

**Report on the Quality of Land Surface
Observations in Region II (Asia)**

January – June 2024

No. 67

December 2024

RSMC Tokyo

Lead Center for Monitoring Quality of Land Surface Observations

Japan Meteorological Agency

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Japan

Report on the Quality of Land Surface Observations in Region II
(No. 67)
January – June 2024

Summary

In its role as a Lead Center, RSMC Tokyo has issued the 67th report on the land surface observation quality monitoring for the period from January to June 2024. The report includes a consolidated list of stations suspected of producing low-quality observation data.

(1) SLP

As a result of monitoring, fourteen stations (43418, 43479, 44424, 44429, 47102, 47145, 47152, 48107, 54945, 56946, 56951, 57731, 58921, 59632) were excluded from the consolidated lists of the previous report (July – December 2023), and three stations (38567, 48001, 53923) were newly added to the lists.

(2) MSLP

As a result of monitoring, one station (42056) was excluded from the consolidated lists of the previous report (July – December 2023), and three stations (38567, 48966, 48986) were newly added to the lists.

(3) GZ

As a result of monitoring, one station (41437) was excluded from the consolidated lists of the previous report (July – December 2023).

1. Introduction

Pursuant to Paragraph 22 of Attachment II.7 of the Manual on the Global Data Processing and Forecasting System (WMO No. 485), the Regional Specialized Meteorological Center (RSMC) Tokyo was designated by the President of the Commission for Basic Systems (CBS) as a Lead Center for monitoring the quality of land surface observations (i.e., SYNOP) in Region II in March 1991. The Center is responsible for monitoring the quality of land surface observations and maintaining consolidated lists of stations suspected of reporting low-quality observation data together with adequate evidence. The lists are to be passed on to the WMO Secretariat and monitoring centers participating in this activity as well as to Members of Regional Association (RA) II for their reference.

2. Monitored Data

Monitored surface observation data are obtained at 00, 06, 12 and 18 UTC and collected at RSMC Tokyo before the data cut-off time, defined as the end of the period in which observation data are gathered for operational analysis. The cut-off times for Japan Meteorological Agency (JMA) global analysis are shown in Table 1.

Table 1 Data cut-off times for JMA global analysis.

Analysis time	Data cut-off time
00 UTC	11:50 UTC
06 UTC	13:50 UTC
12 UTC	23:50 UTC
18 UTC	01:50 UTC

The observation elements monitored are (1) station level pressure, (2) mean sea level pressure and (3) geopotential height, hereafter referred to as SLP, MSLP and GZ, respectively. In accordance with the Manual on Codes (WMO No. 306) Volume II, GZ data on an agreed standard pressure level are reported at the stations whose elevation is higher than 800 m. Standard pressure levels defined in line with station elevation are shown in Table 2.

Table 2 Elevation of stations reporting GZ data and corresponding standard pressure levels.

Station elevation (m)	Pressure level (hPa)
800 - 2,300	850
2,300 - 3,700	700
Higher than 3,700	500

The numbers of stations reporting SLP, MSLP and/or GZ data in Region II are shown in Table 3, and the locations of these land surface stations are shown in Figure 1.

Table 3 Numbers of stations reporting SLP, MSLP and/or GZ data in Region II

Element	Number of stations
SLP	1932
MSLP	2005
GZ	97

3. Monitoring Methods

The three items described below are examined for each element.

- (i) Monthly statistics on observation deviations from the most recent forecast of JMA 's global model (referred to as first-guess values) (observation minus guess, hereafter referred to as O-G) and on related trends over the monitoring period
- (ii) Monthly statistics on deviations from values observed at surrounding stations
- (iii) Reference information from other monitoring centers

Information on the latitude, longitude and altitude of each station is necessary for calculation of first-guess values. Such data for land surface station locations is retrieved from the surface-based observing

system component of the Observing Systems Capability Analysis and Review Tool (OSCAR/Surface)* , replacing WMO No. 9, Volume A.

The monitoring procedure has two steps as outlined below.

