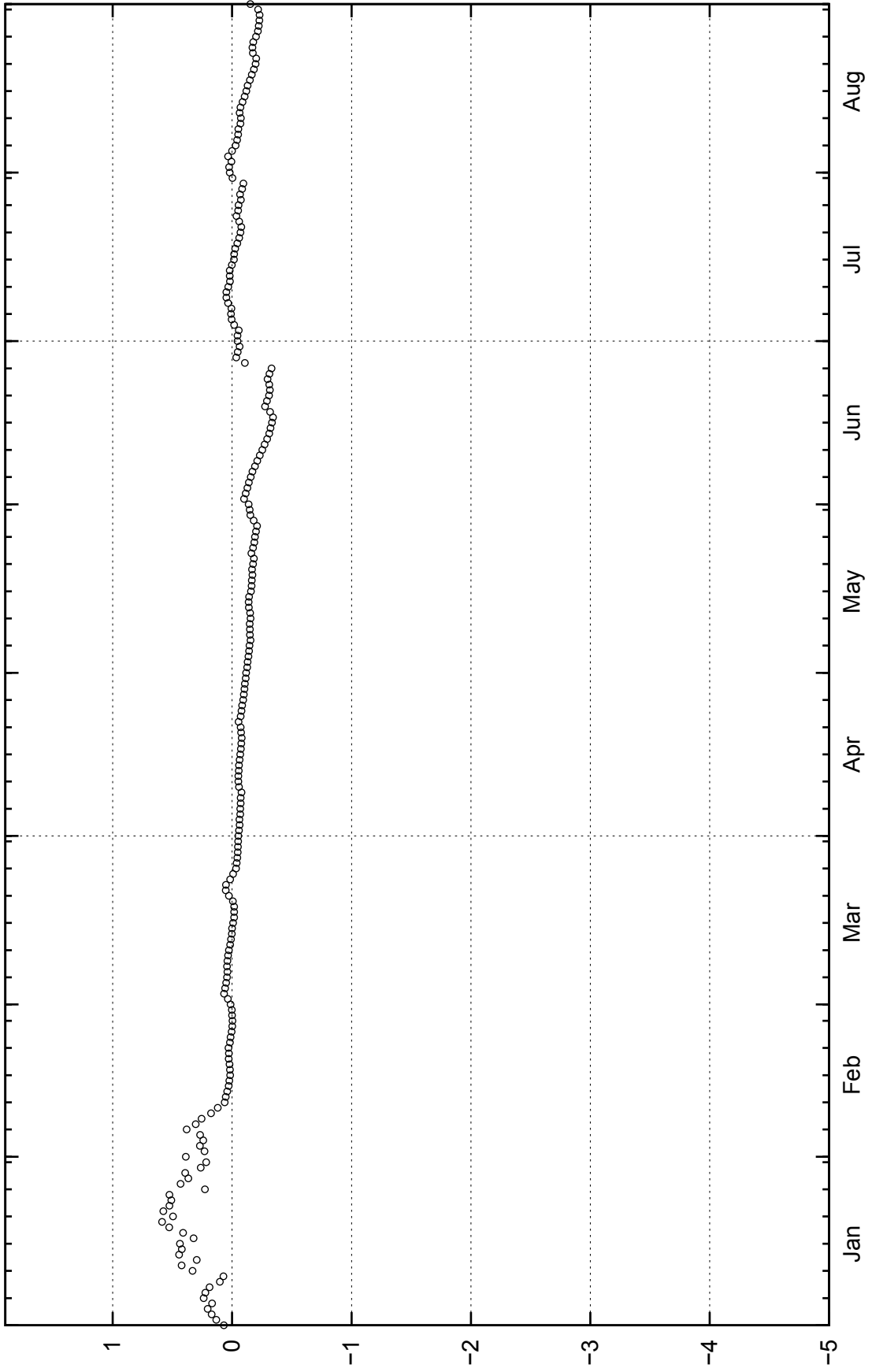
Start: 2007-01-01 month

SSM000033



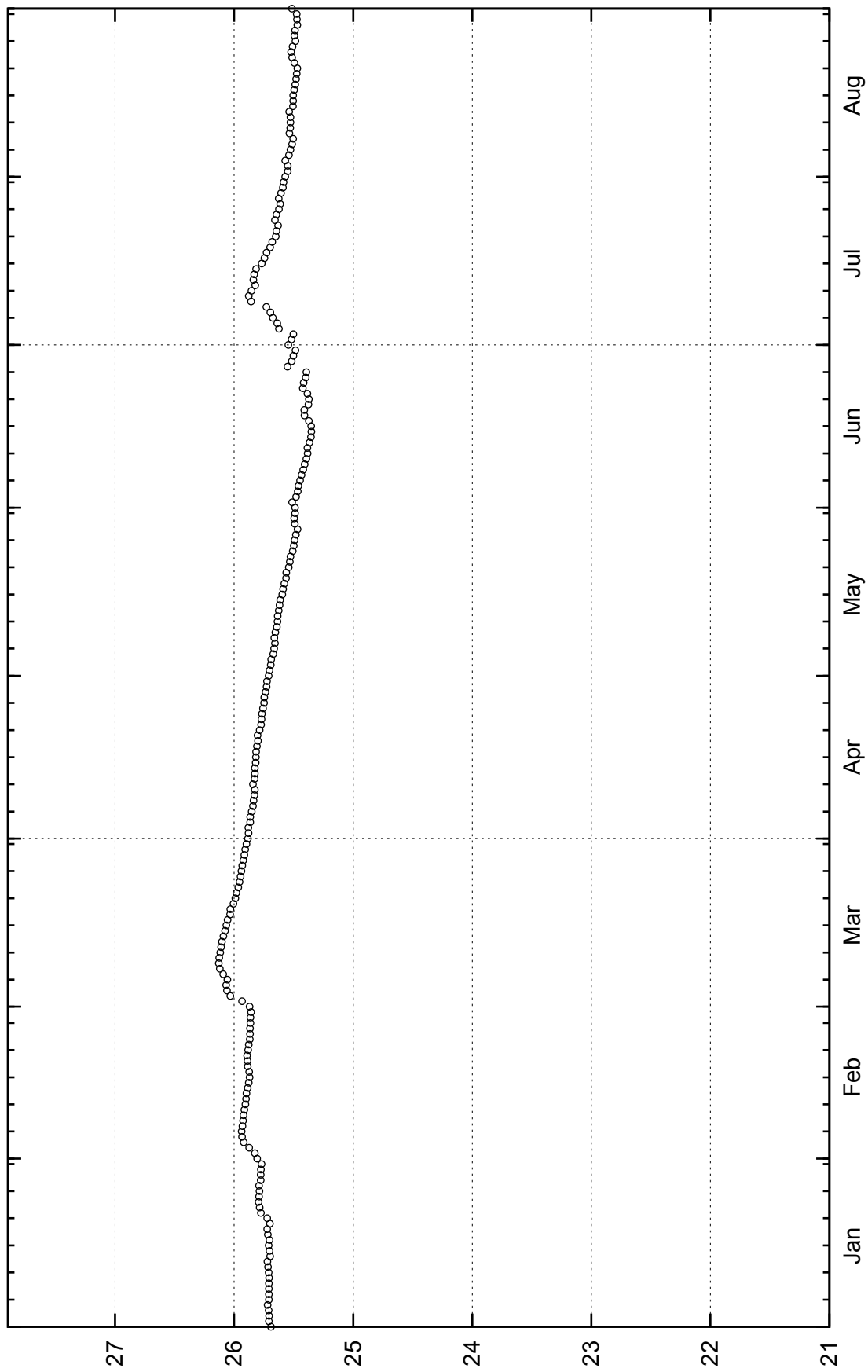
Start: 2007-01-01 month

SSM000034



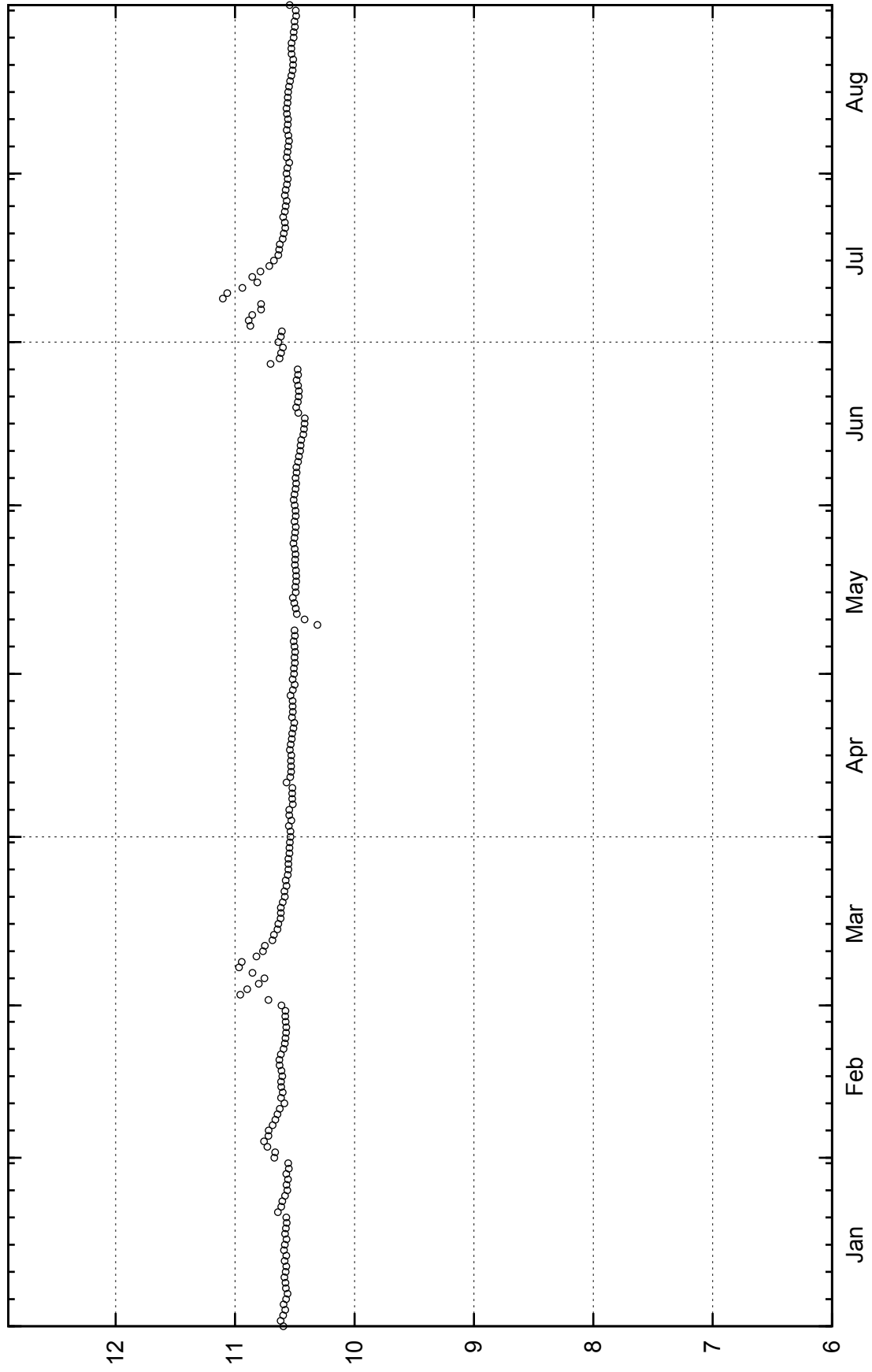
Start: 2007-01-01

SSM0000035



Start: 2007-01-01 month

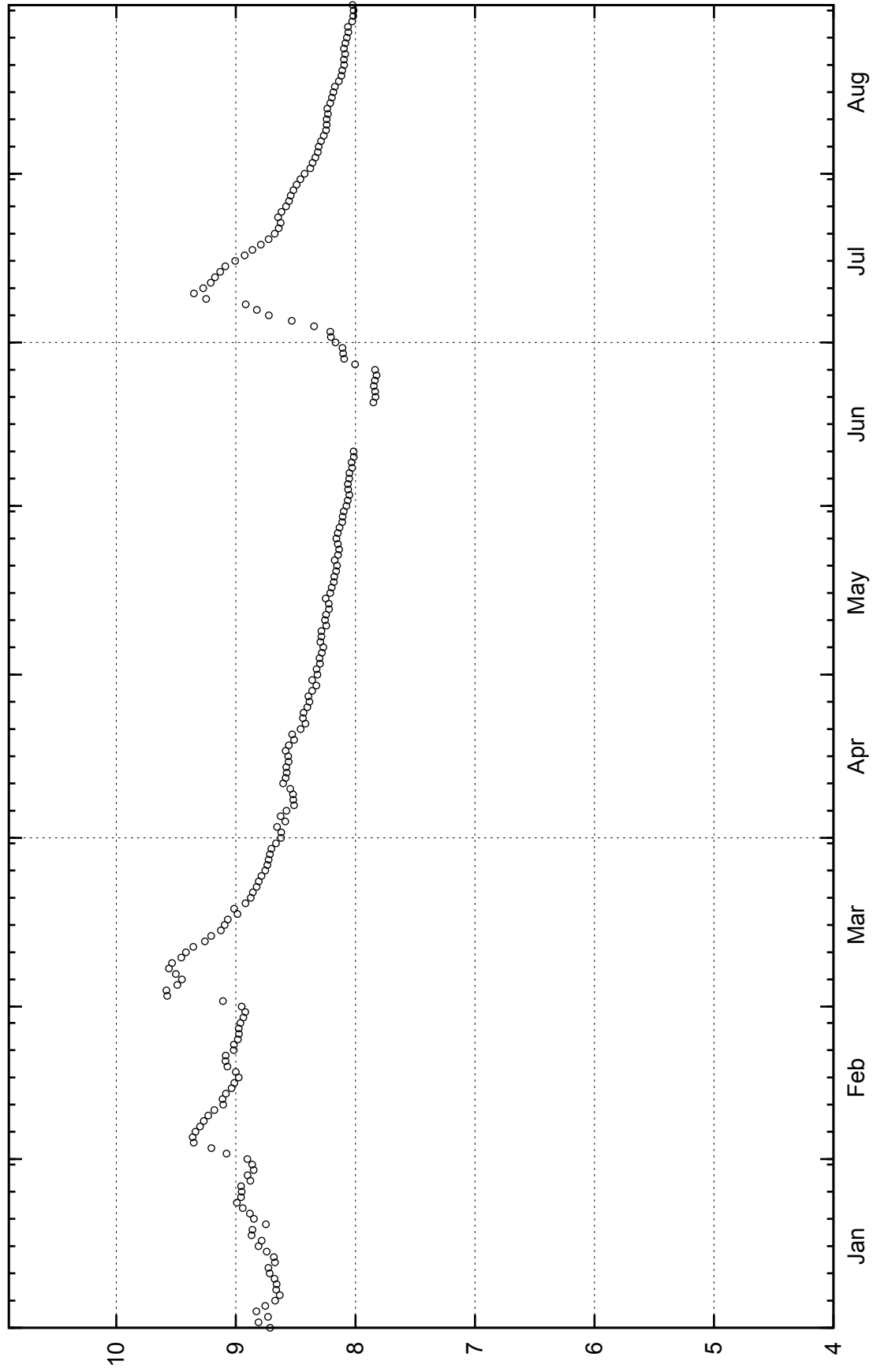
SSM000037



Start: 2007-01-01 month

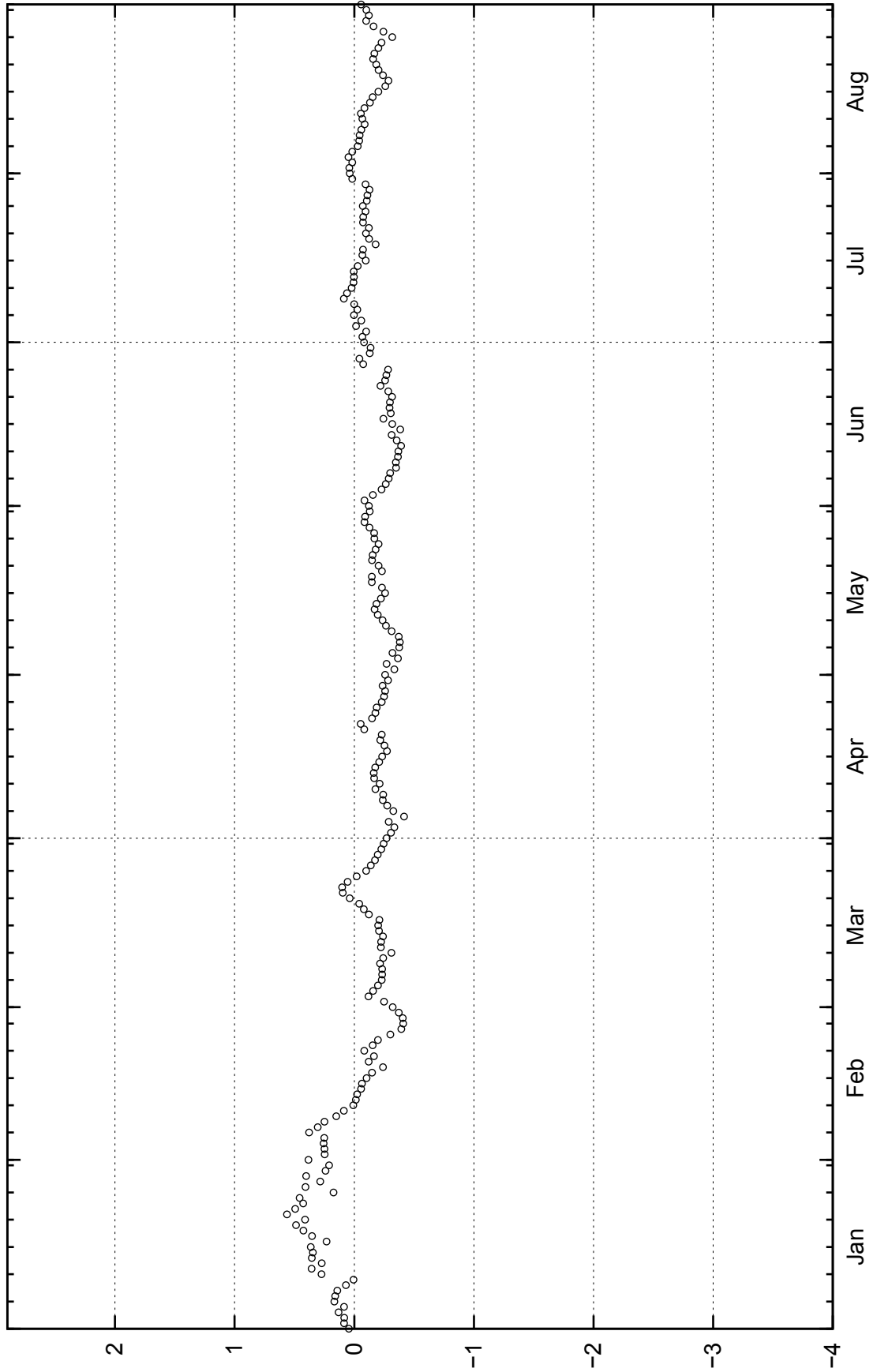
masl

SSM000039

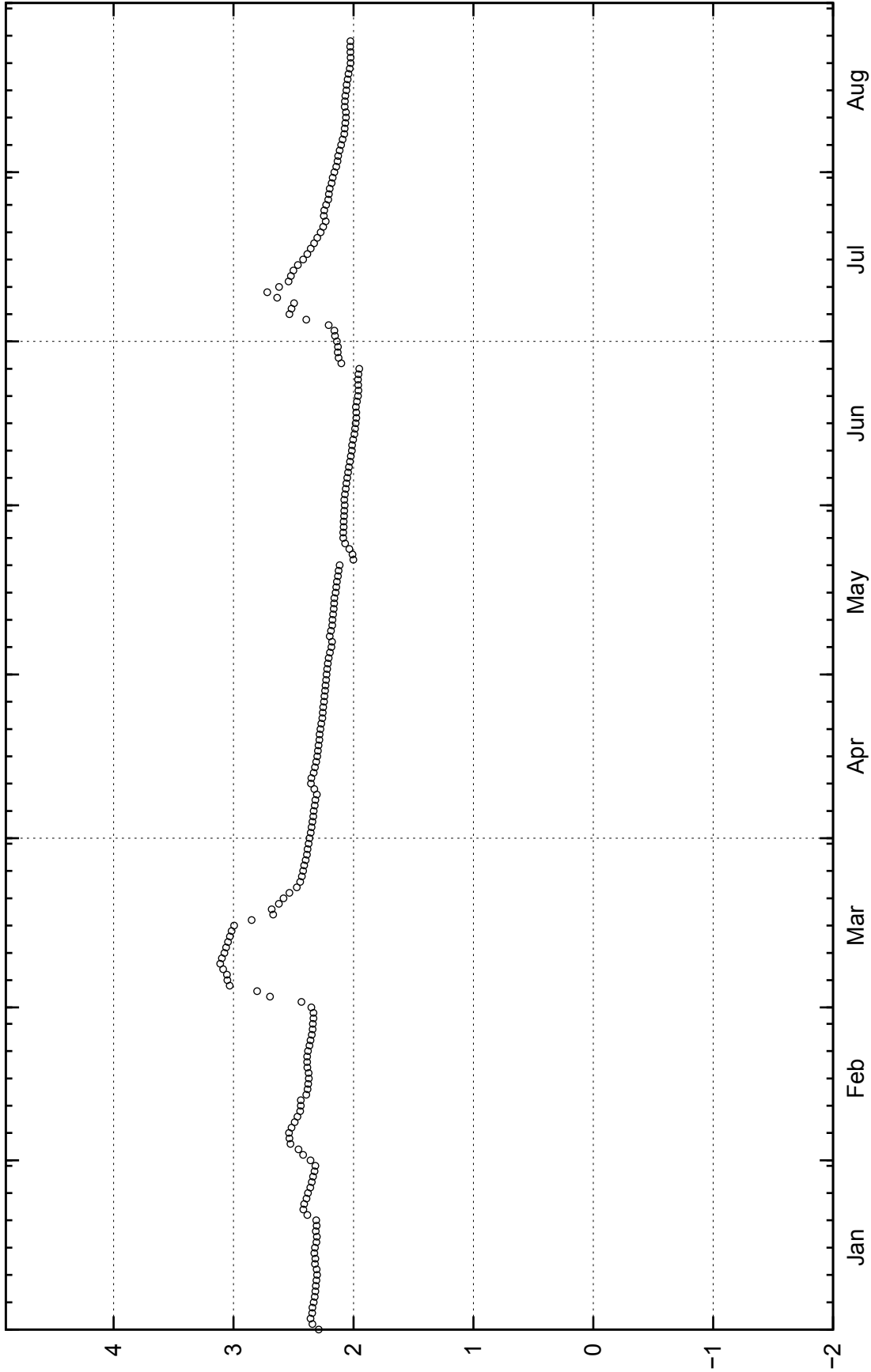


Start: 2007-01-01 month

SSM000040

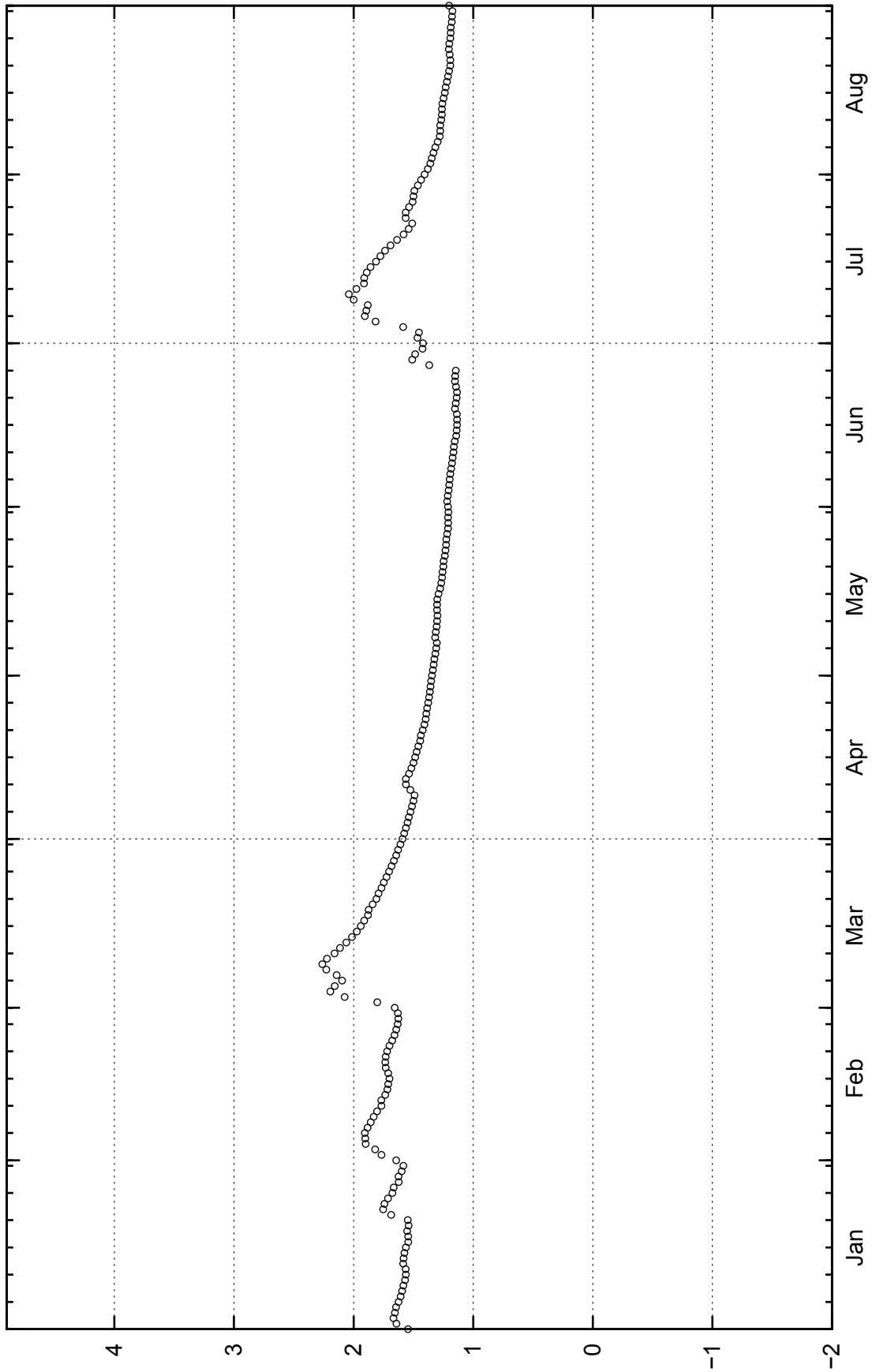


SSM000041



Start: 2007-01-01 month