(1) Exclusion of data with gross errors from the statistical calculation sample

The following thresholds are applied for the gross error check in the first step:

$$\begin{aligned} |O-G| &\geq 15 \text{ hPa for SLP and MSLP} \\ |O-G| &\geq 100 \text{ gpm for GZ} \end{aligned}$$

Gross error data are excluded from the calculation of BIAS (the mean of O-G) and SD (the standard deviation of O-G).

(2) Identification of suspect stations

When the total number of observations (NOBS) is 182 or more, the next criteria are applied:

- BIAS	$ BIAS \geq 3 \text{ hPa for SLP and MSLP}$
	$ BIAS \geq 30 \text{ gpm for GZ}$
- SD	$SD \geq 5 \text{ hPa for SLP and MSLP}$
	$SD \geq 40 \text{ gpm for GZ}$
- Percentage of gross errors (PGE)	$PGE \geq 25\%$

Stations with even one statistic exceeding the threshold are considered suspect.

Note:

- (i) The quality of observation data from stations is not checked when the NOBS value is less than 182 or the difference between the station elevation and the model elevation is greater than 1,000 m. MSLP reports are also not checked for stations located at altitudes higher than 1,000 m above sea level.
- (ii) In case of low quality of the first-guess field, those statistics can exceed the threshold and the stations are listed in the consolidated list. To avoid such situations, statistics of surrounding stations and information from other monitoring centers are also used to judge whether the quality of the station's first-guess field value is appropriate.

*<https://oscar.wmo.int/surface/index.html#/>

4. Monitoring Results

4.1 Consolidated list of suspect stations throughout the period

Table 4 List of suspect land surface stations during the period from January to June 2024

WMO IDENT	LAT (N)	LON (E)	H (m)	HM (m)	ELEM	NOBS	PGE (%)	SD	BIAS	RMS
30673	53.8	119.7	625	747	SLP	723	0	0.9	-8.7	8.7
					MSLP	723	0	1.4	-0.3	1.4
31445	51.5	128.1	200	195	SLP	407	0	0.5	0.3	0.6
					MSLP	407	0	0.9	11.3	11.3
35284	50.6	70.0	384	330	SLP	727	0	0.7	6.7	6.7
					MSLP	727	0	0.8	0.8	1.1
35615	47.6	53.3	-21	-16	SLP	627	0	0.5	0.4	0.6
					MSLP	627	0	0.9	5.4	5.5
35701	47.2	51.0	-27	-24	SLP	695	0	0.5	0.1	0.5
					MSLP	695	0	0.9	6.6	6.7
38262	43.0	59.8	93	64	SLP	728	0	0.8	3.4	3.5
					MSLP	728	0	0.7	0.3	0.8
38313	43.7	69.0	405	737	SLP	655	86	1.3	13.9	14.0
					MSLP	655	0	2.6	-0.7	2.7
38318	42.1	68.1	183	214	SLP	313	0	0.7	-8.3	8.3
					MSLP	313	0	0.8	-3.9	4.0
38836	38.6	68.7	800	1034	SLP	709	1	1.3	-2.6	2.9
					MSLP	710	0	2.2	-3.6	4.2
38875	39.0	73.6	3930	4259	SLP	342	100	*****	*****	*****
					GZ500	4	0	24.1	10.5	26.3
38880	38.0	58.4	312	199	SLP	725	0	0.9	11.9	11.9
					MSLP	728	0	0.8	0.1	0.8
38944	37.5	69.4	447	622	SLP	708	0	1.2	-5.3	5.4
					MSLP	708	0	1.4	-5.4	5.6
41249	23.9	56.2	633	784	SLP	600	0	0.5	-0.6	0.8
					GZ850	532	87	56.8	-2.9	56.9
41265	22.8	58.5	469	585	SLP	572	0	0.5	-5.0	5.0
					MSLP	512	0	0.7	-1.8	1.9
41315	17.3	54.1	881	641	SLP	674	98	0.2	14.9	14.9
					GZ850	659	91	56.8	-13.5	58.4
41396	16.0	49.0	700	801	SLP	287	0	0.5	6.3	6.3
					MSLP	302	2	1.3	0.4	1.4
41437	14.5	46.9	1067	1292	SLP	323	0	2.4	-9.3	9.6
					GZ850	323	1	19.9	-14.6	24.7
41573	33.9	73.4	2127	1411	SLP	713	0	1.3	9.0	9.1
					GZ850	712	0	12.6	-2.7	12.9
42056	32.7	74.8	323	295	SLP	710	0	0.9	-6.9	7.0

4. MONITORING RESULTS

WMO IDENT	LAT (N)	LON (E)	H (m)	HM (m)	ELEM	NOBS	PGE (%)	SD	BIAS	RMS
42083	31.1	77.2	2202	1552	SLP	341	73	1.1	14.5	14.5
					GZ850	11	100	*****	*****	*****
42111	30.3	78.1	683	851	SLP	707	0	1.0	5.6	5.7
					MSLP	707	0	1.4	-2.0	2.4
42114	30.4	78.4	770	1482	SLP	354	100	0.0	-11.9	11.9
					-	-	-	-	-	-
42147	29.5	79.7	2311	1687	SLP	354	0	0.5	4.5	4.5
					-	-	-	-	-	-
42299	27.3	88.6	1756	1964	SLP	358	0	0.7	0.3	0.8
					GZ850	358	0	8.9	55.6	56.3
44406	29.3	80.9	617	1459	SLP	250	0	1.8	3.7	4.1
					MSLP	250	0	3.7	-3.2	4.9
47020	41.0	126.6	306	677	SLP	727	0	1.1	-0.4	1.2
					MSLP	727	0	2.6	8.4	8.8
47037	40.0	125.3	99	217	SLP	728	0	1.4	-4.1	4.3
					MSLP	728	0	1.5	-4.2	4.5
48018	24.2	96.3	95	204	SLP	538	0	1.2	3.7	3.9
					MSLP	538	0	1.1	-0.3	1.1
48921	21.6	101.9	1360	1049	SLP	503	1	1.1	-4.4	4.5
					GZ850	498	100	0.0	90.9	90.9
48925	20.7	102.0	636	960	SLP	466	0	0.8	-3.8	3.9
					MSLP	466	0	1.4	-1.9	2.4
48935	19.5	103.1	1094	1204	SLP	509	0	1.5	0.0	1.5
					GZ850	507	26	10.1	-84.8	85.4
48944	18.3	102.6	185	226	SLP	342	98	3.5	5.2	6.3
					MSLP	341	0	3.2	-6.8	7.5
48952	15.7	106.4	180	288	SLP	515	1	1.3	3.6	3.8
					MSLP	515	0	1.2	2.4	2.7
48961	14.2	103.5	23	42	SLP	555	0	1.7	1.8	2.5
					MSLP	555	0	1.7	4.5	4.8
48963	12.8	102.6	170	353	SLP	610	98	0.6	14.6	14.6
					MSLP	610	100	*****	*****	*****

WMO IDENT: WMO station identification number
LAT: station latitude
LON: station longitude
H: barometer elevation
HM: model elevation
ELEM: observed element
NOBS: total number of observations during the period
PGE: percentage of gross errors
SD: standard deviation of (observation - guess)
BIAS: bias of (observation - guess)
RMS: root mean square of (observation - guess)

RUSSIAN FEDERATION IN ASIA

30673 - Negative bias of O-G at the station level (Figures 2 and 3)

31445 - Positive bias of O-G at the mean sea level (Figures 4 and 5)

KAZAKHSTAN

35284 - Positive bias of O-G at the station level (Figures 6 and 7)

35615 - Positive bias of O-G at the mean sea level (Figures 8 and 9)

35701 - Positive bias of O-G at the mean sea level (Figures 8 and 10)

38313 - Positive bias of O-G at the station level (Figures 13 and 14)

38318 - Negative bias of O-G at the station level and at the mean sea level (Figures 13, 15 and 16)