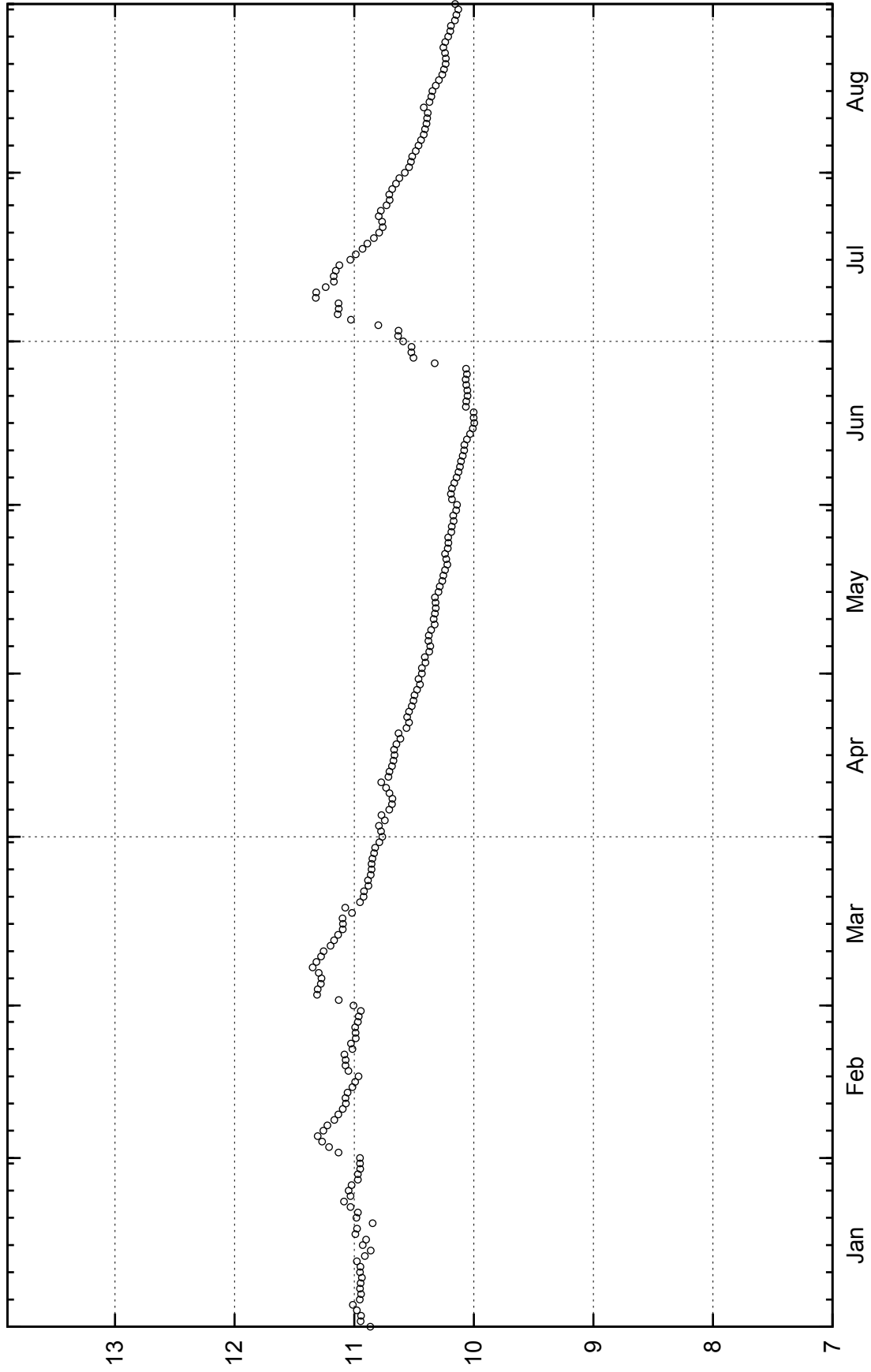
SSM000042



Start: 2007-01-01 month

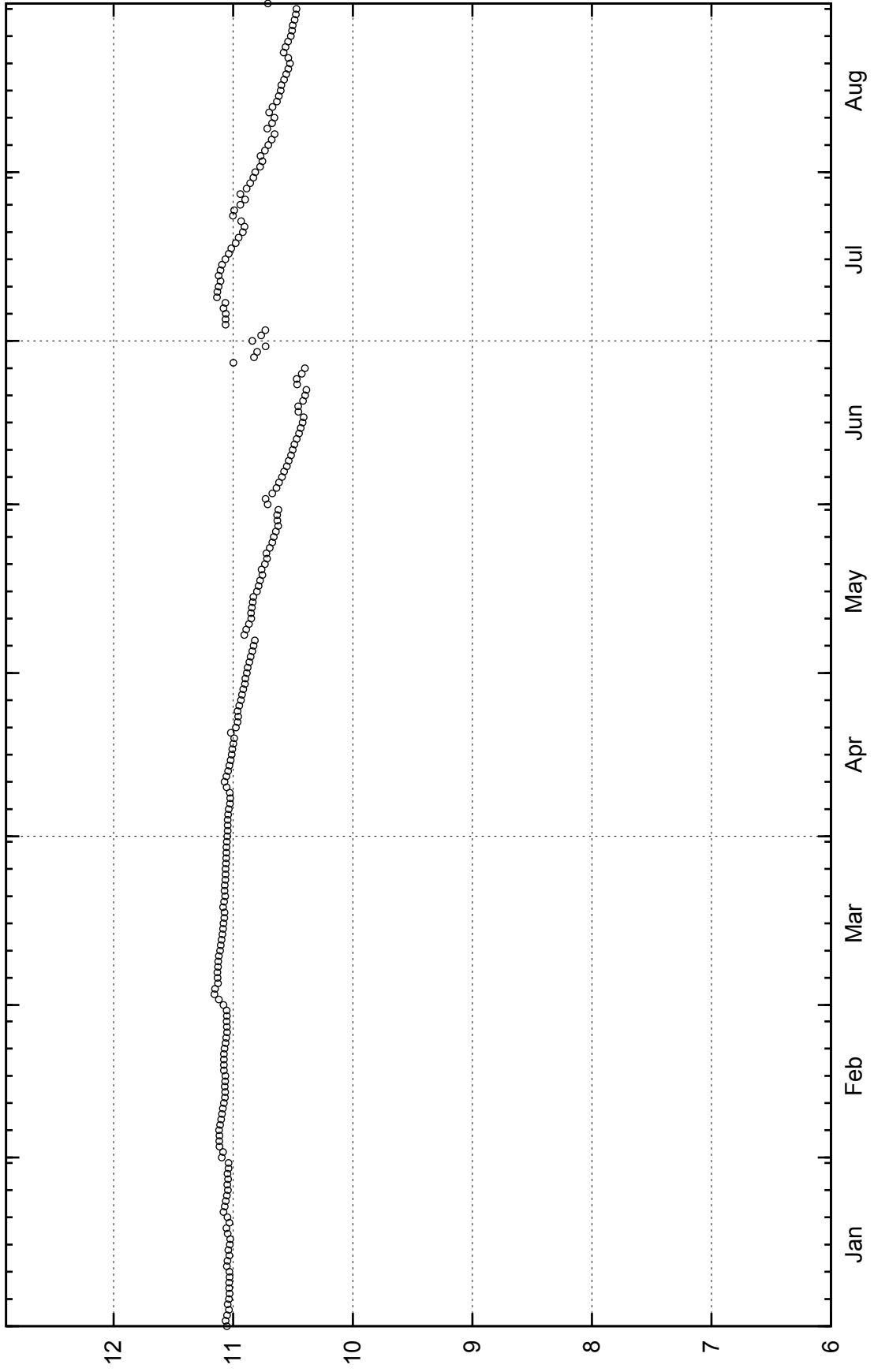
masl

SSM000210



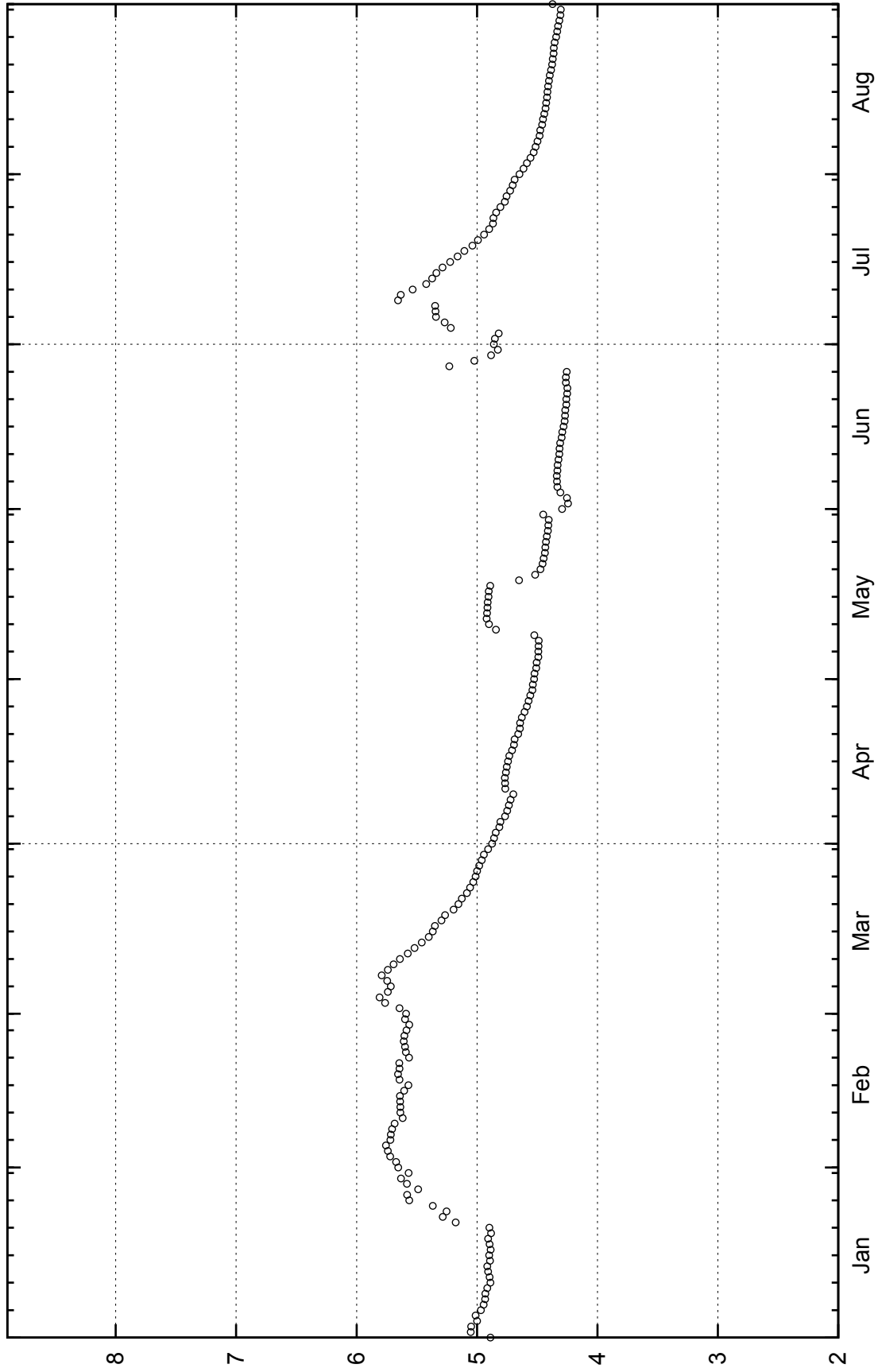
Start: 2007-01-01 month

SSM000213



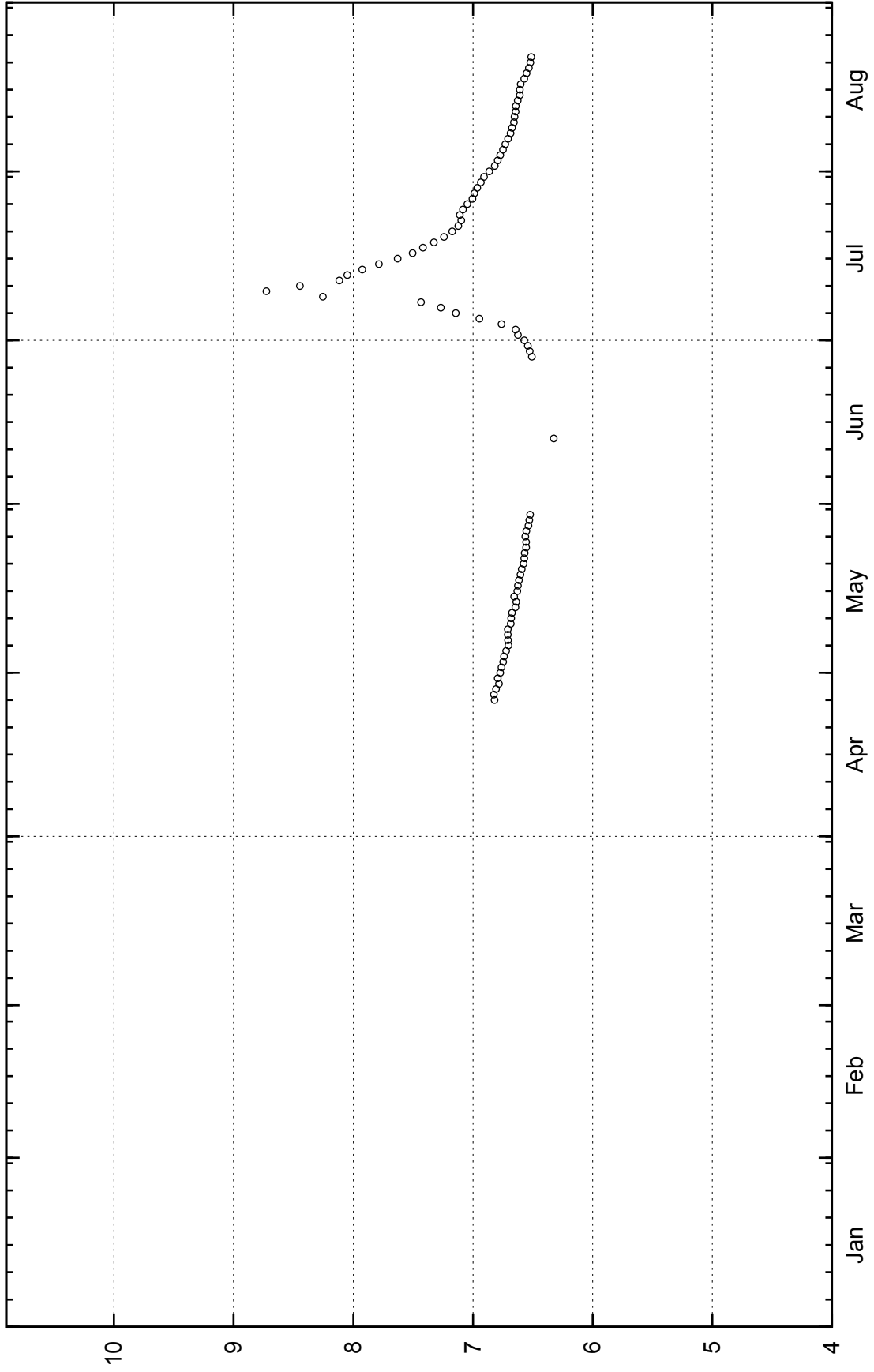
Start: 2007-01-01 month

SSM000215



Start: 2007-01-01 month

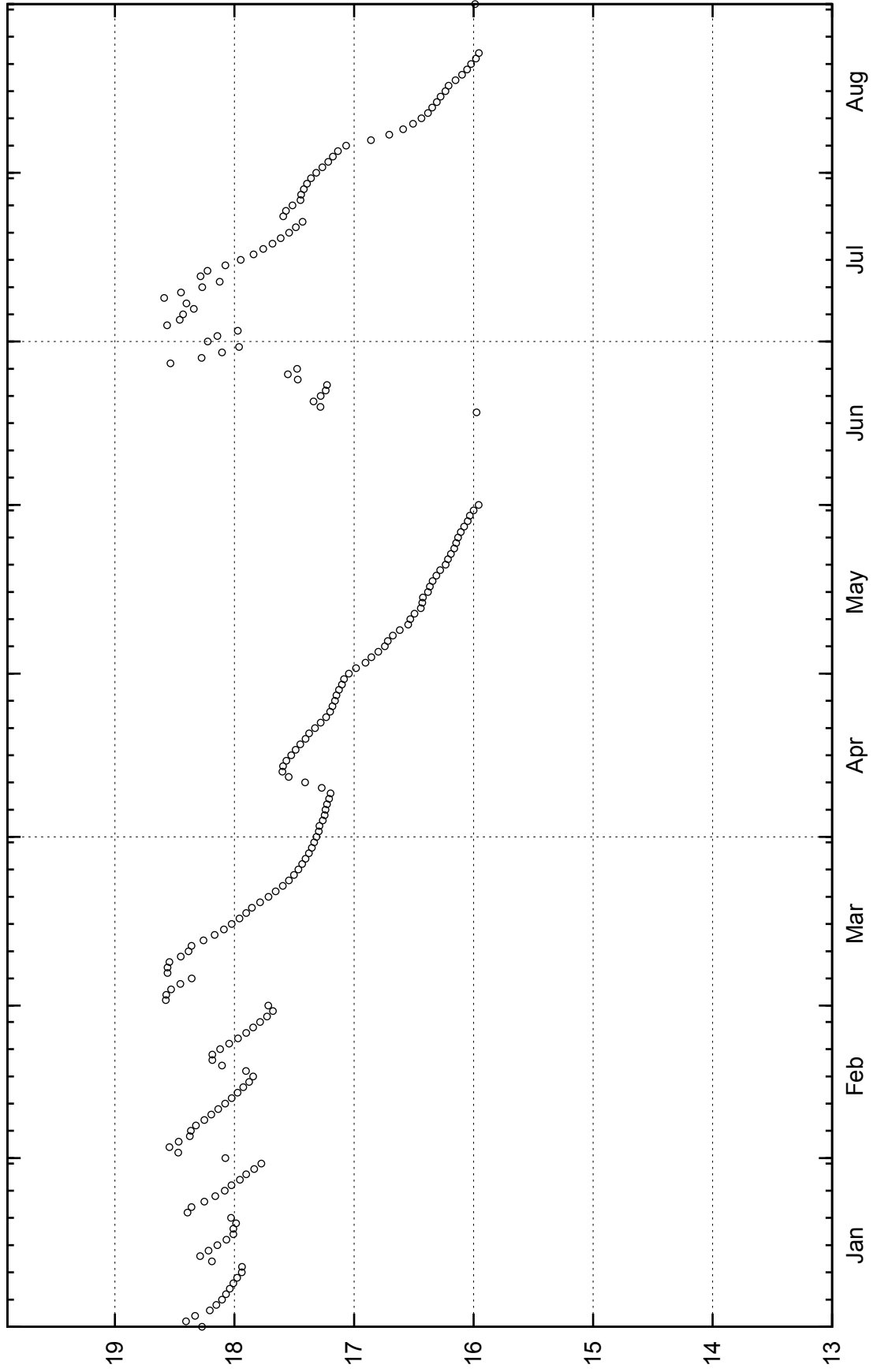
SSM000217



Start: 2007-01-01 month

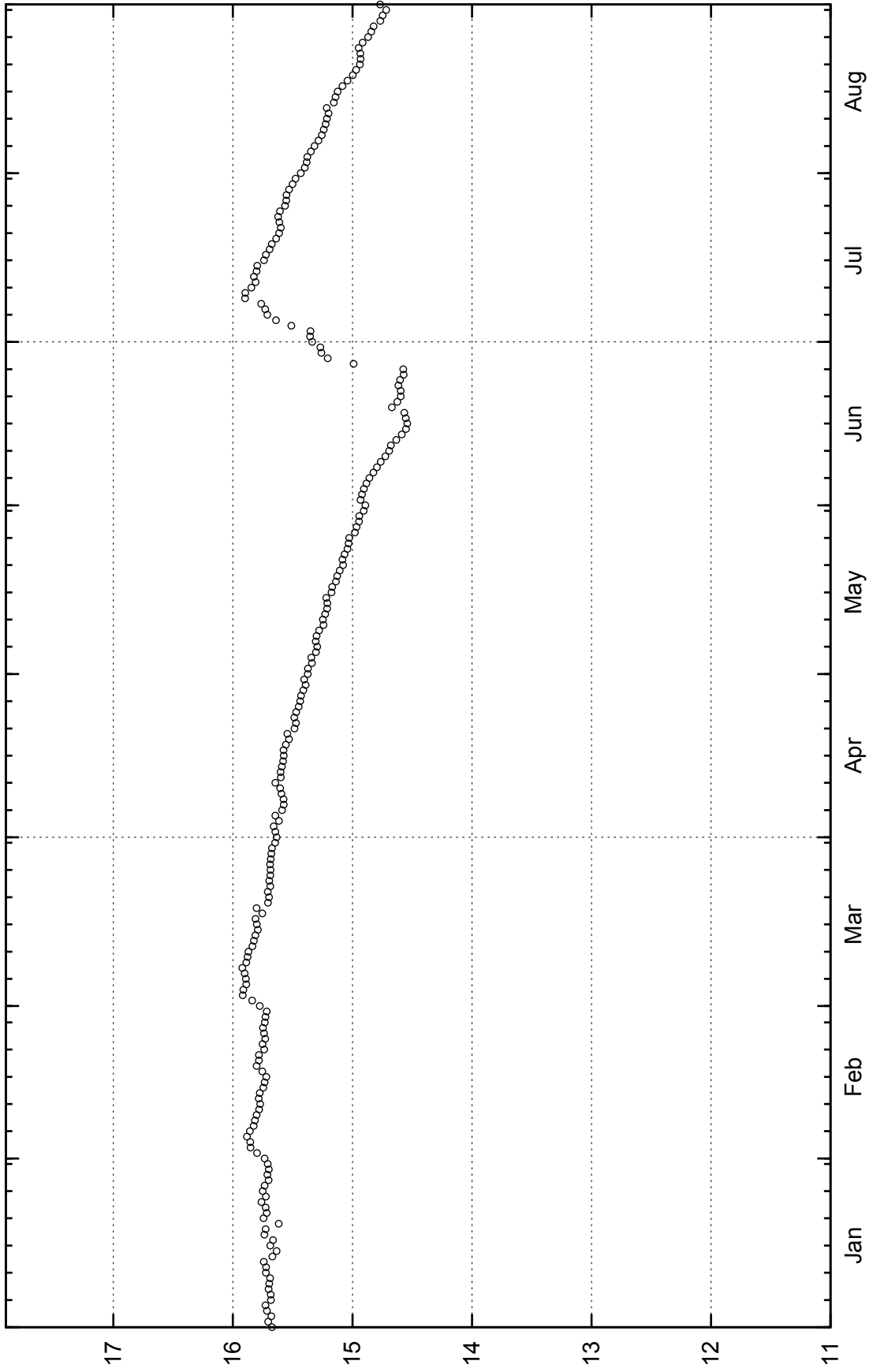
masl

SSM000218



Start: 2007-01-01 month

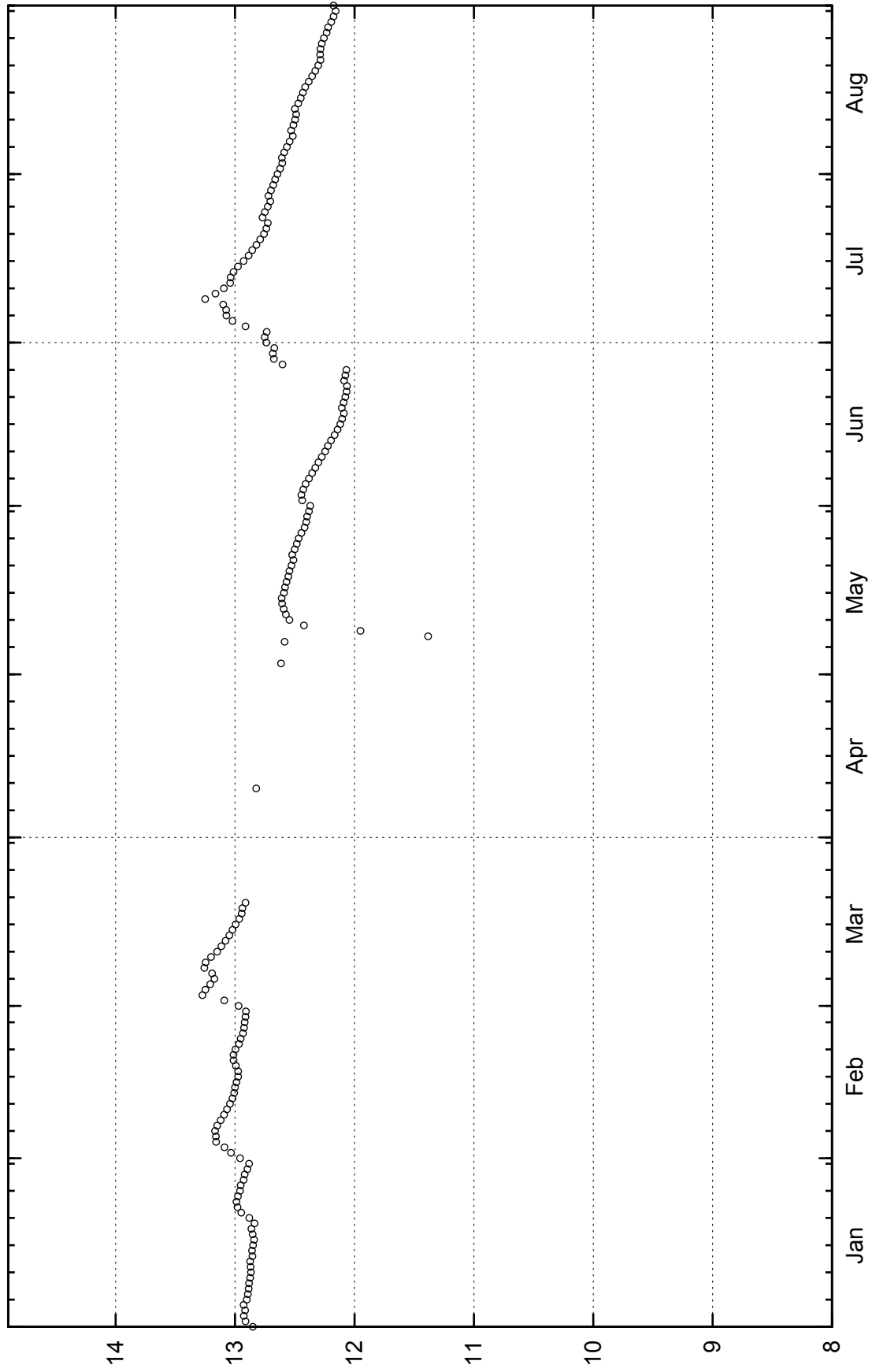
SSM000219



Start: 2007-01-01 month

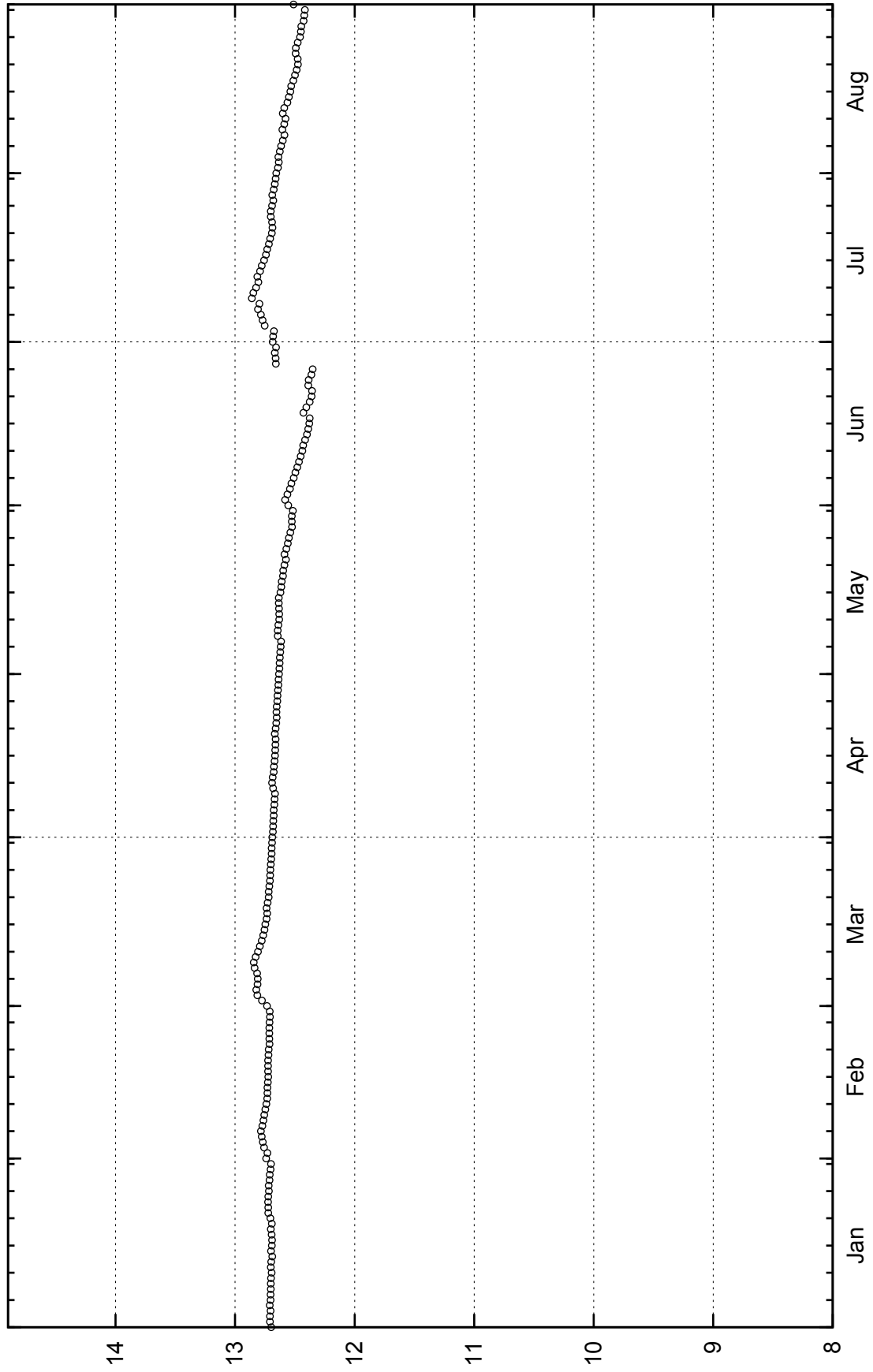
masu

SSM000220



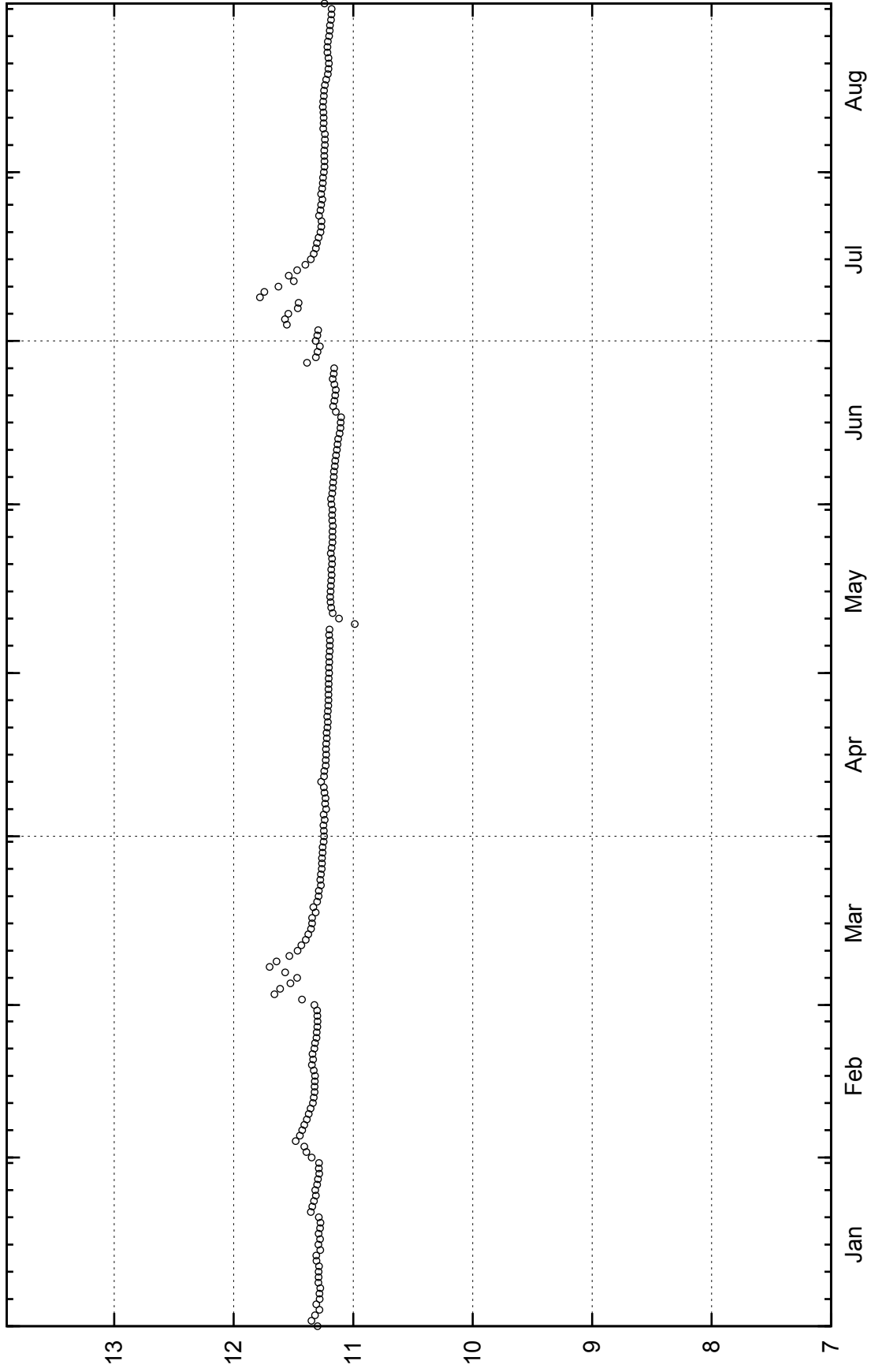
Start: 2007-01-01 month

SSM000221



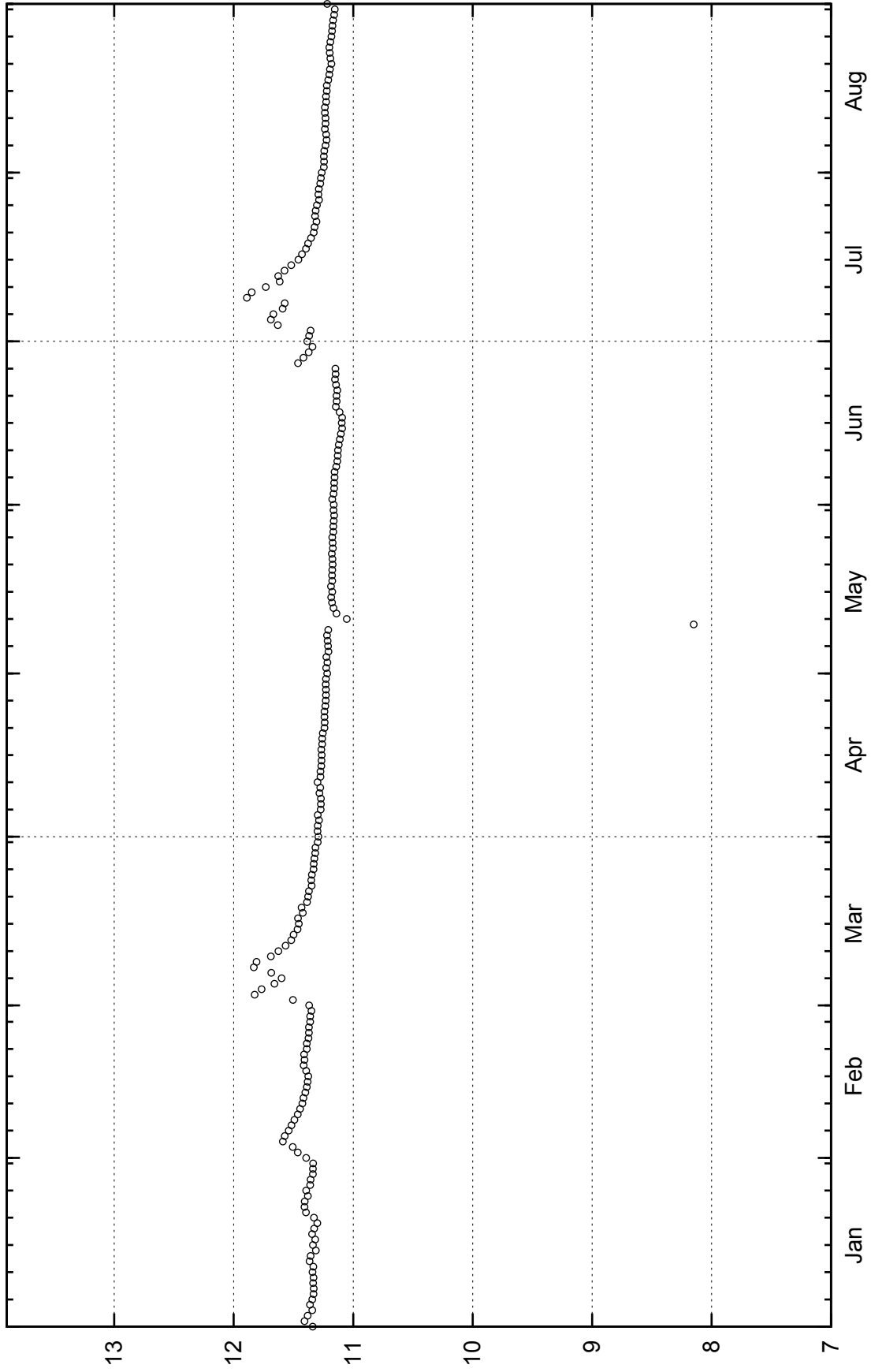
Start: 2007-01-01 month

SSM000222



Start: 2007-01-01 month

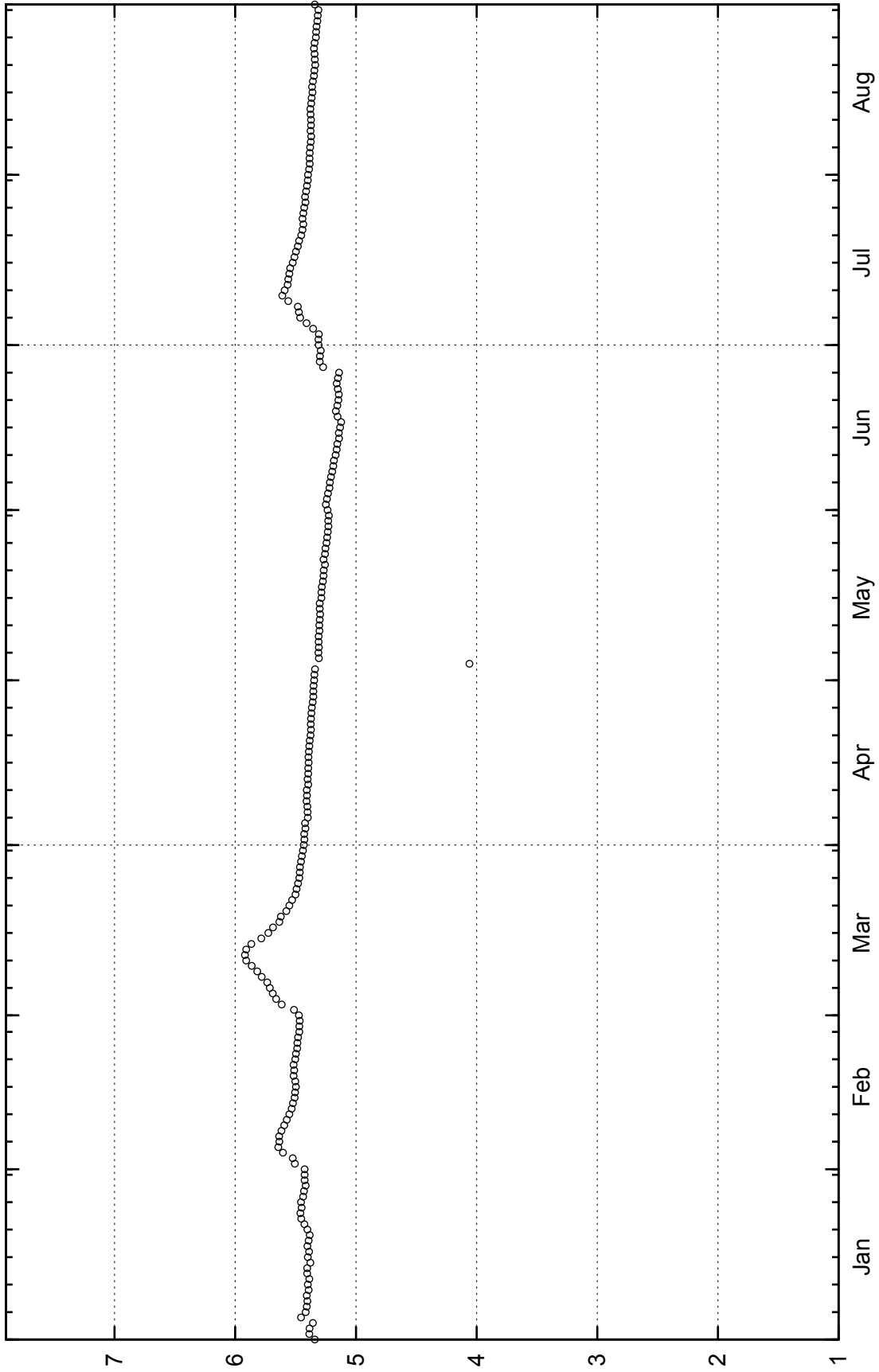
SSM000223



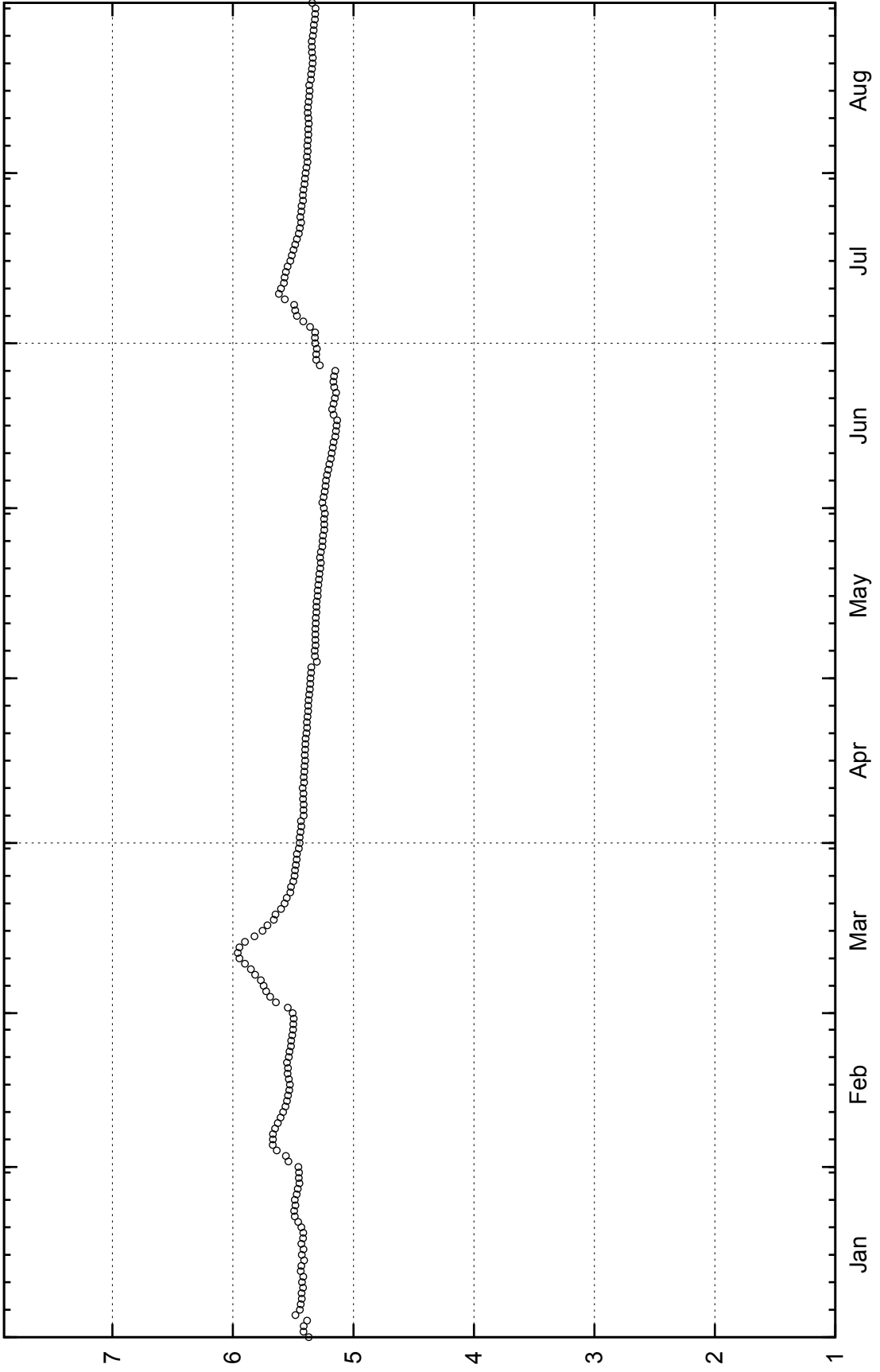
Start: 2007-01-01 month

masl

SSM000224

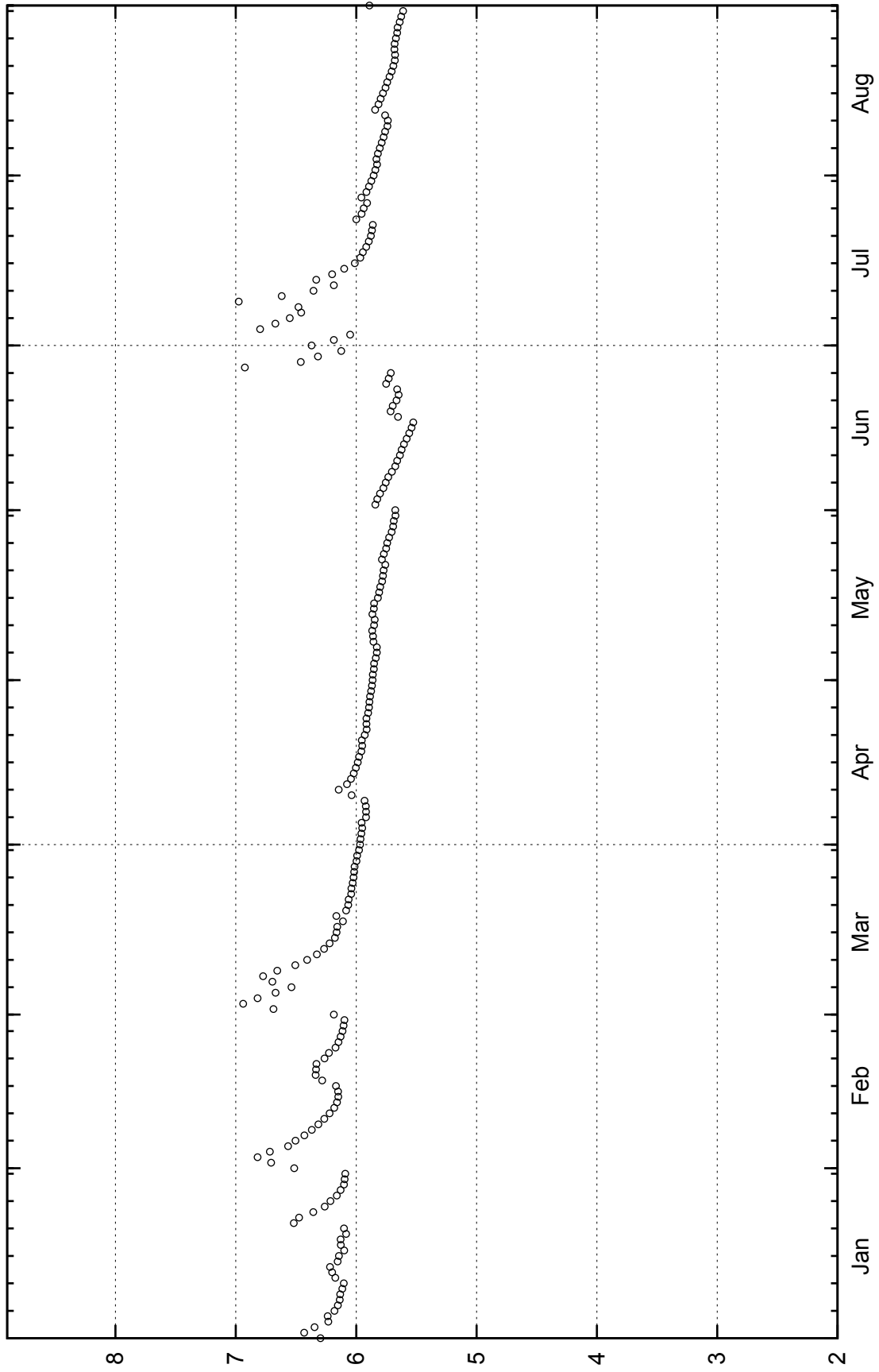


SSM000225



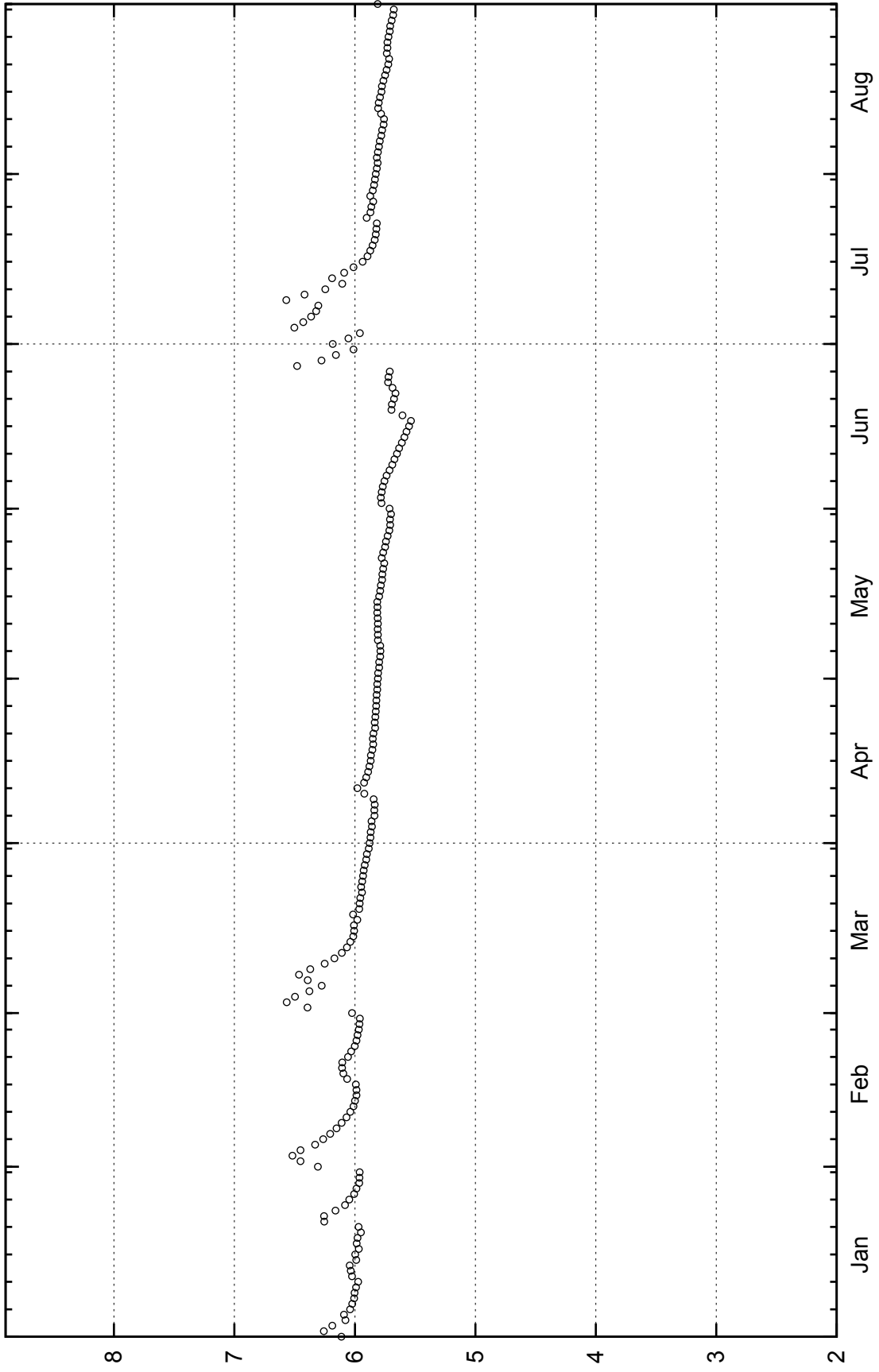
Start: 2007-01-01 month

SSM0000226



Start: 2007-01-01 month

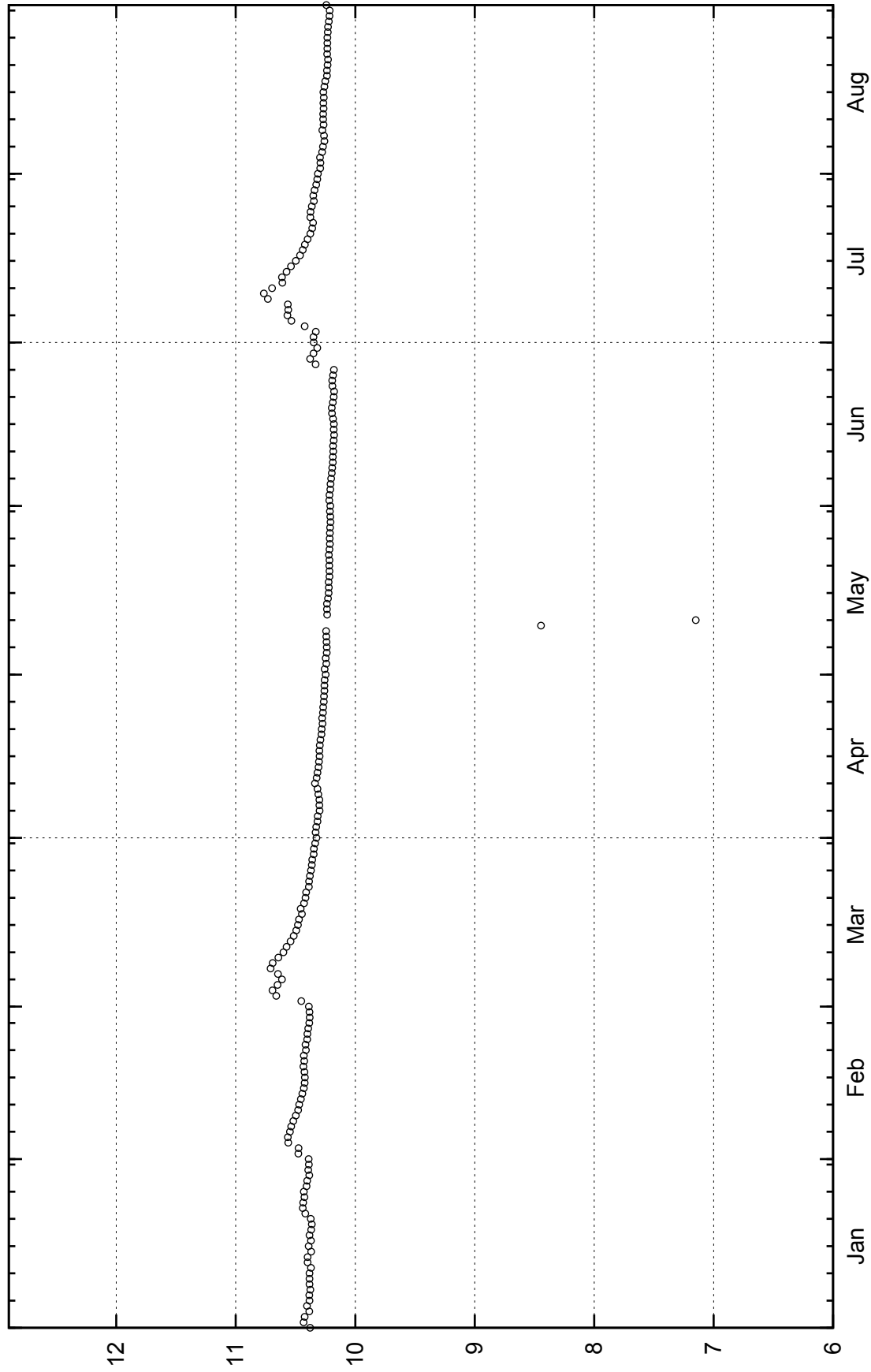
SSM000227



Start: 2007-01-01 month

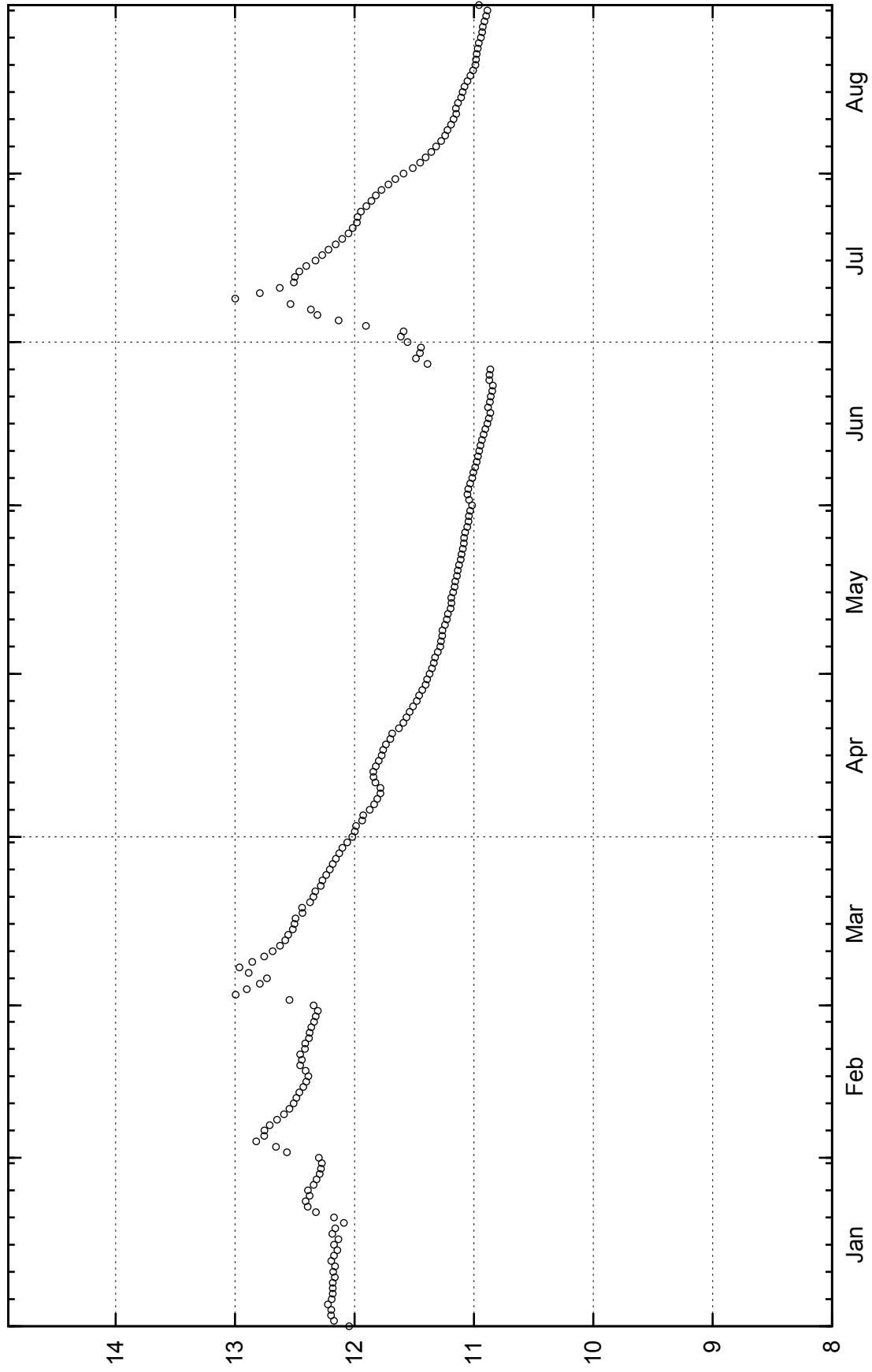
masl

SSM000228



Start: 2007-01-01 month

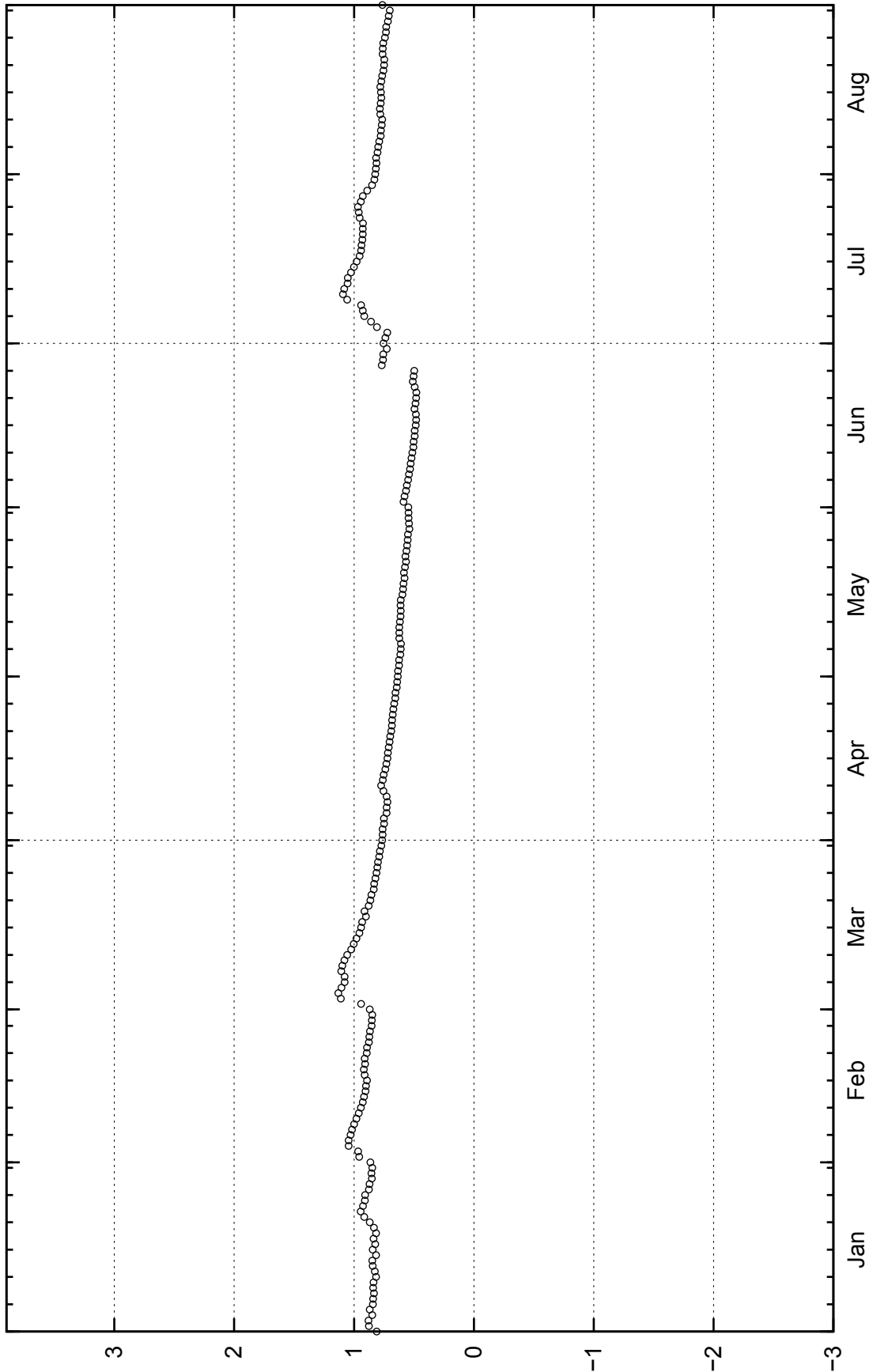
SSM000229



Start: 2007-01-01 month

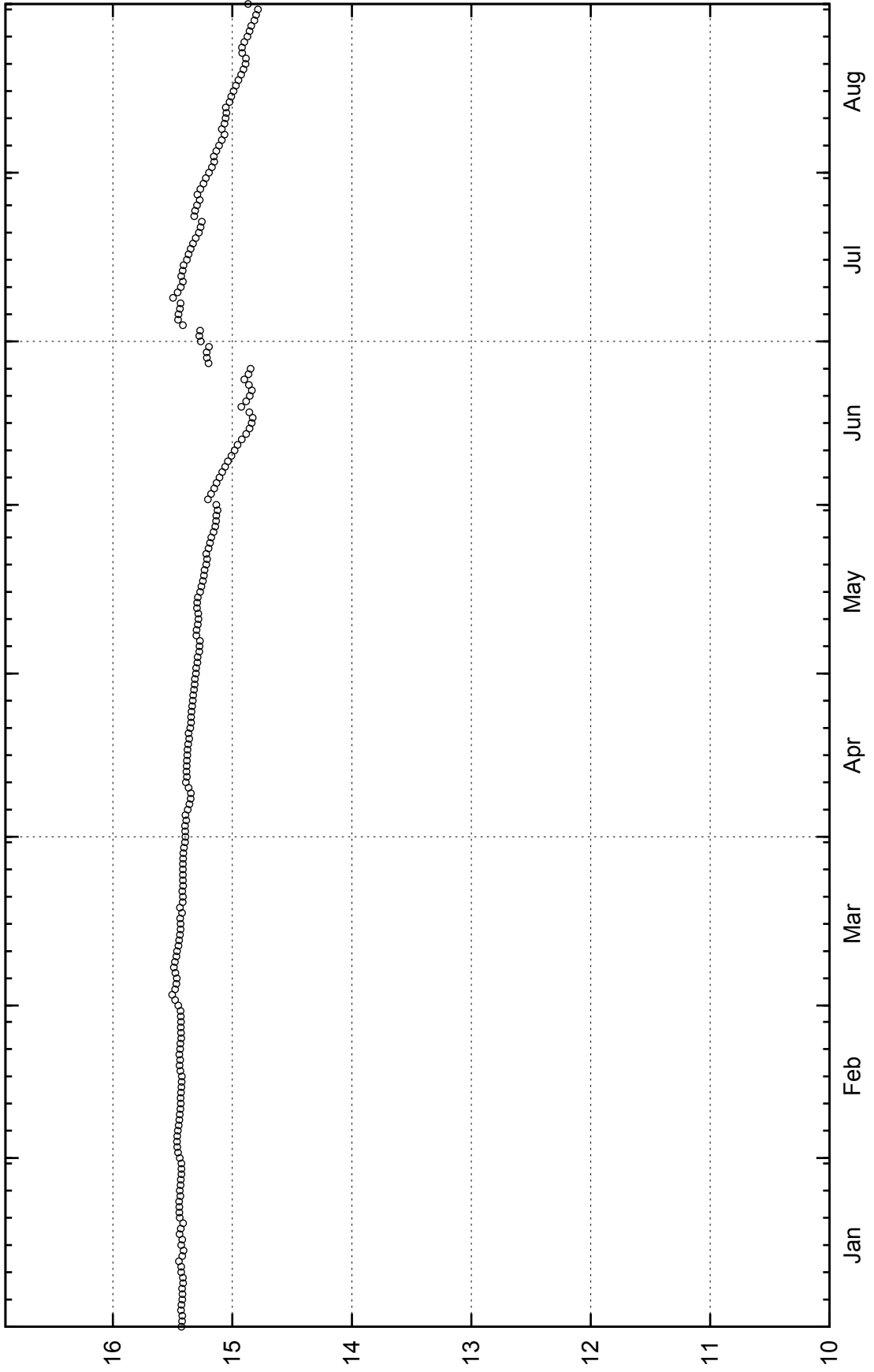
masl

SSM000230



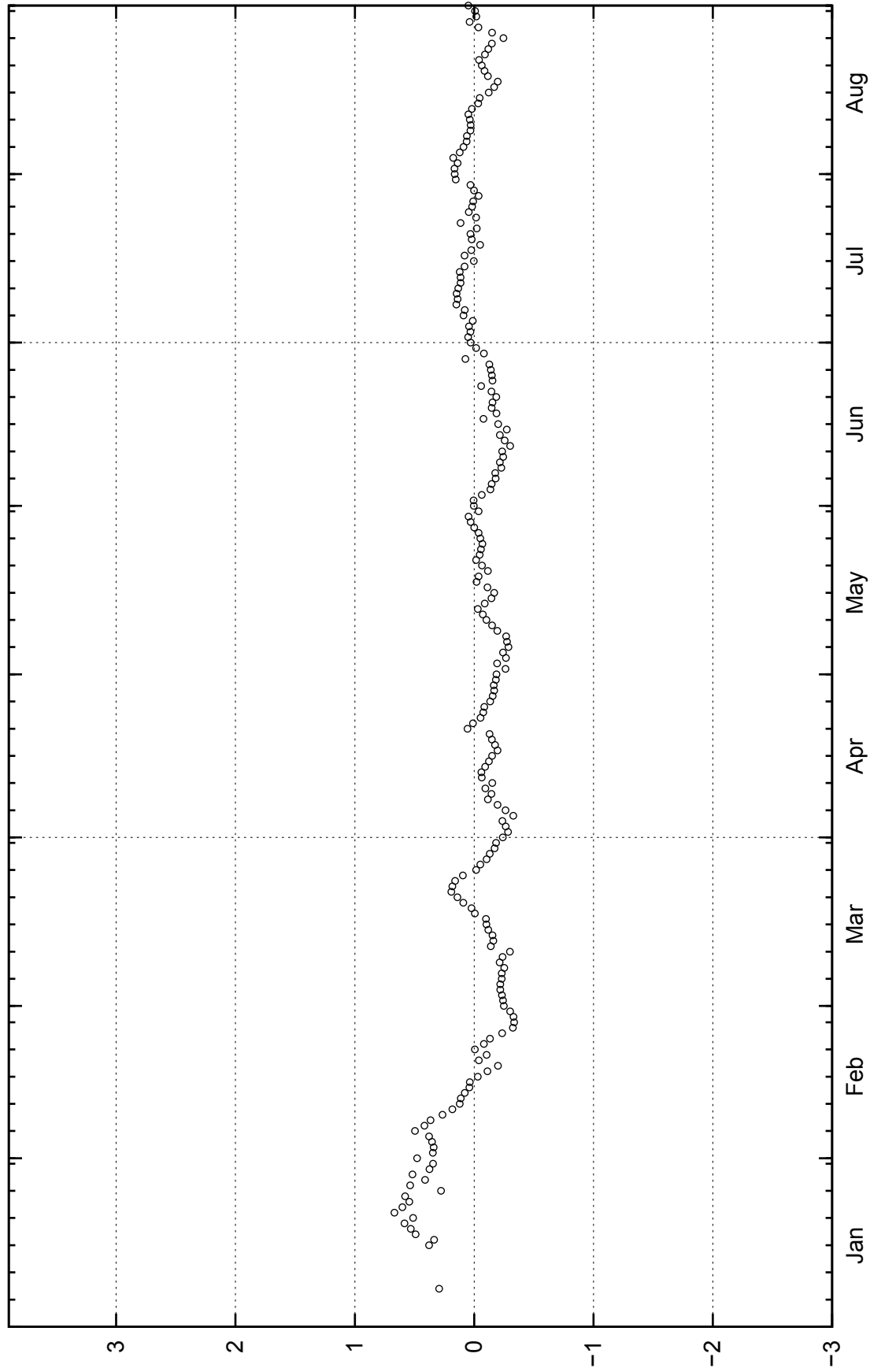
Start: 2007-01-01 month

SSM000237



Start: 2007-01-01 month

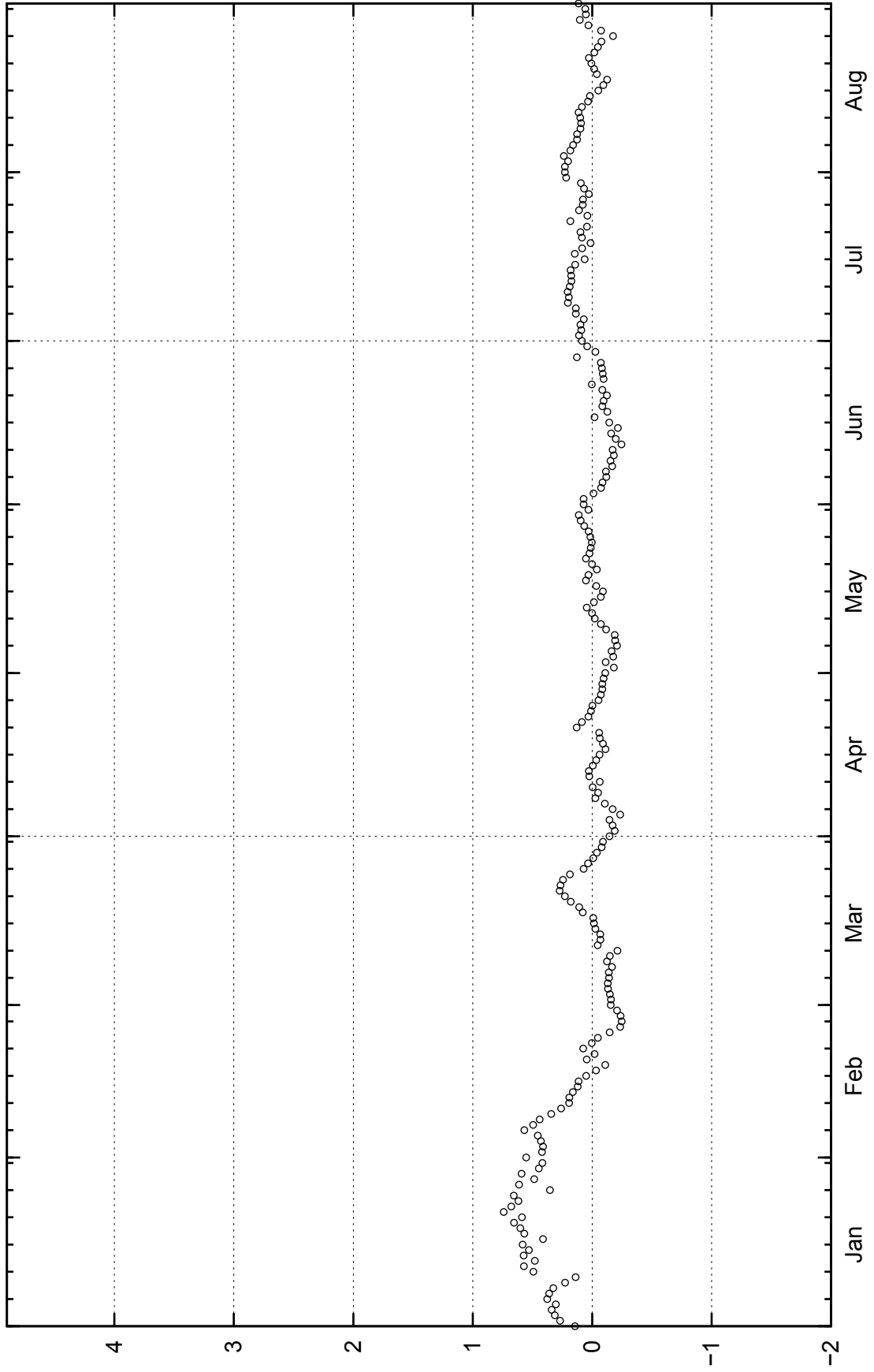
SSM000238



Start: 2007-01-01 month

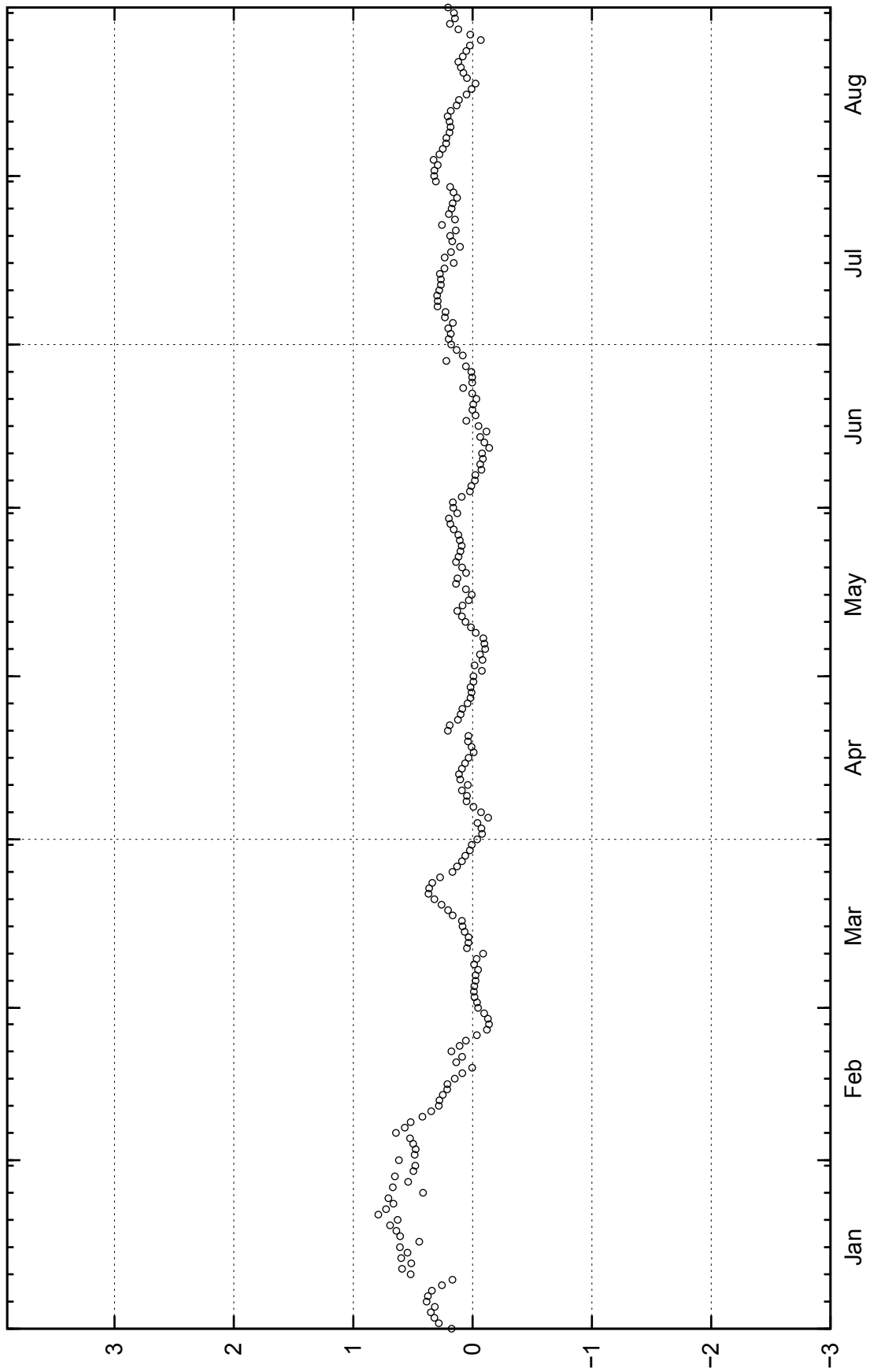
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SSM000239



Start: 2007-01-01 month

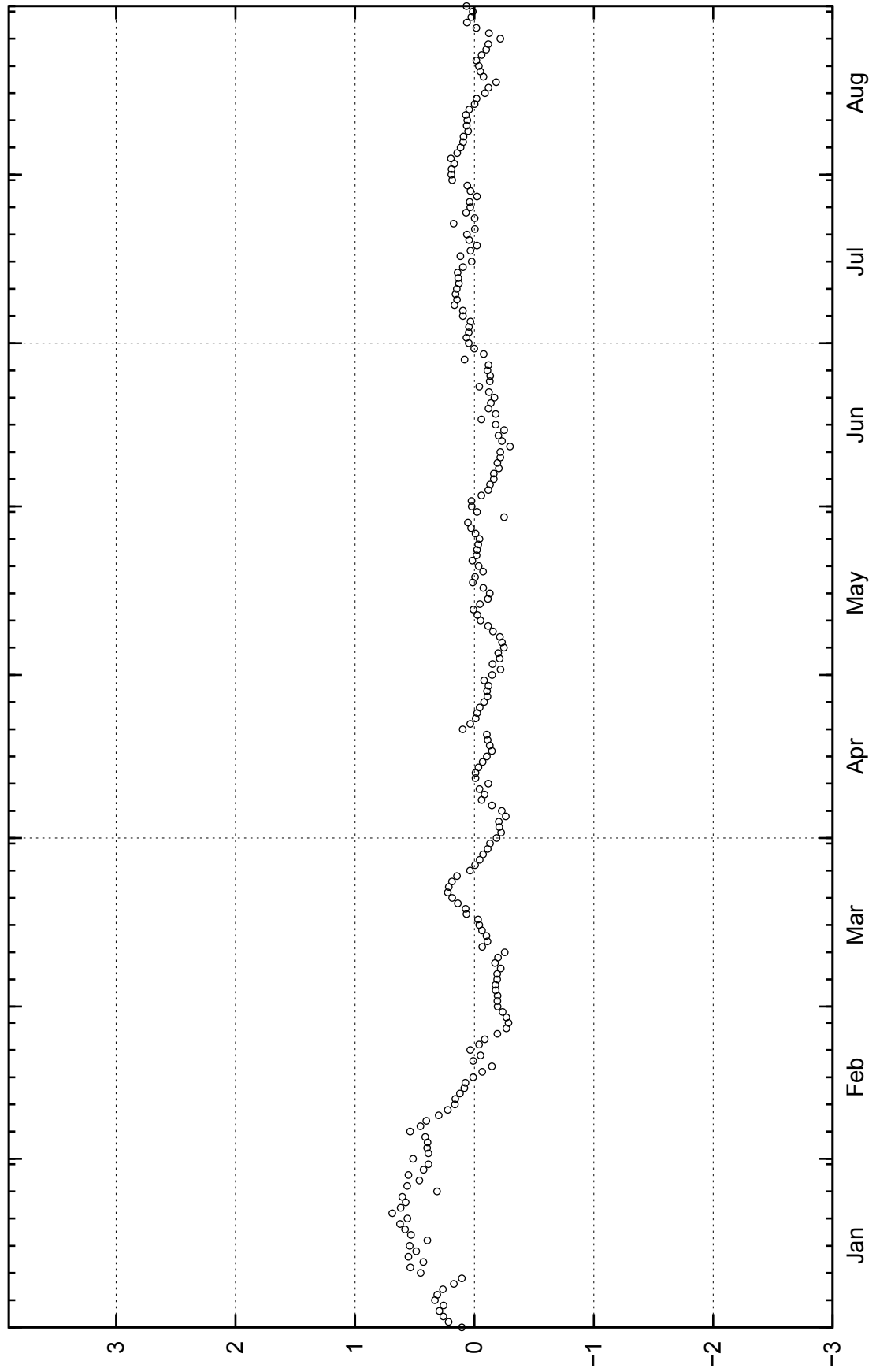
SSM000240



Start: 2007-01-01 month

masl

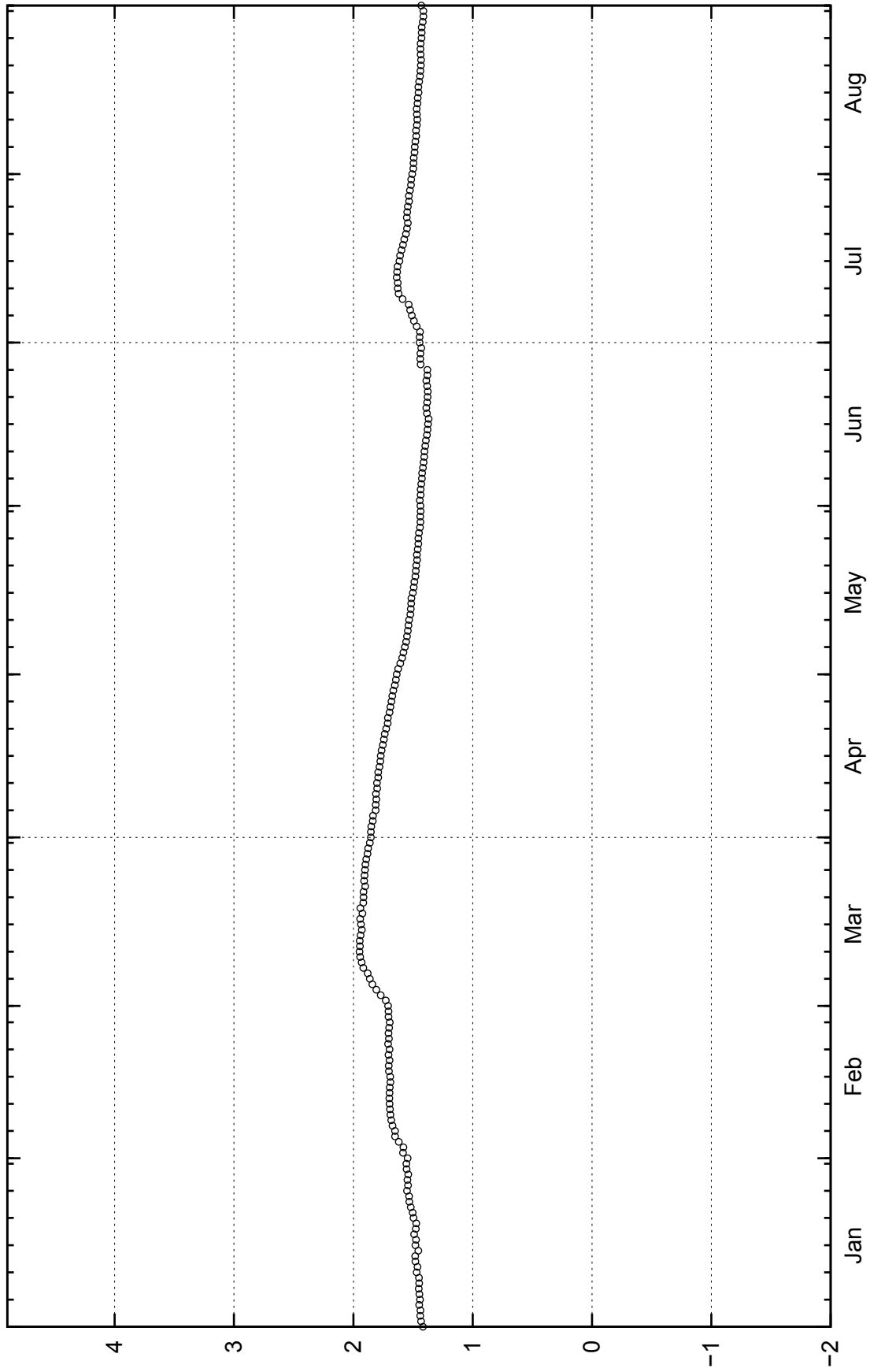
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Start: 2007-01-01 month

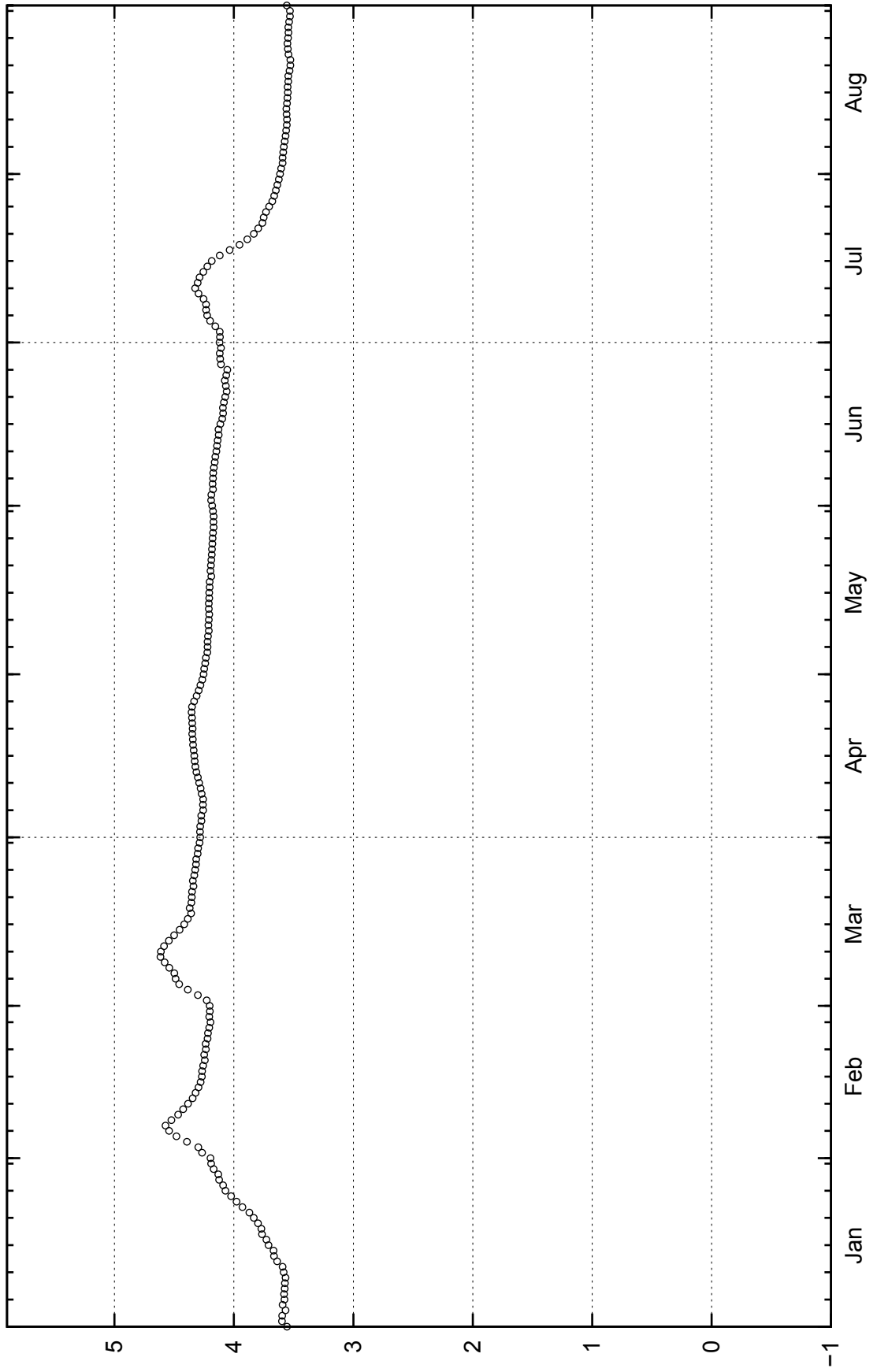
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SSM000242



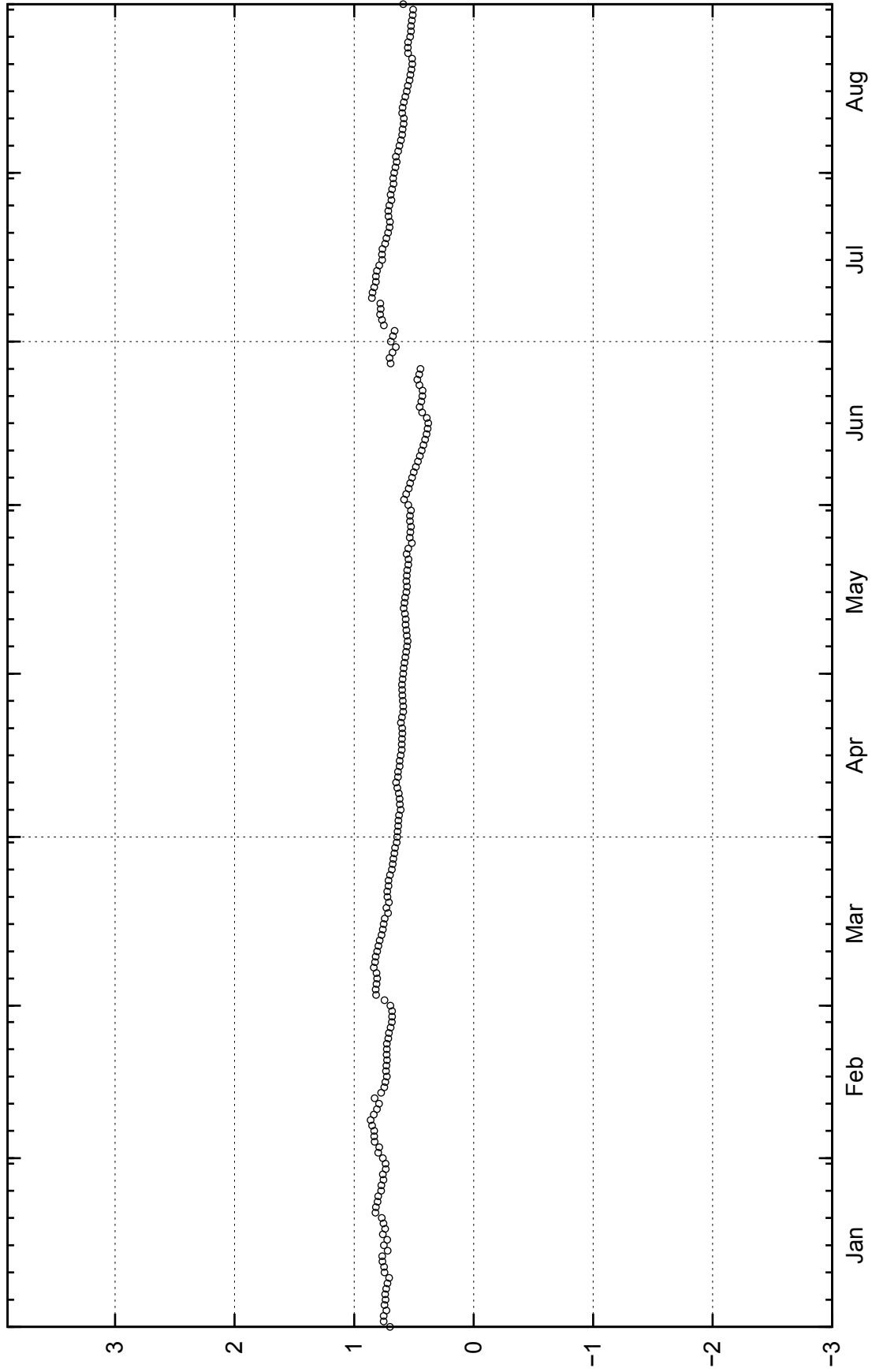
Start: 2007-01-01 month

SSM000243



Start: 2007-01-01 month

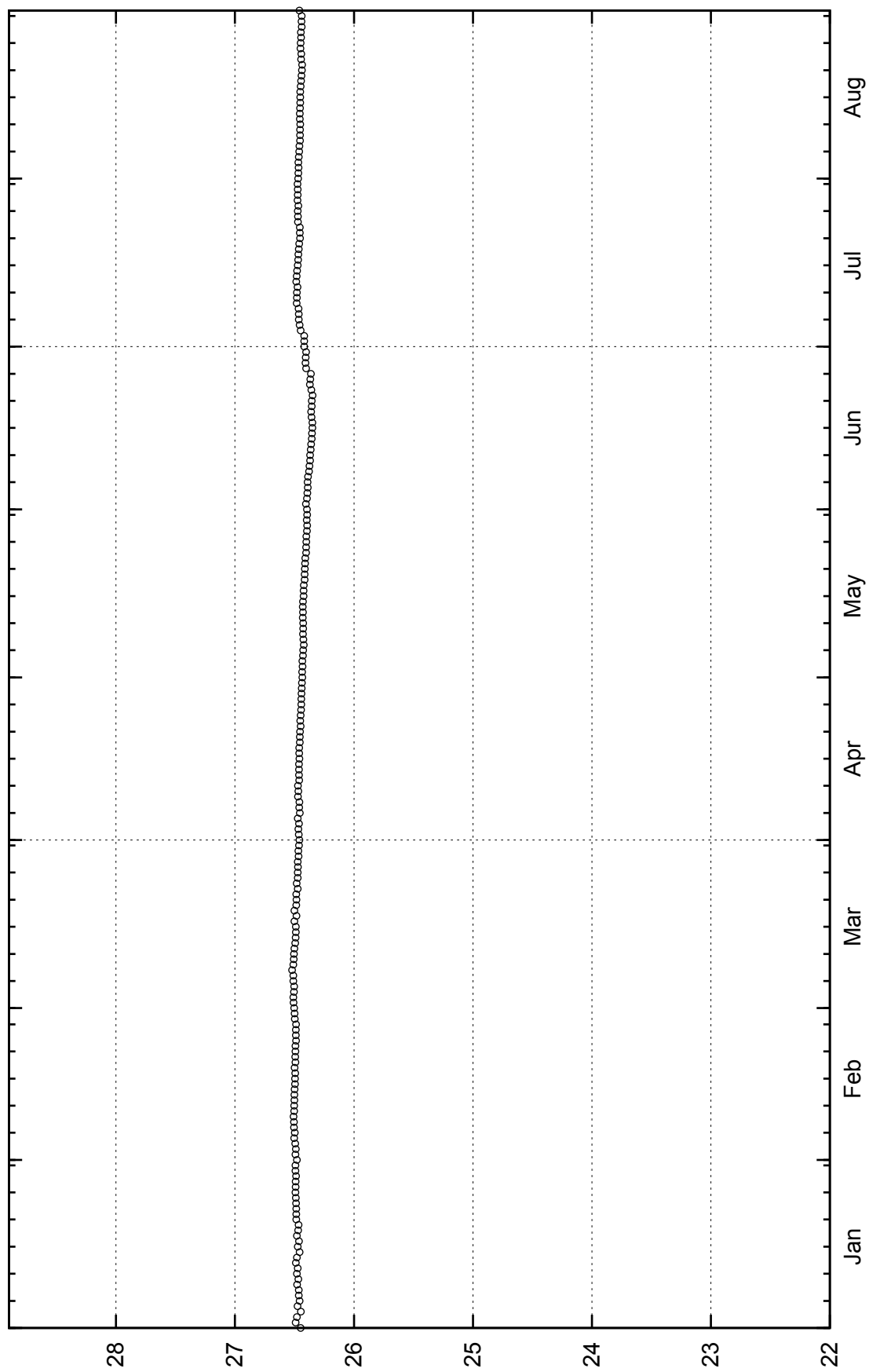
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Start: 2007-01-01

masl

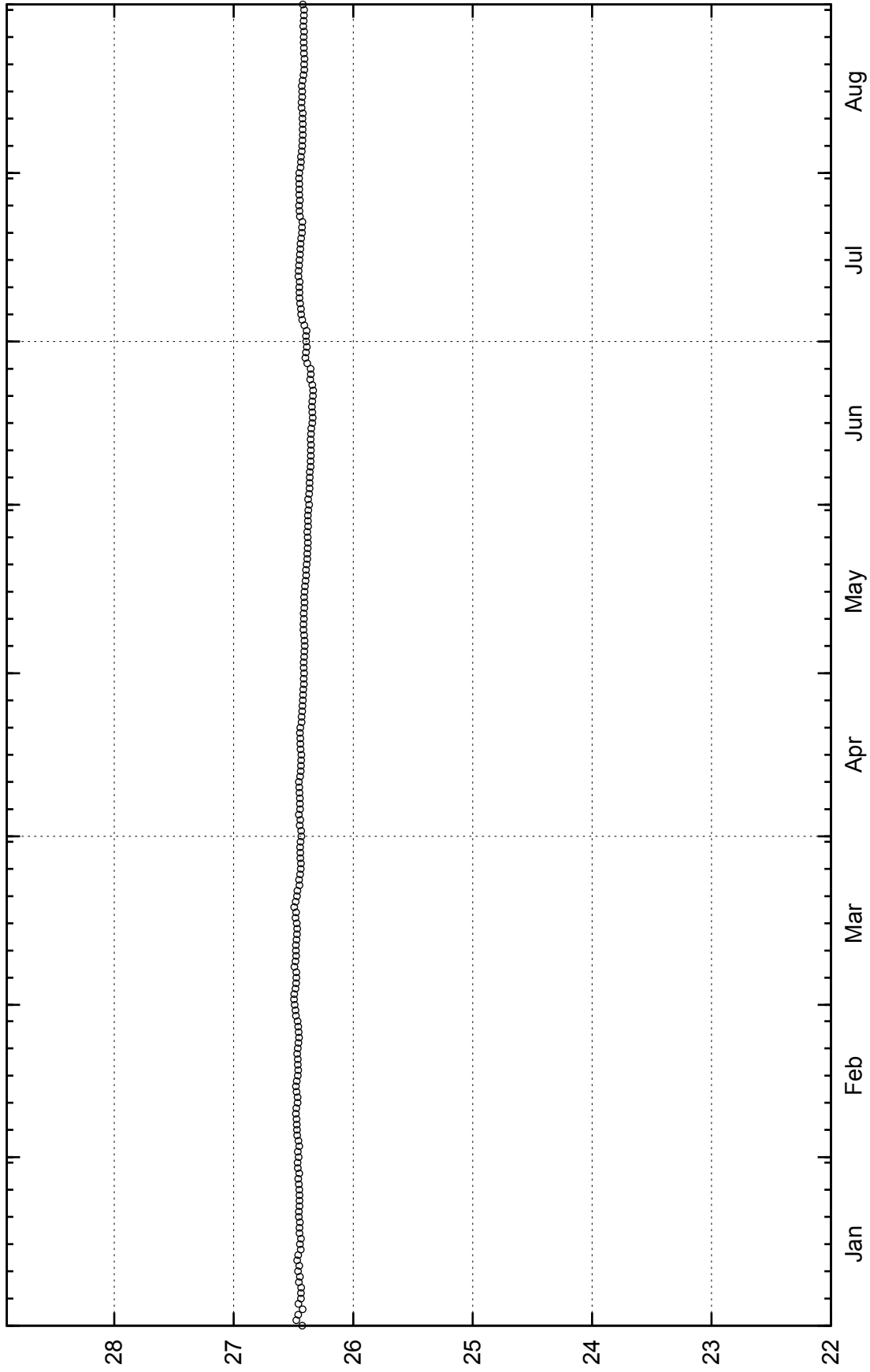
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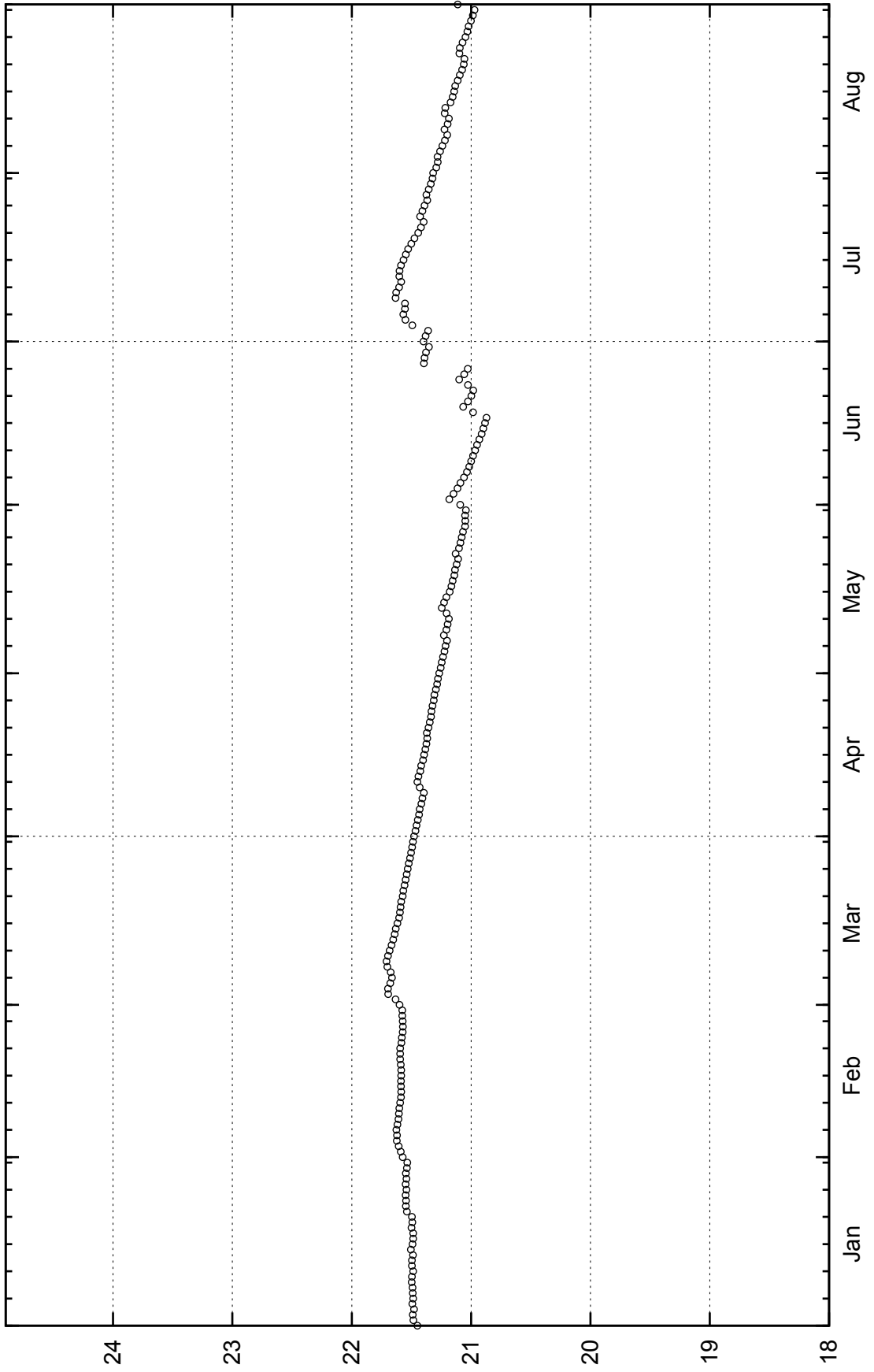
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SSM000246



Start: 2007-01-01 month

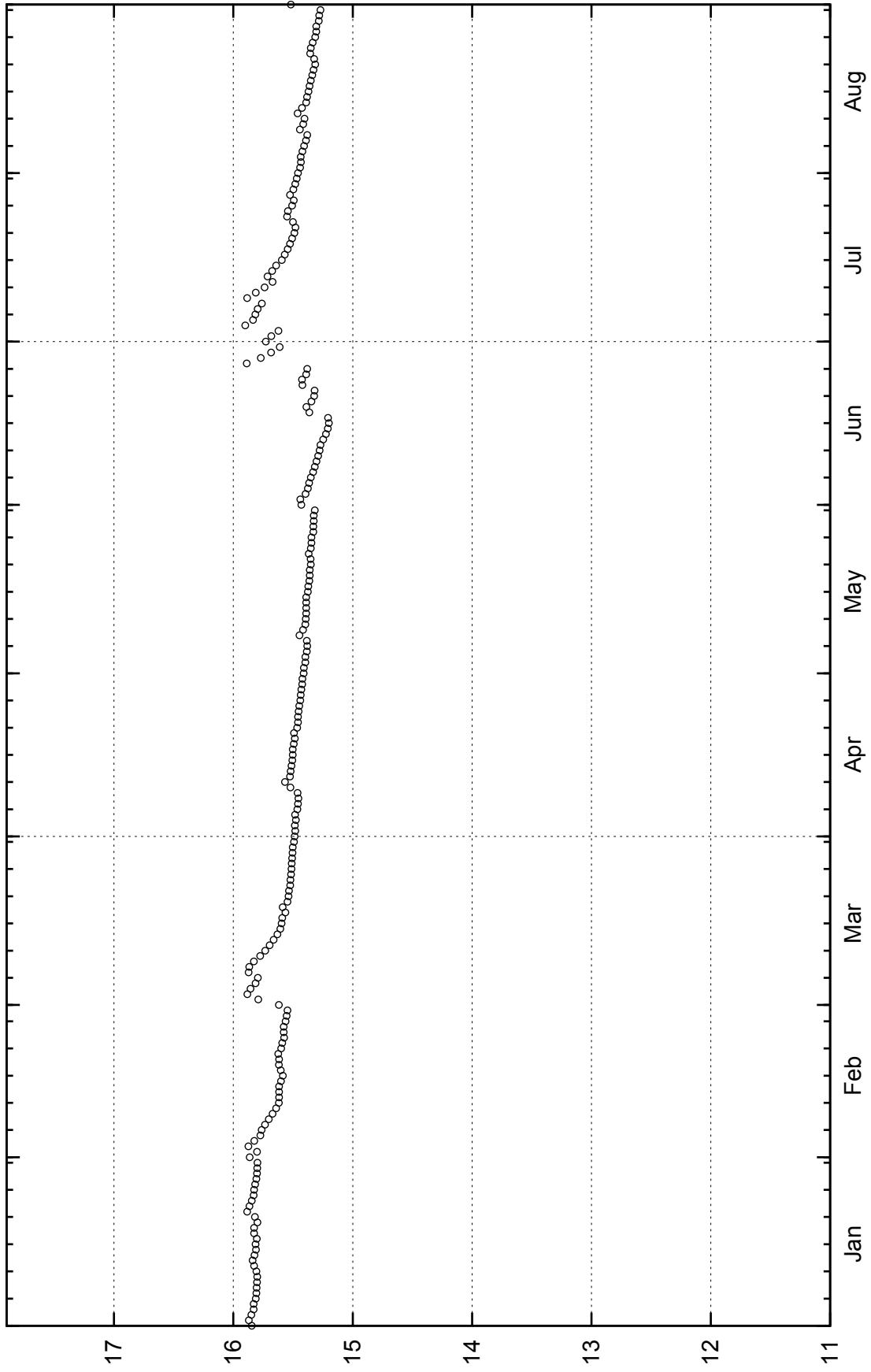
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Start: 2007-01-01 month

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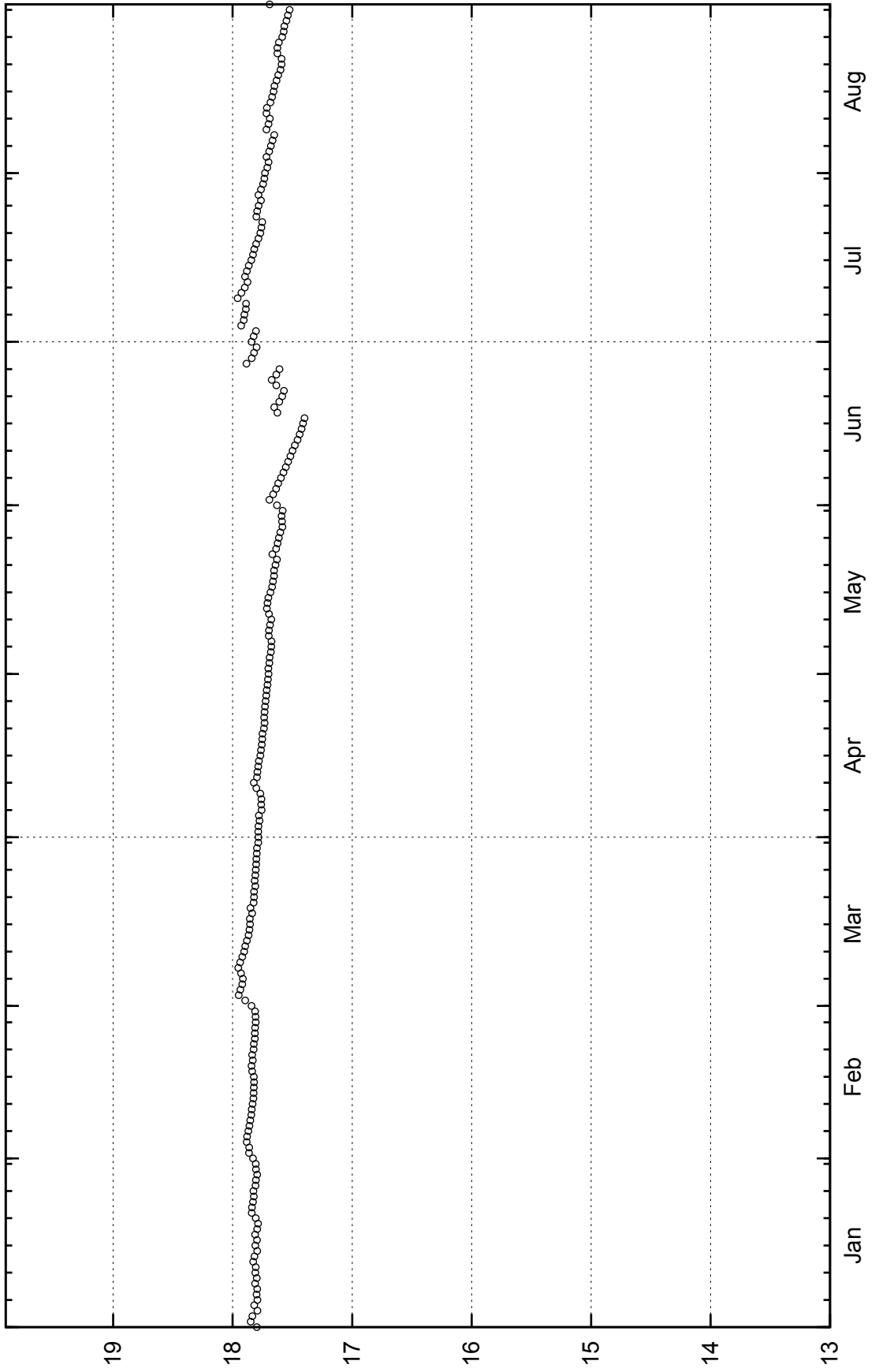
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Start: 2007-01-01 month

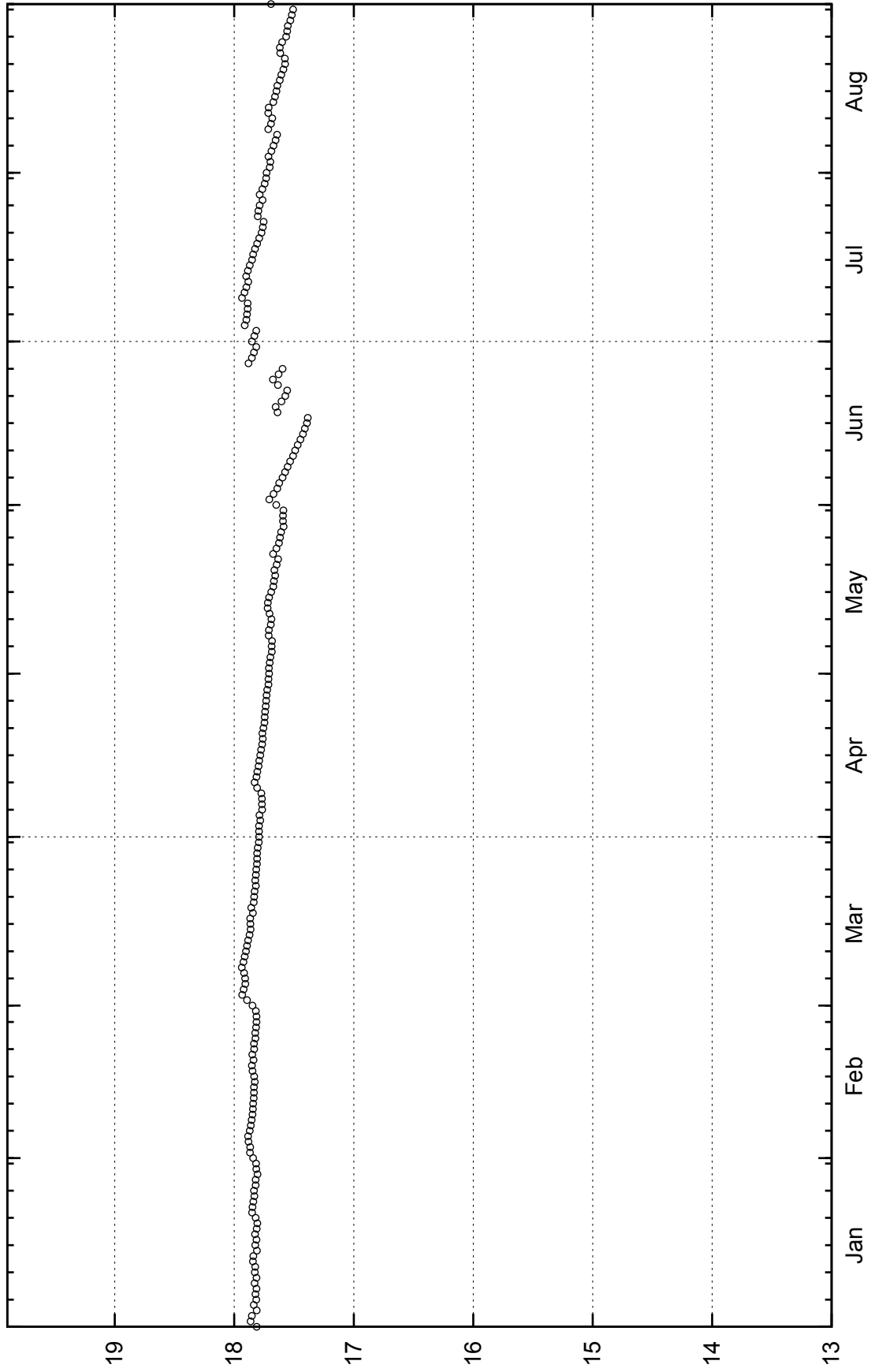
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SSM000252



Start: 2007-01-01 month

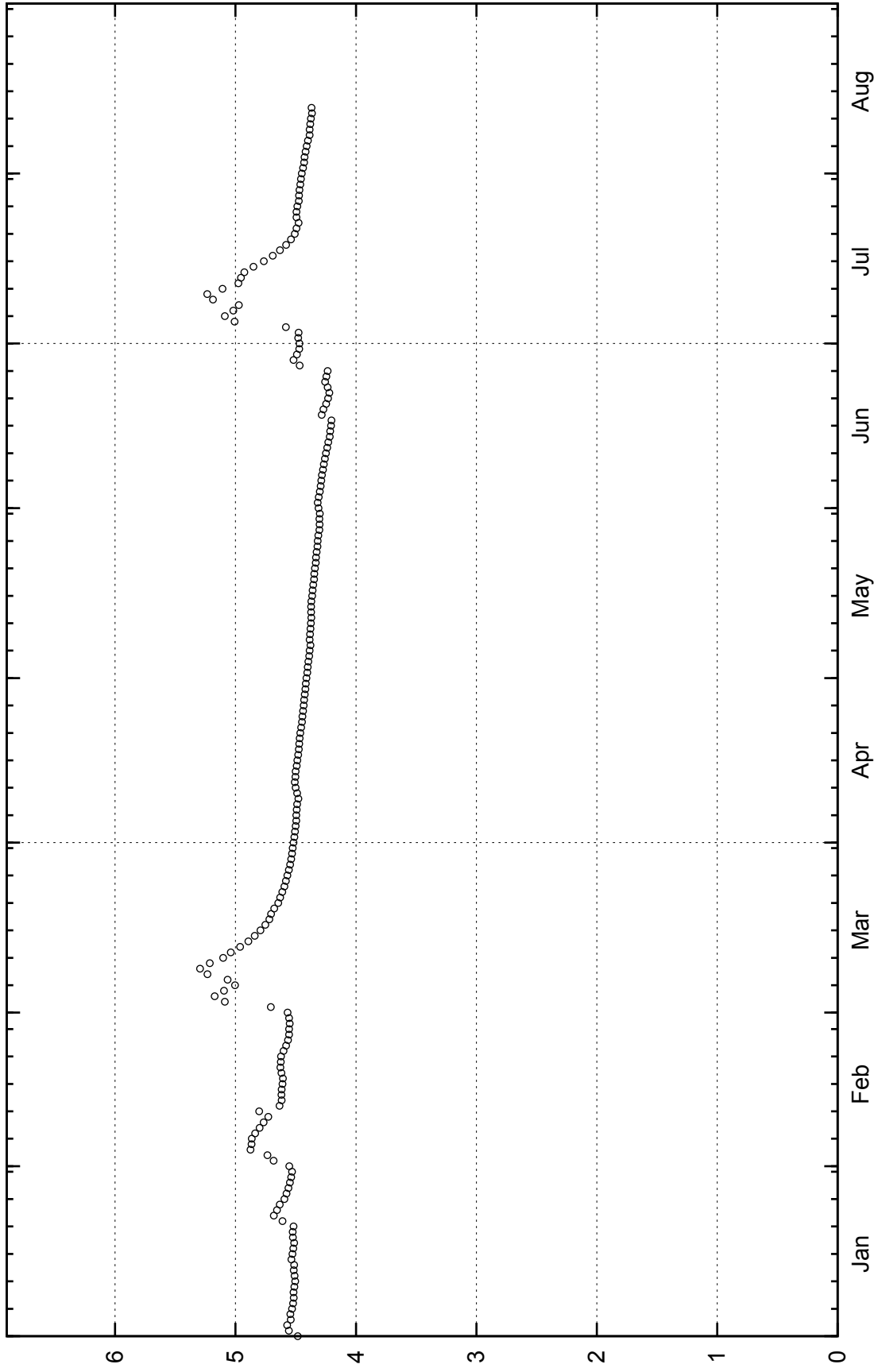
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Start: 2007-01-01 month

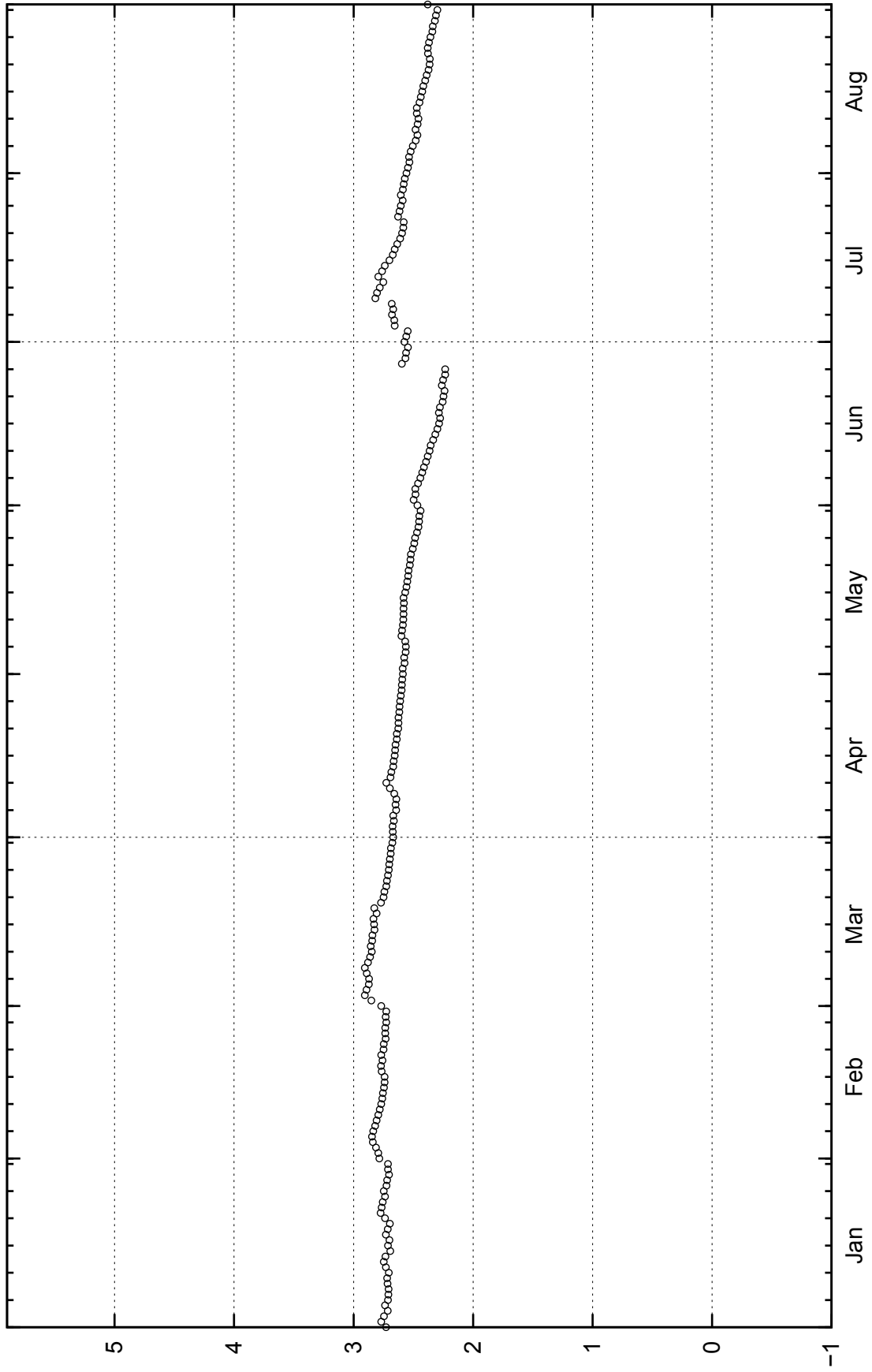
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SSM000255



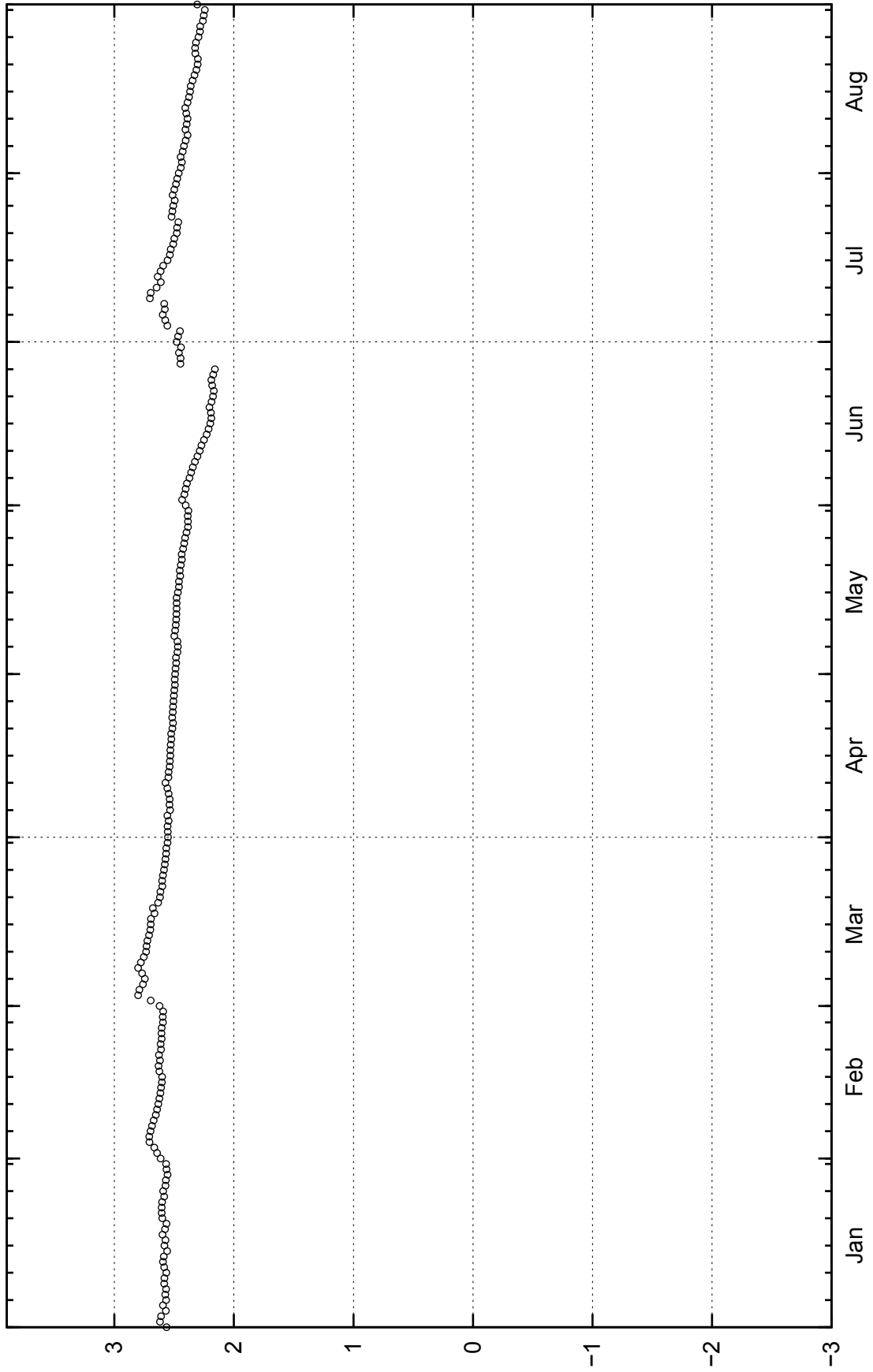
Start: 2007-01-01 month

SSM000256



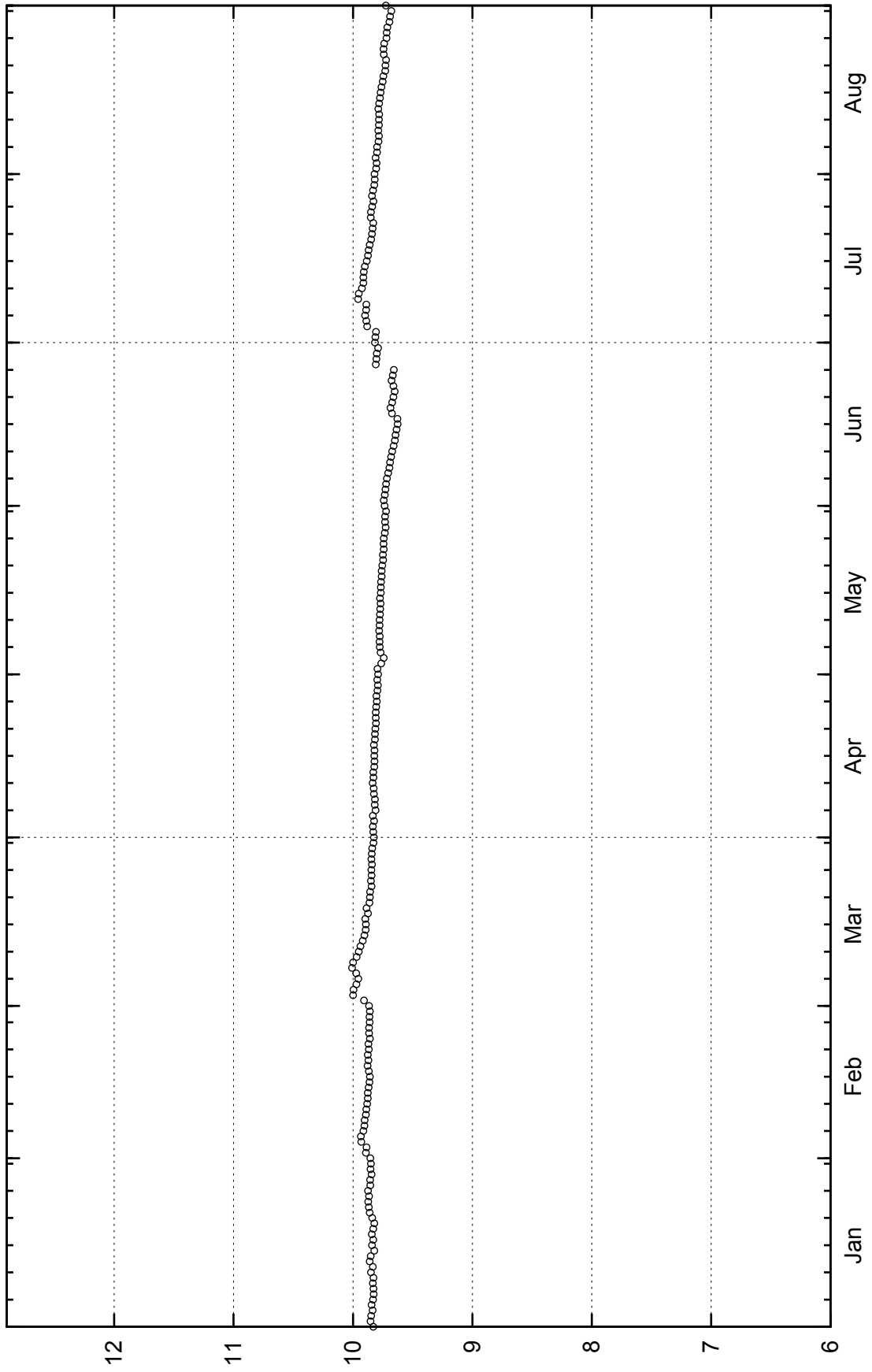
Start: 2007-01-01 month

SSM000257



Start: 2007-01-01 month

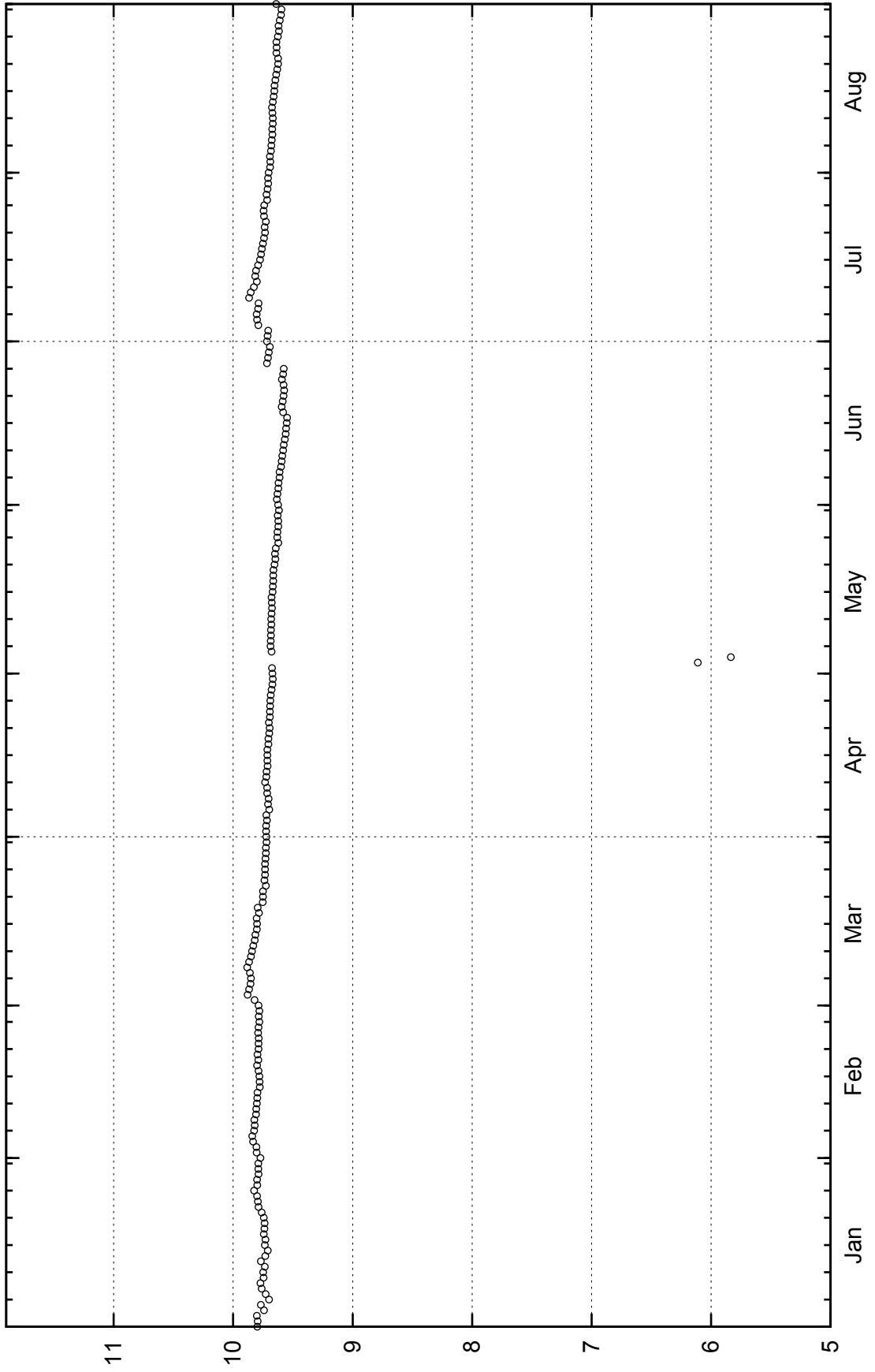
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Start: 2007-01-01 month

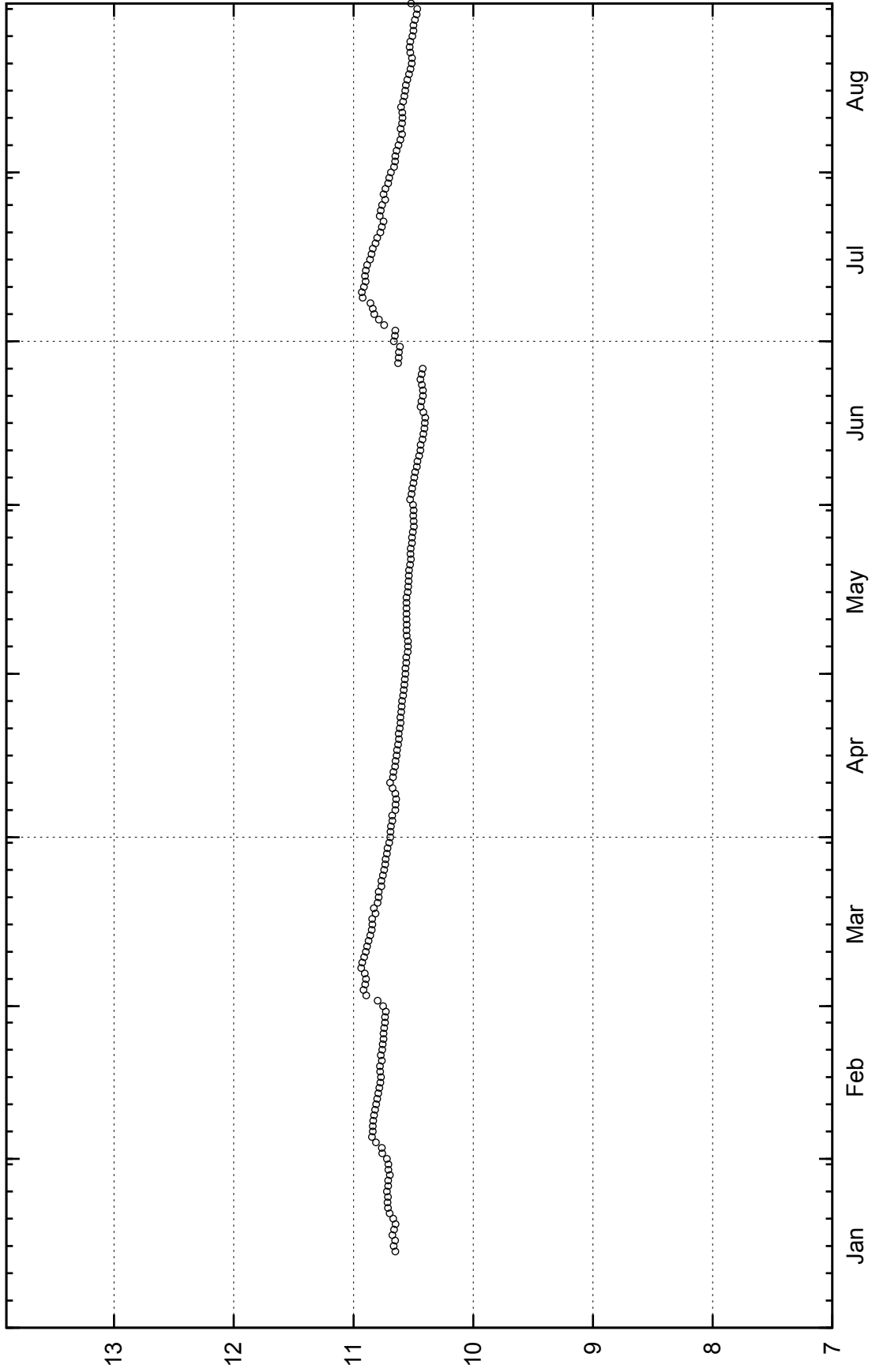
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SSM000261



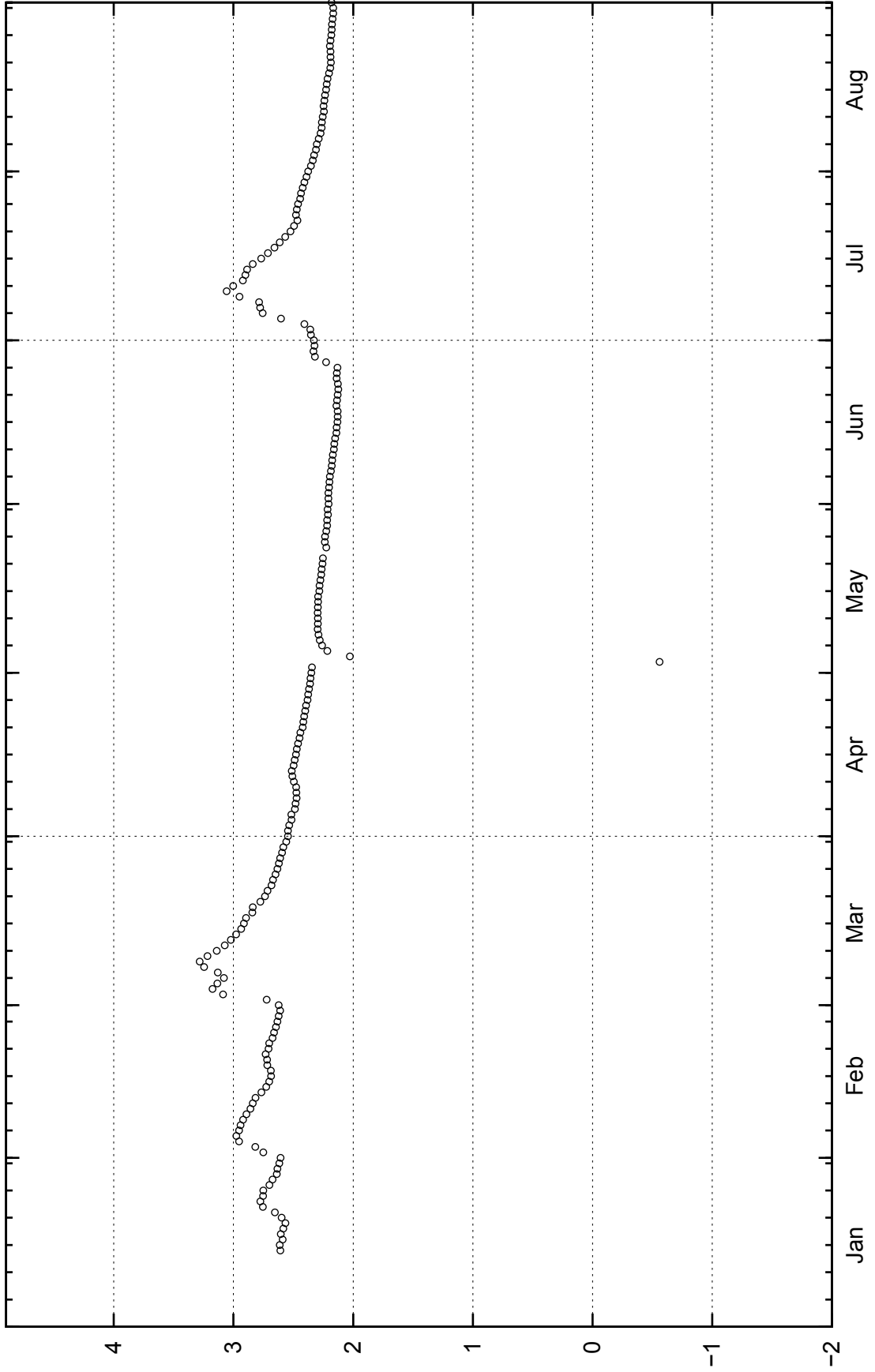
Start: 2007-01-01 month

SSM000262



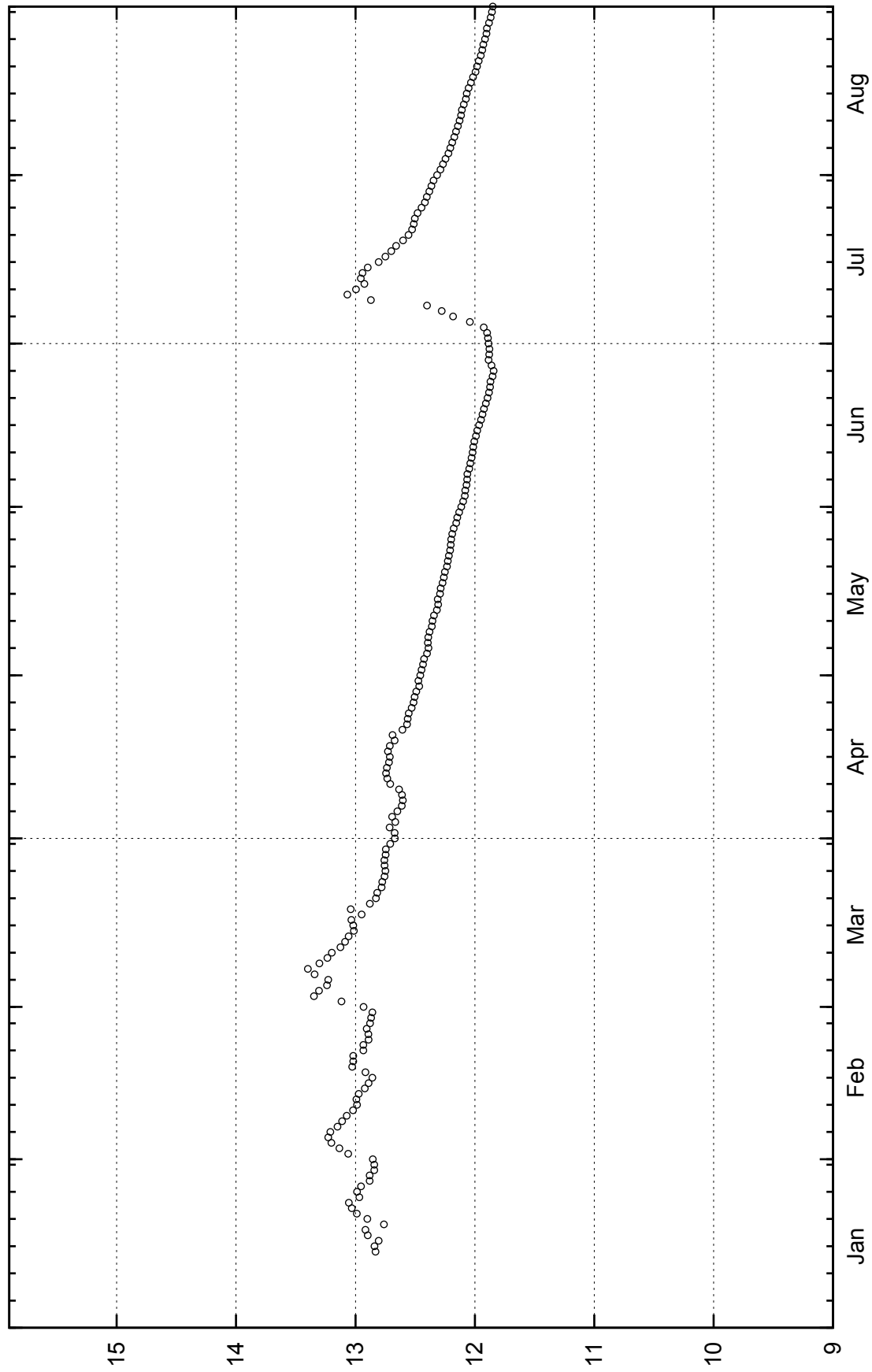
Start: 2007-01-01 month

SSM000263



Start: 2007-01-01 month

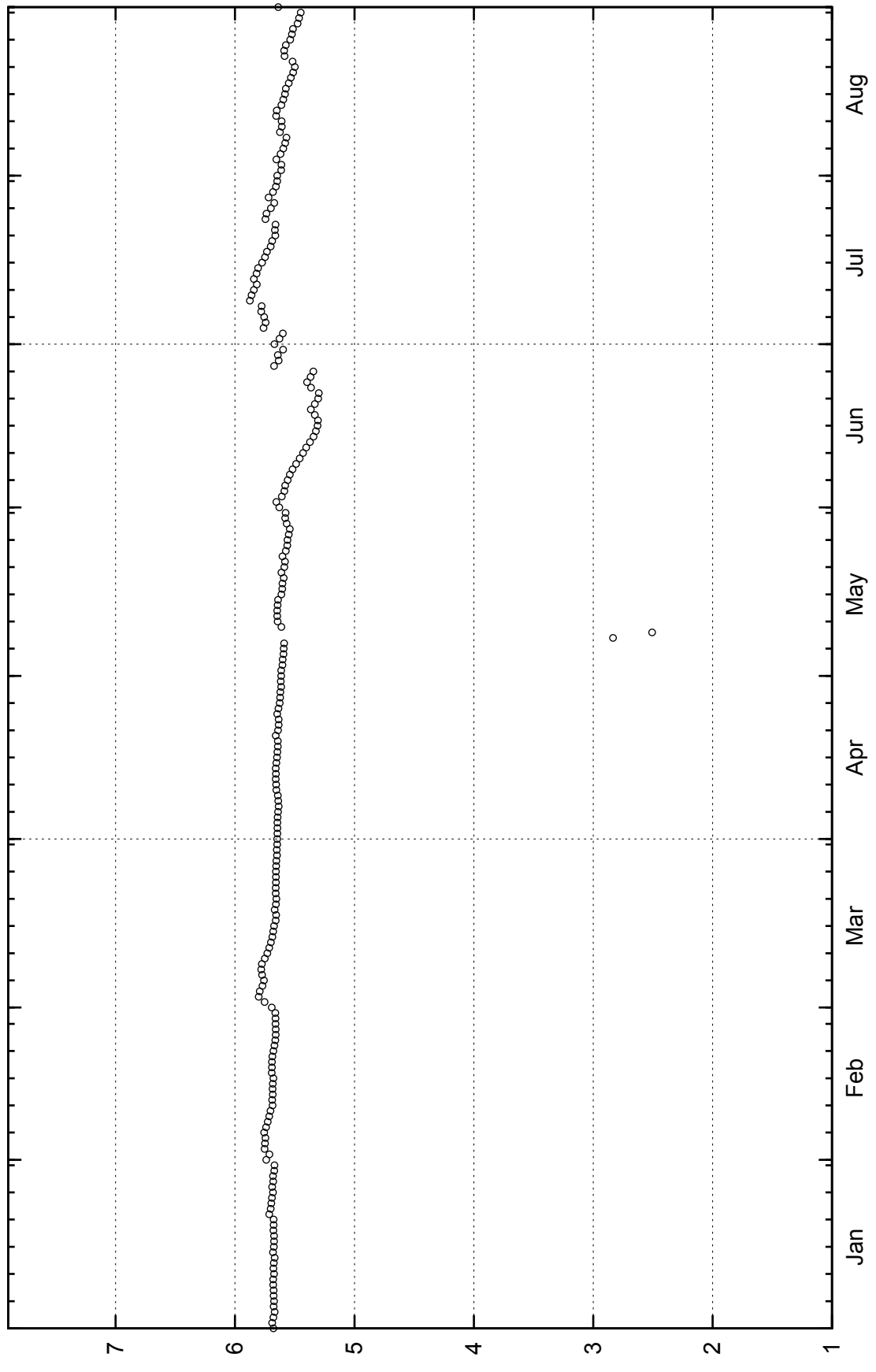
SSM000264



Start: 2007-01-01 month

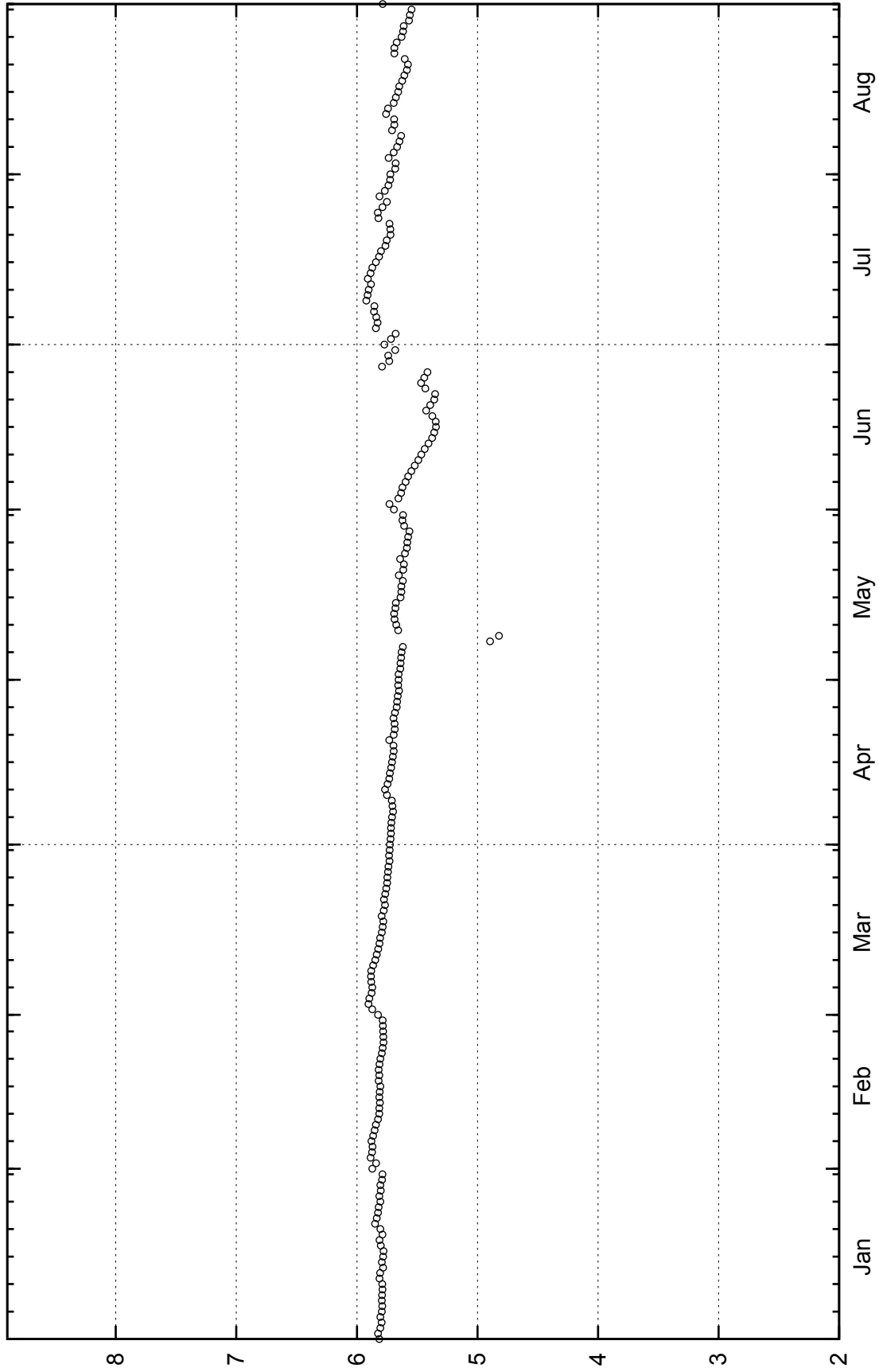
masl

SSM000265



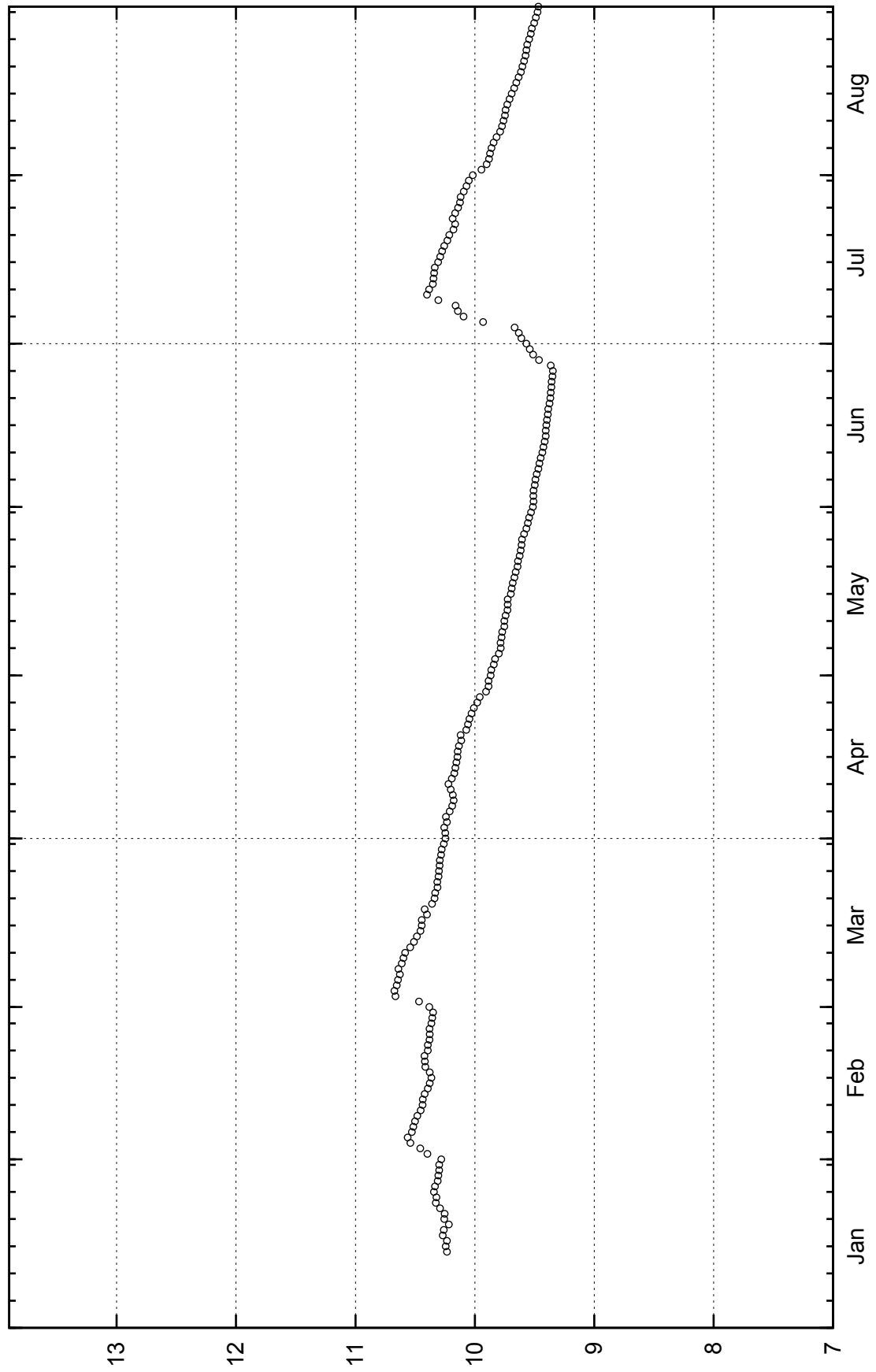
Start: 2007-01-01 month

SSM000266



Start: 2007-01-01 month

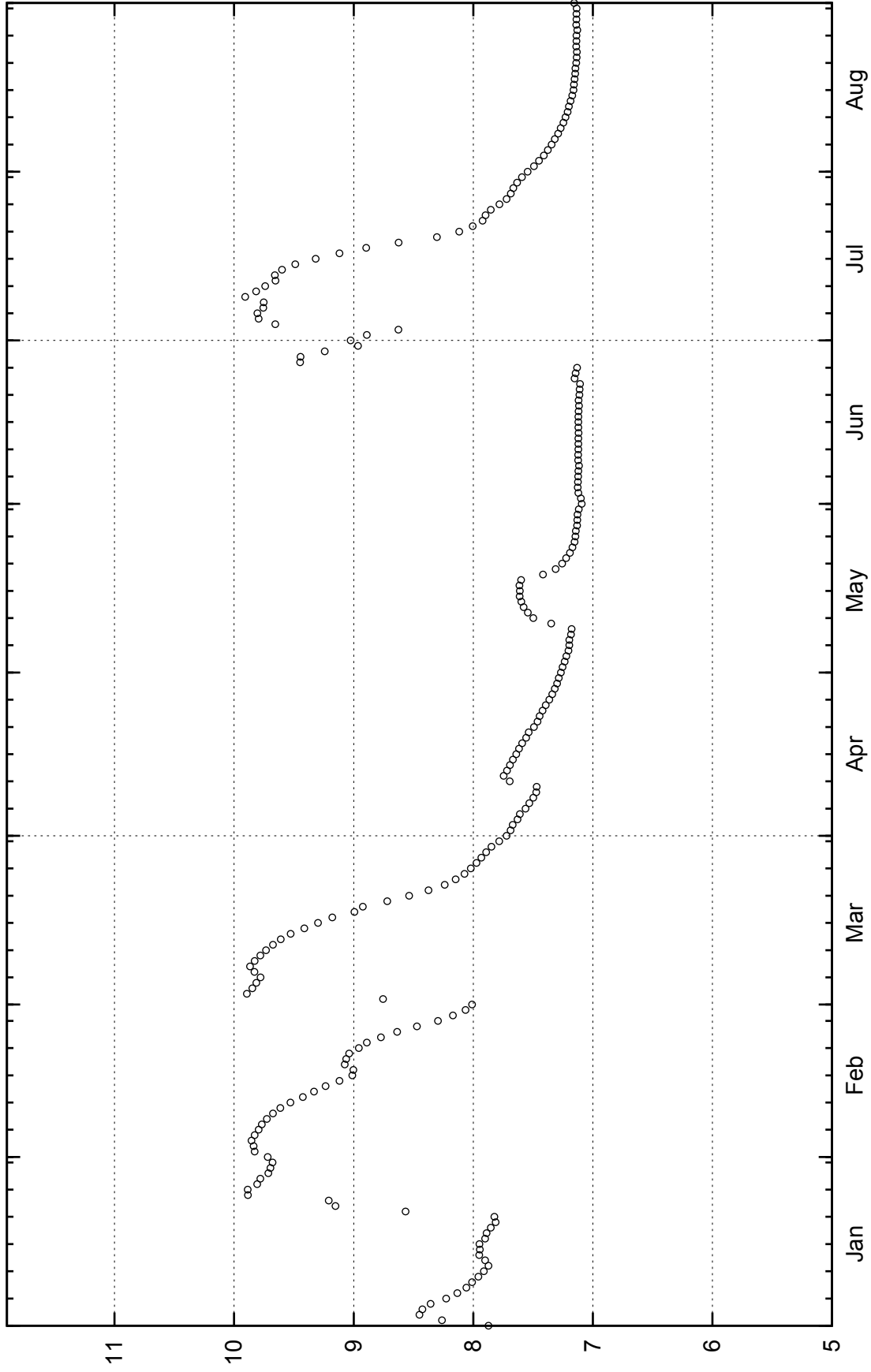
SSM000267



Start: 2007-01-01 month

masi

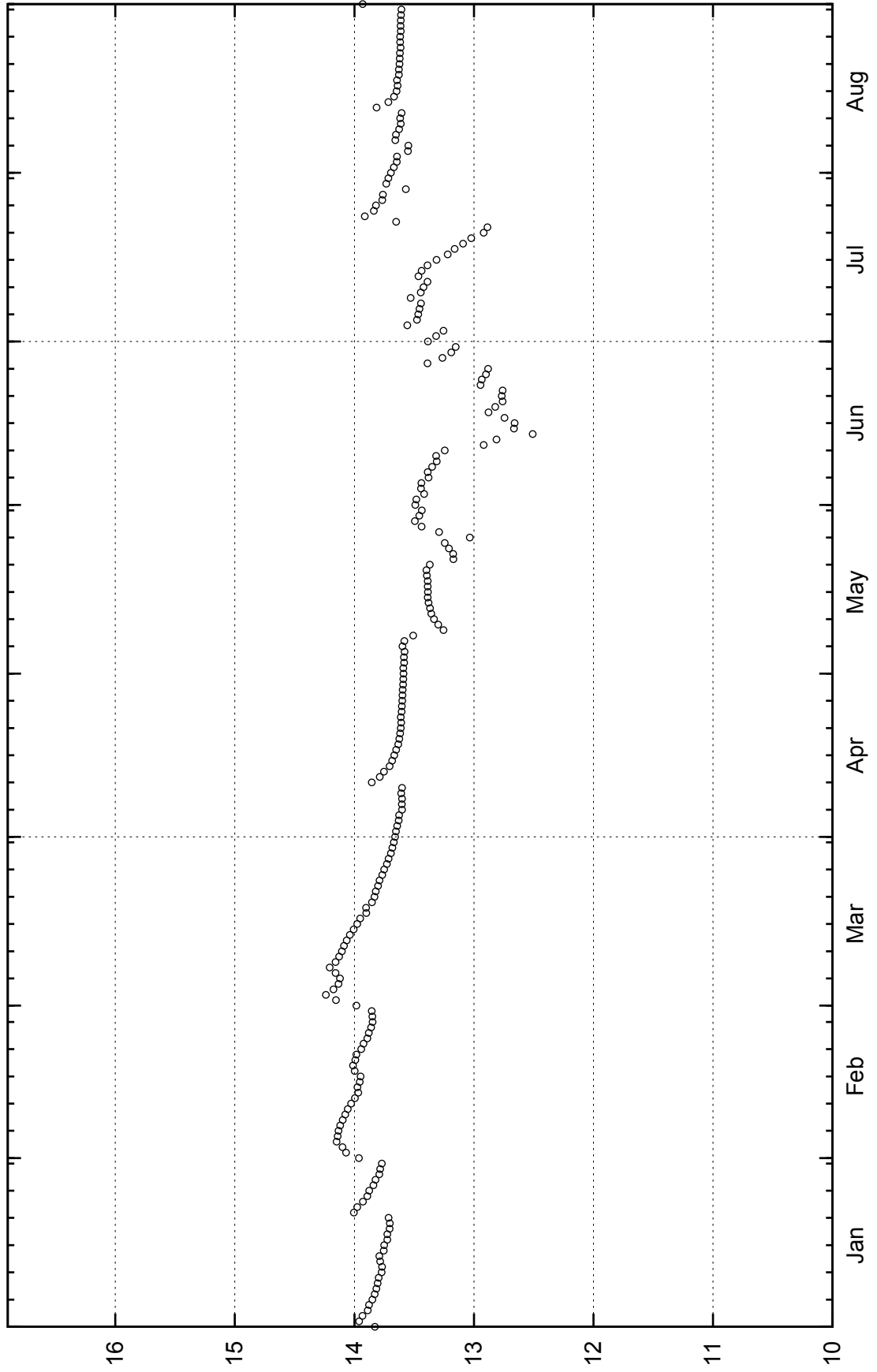
SSM000268



Start: 2007-01-01 month

masl

SSM000269

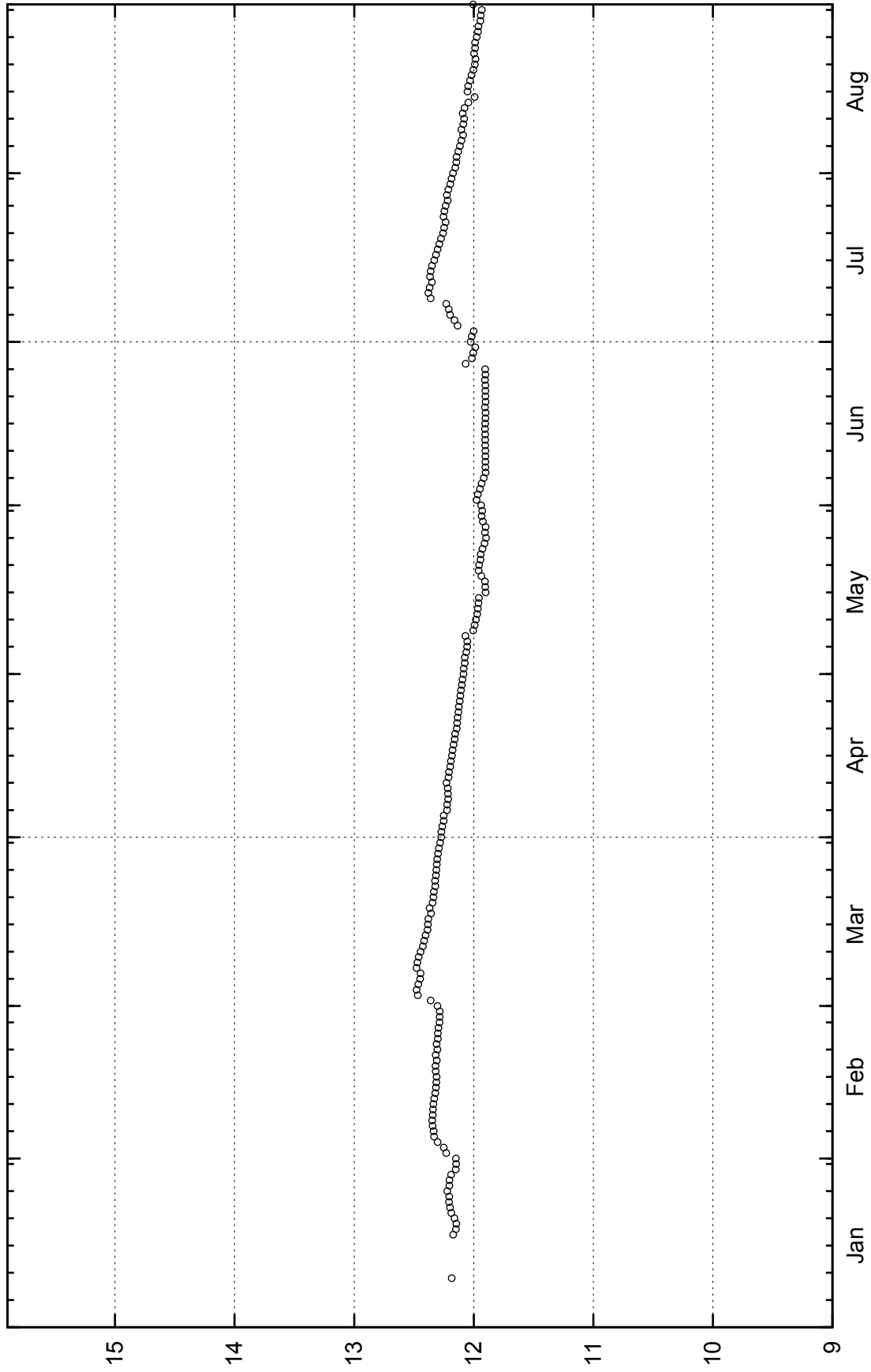


Start: 2007-01-01 month

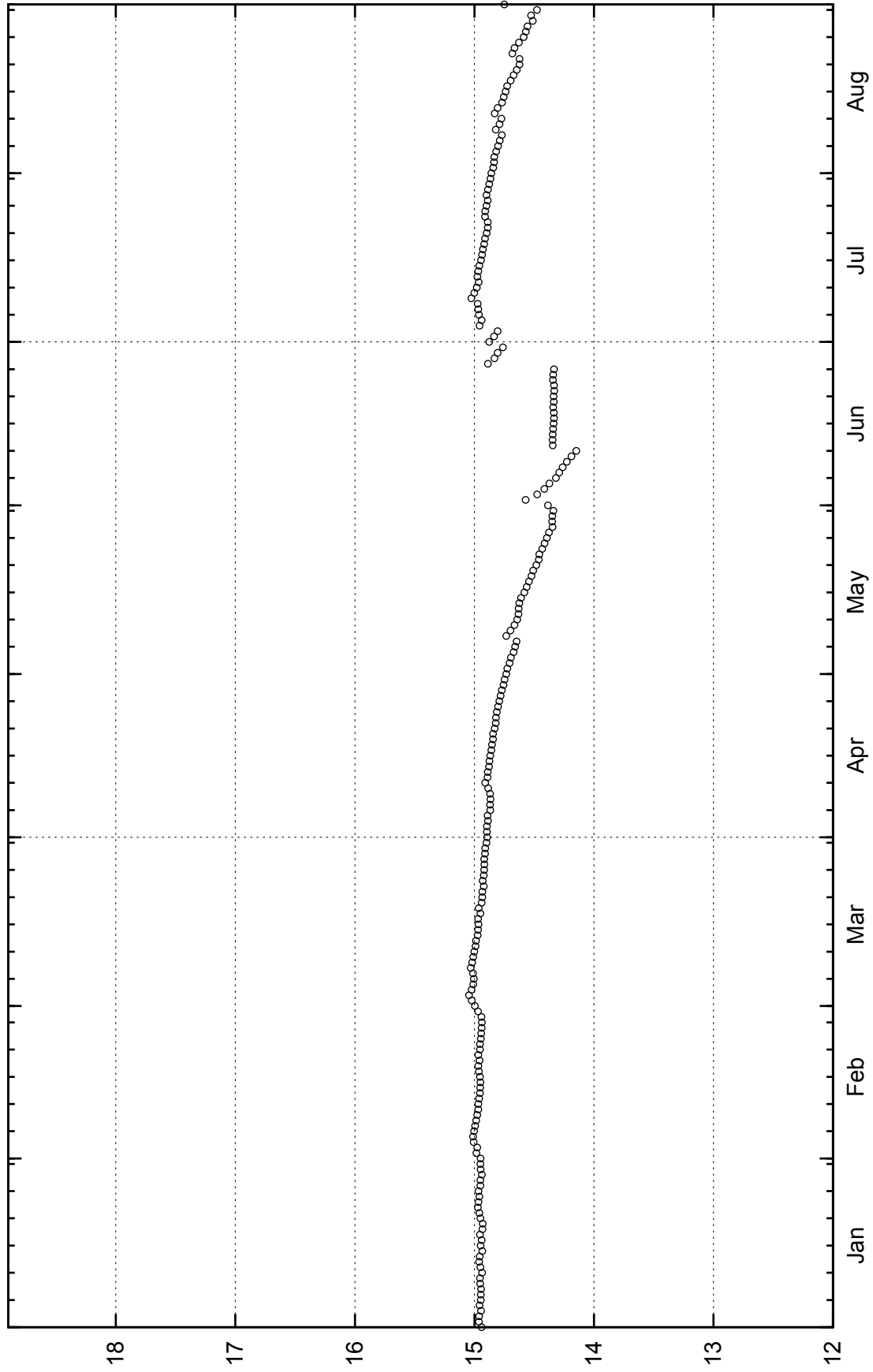
masl

2007-10-18 11:01:33

SSM000270

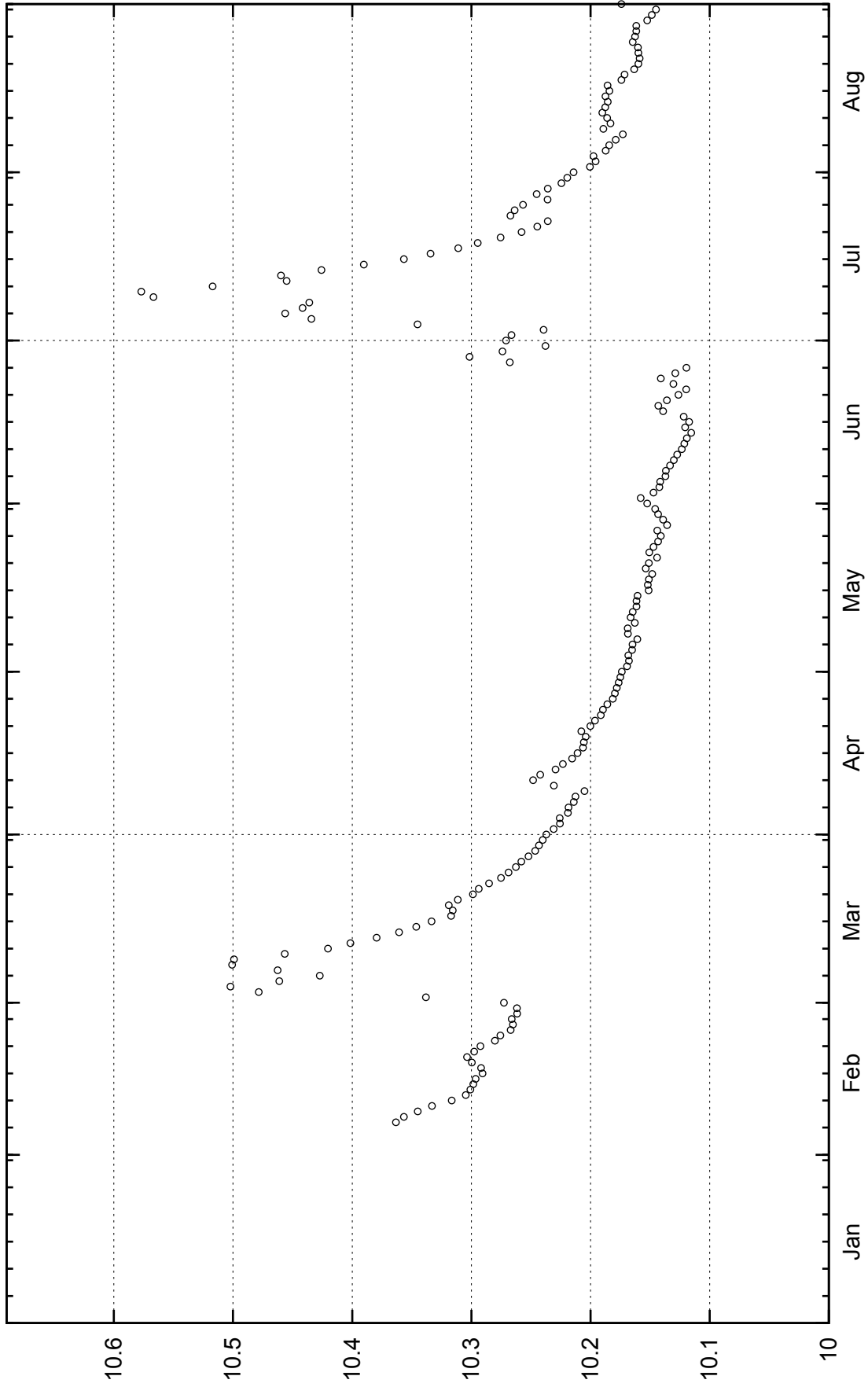


SSM000271



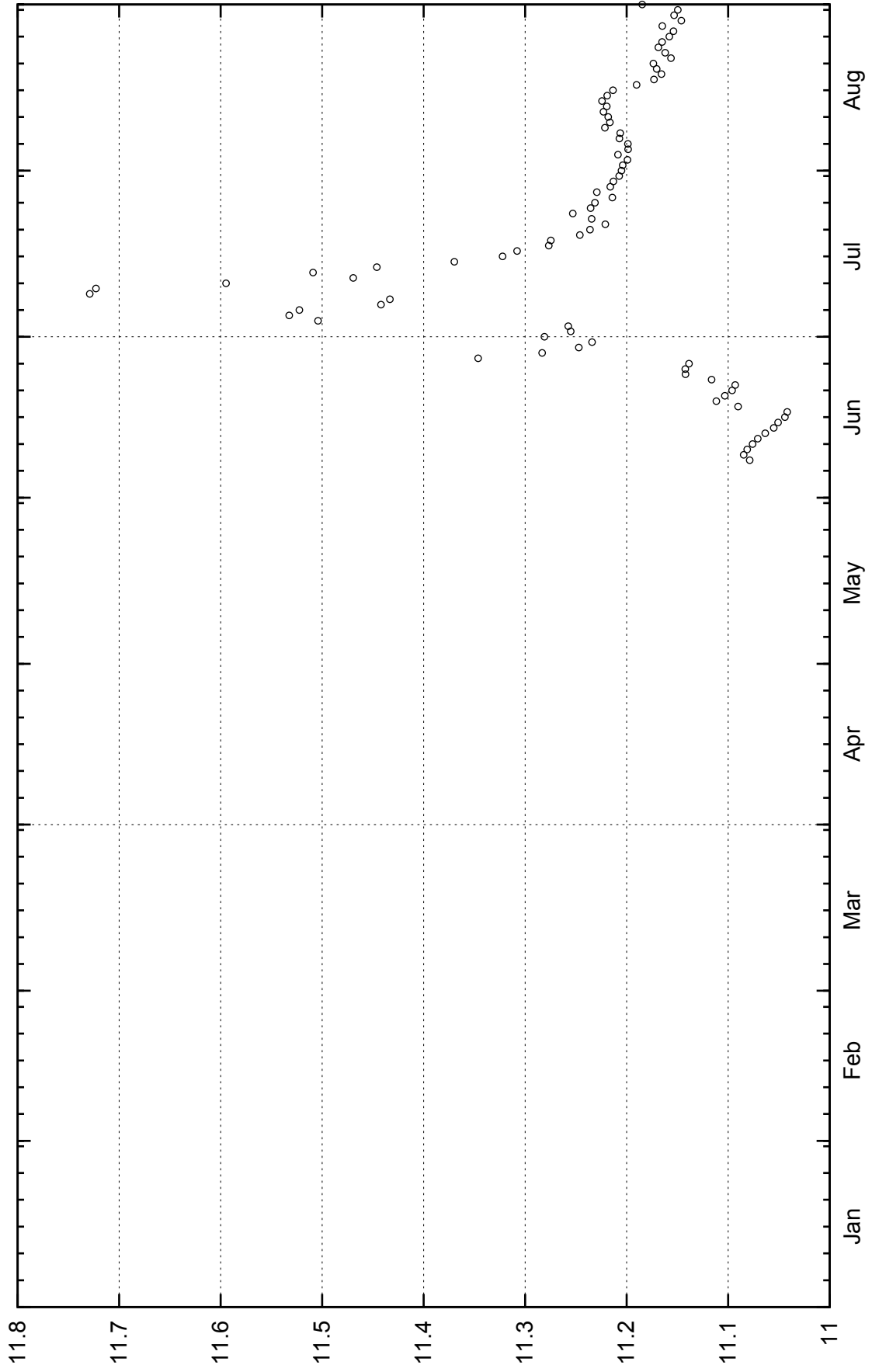
Start: 2007-01-01 month

PSM000272 - Stream water level



Start: 2007-01-01 month

PSM000273 - Stream water level



Start: 2007-01-01 month

Hydraulic disturbances in boreholes – GANTT chart

The extensive geoscientific investigation programme that took place during the period for this monitoring report generated fluctuations in groundwater level to various degree.

This appendix compiles, in chronological order, the dates when major hydraulic disturbances took place in boreholes. A word of caution, the compilation endeavoured to be complete but does nevertheless not necessarily constitute all disturbances.

Hydraulic disturbances:

- **Core drilling:** While drilling of core boreholes includes a) flushing and air-lift pumping and b) nitrogen lifting.
- **Percussion drilling:** Is done with DTH-technology which involves constantly flushing out the boreholes water and drill chips with air while drilling. Separate airlifting operations are also included.
- **Pumping test sub-mersible pump:** Conventional test for assessment of aquifer properties, including interference testing, flow logging (spinner and difference flow logging).
- **Pumping for drilling water supply:** While core drilling large amount of drilling fluid is required, water taken from a percussion hole serve this purpose.
- **Injection test:** Constant head injection test of relatively short duration, are done in sections along the complete borehole length for characterisation of aquifer properties. Injection phase duration is usually 20-30 min.
- **Pumping for water supply:** An site investigation borehole (HLX22) was taken into production as a water supply well to the village of Lilla Laxemar.
- **Water pumping:** Pumping for sampling of water for chemical analysis.