UZBEKISTAN

38262 - Positive bias of O-G at the station level (Figures 11 and 12)

TAJIKISTAN

38836 - Negative bias of O-G at the mean sea level (Figures 15 and 17)

38875 - Positive bias of O-G at the station level (Figure 18)

38944 - Negative bias of O-G at the station level and at the mean sea level (Figures 13, 15 and 20)

TURKMENISTAN

38880 - Positive bias of O-G at the station level (Figures 11 and 19)

OMAN

41249 - Mostly negative bias of O-G at 850 hPa or 700hPa (Figure 21)

41265 - Negative bias of O-G at the station level (Figures 22 and 23)

41315 - Positive bias of O-G at the station level and mostly negative bias at 850 hPa or 700hPa (Figures 24 and 25)

YEMEN

41396 - Positive bias of O-G at the station level (Figures 26 and 27)

41437 - Negative bias of O-G at the station level (Figures 26 and 28)

PAKISTAN

41573 - Positive bias of O-G at the station level (Figures 29 and 30)

INDIA

42056 - Negative bias of O-G at the station level (Figures 29 and 31)

42083 - Positive bias of O-G at the station level (Figures 29 and 32)

42111 - Positive bias of O-G at the station level (Figures 29 and 33)

42114 - Negative bias of O-G at the station level (Figure 34)

42147 - Positive bias of O-G at the station level (Figures 29 and 35)

42299 - Positive bias of O-G at 850 hPa (Figures 36 and 37)

NEPAL

44406 - Positive bias of O-G at the station level (Figures 29 and 38)

KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF

47020 - Positive bias of O-G at the mean sea level (Figures 39 and 40)

47037 - Negative bias of O-G at the station level and at the mean sea level (Figures 39, 41 and 42)

MYANMAR

48018 - Positive bias of O-G at the station level (Figures 43 and 44)

LAO PEOPLE'S DEMOCRATIC REPUBLIC

48921 - Negative bias of O-G at the station level and at 850 hPa (Figures 45 and 46)

48925 - Negative bias of O-G at the station level (Figures 45 and 47)

48935 - Negative bias of O-G at 850 hPa (Figures 48 and 49)

48944 - Negative bias of O-G at the station level and at the mean sea level (Figures 50 and 51)

48952 - Positive bias of O-G at the station level (Figures 45 and 52)

CAMBODIA

48961 - Positive bias of O-G at the mean sea level (Figures 50 and 53)

48963 - Positive bias of O-G at the station level and at the mean sea level (Figures 54 and 55)

4.2 Stations where quality deteriorated during the period

Table 5 List of suspect land surface stations where quality deteriorated during the period

WMO IDENT	LAT (N)	LON (E)	H (m)	HM (m)	ELEM	NOBS	PGE (%)	SD	BIAS	RMS
38567	40.1	65.4	340	407	SLP	728	0	3.3	-3.2	4.6
					MSLP	728	0	3.4	-3.1	4.6
48001	27.3	97.4	434	555	SLP	479	33	1.5	0.7	1.7
					MSLP	479	0	2.0	-0.8	2.2
48966	13.4	103.9	15	9	SLP	502	32	1.3	-2.1	2.5
					MSLP	502	32	1.3	2.4	2.7
48986	11.6	103.0	13	69	SLP	653	0	2.5	-2.3	3.4
					MSLP	653	0	2.5	-3.8	4.5
53923	35.7	107.6	1423	1286	SLP	727	0	0.5	5.9	5.9
					MSLP	727	0	2.0	0.7	2.1

UZBEKISTAN

38567 - Negative bias of O-G at the station level and at the mean sea level since March 2024 (Figures 13, 15 and 56)

MYANMAR

48001 - Intermittent positive bias of O-G at the station level (Figure 57)

CAMBODIA

48966 - Negative bias of O-G at the mean sea level from March to May 2024, followed by positive bias (Figures 50 and 58)

48986 - Negative bias of O-G at the mean sea level (Figures 59 and 60)

CHINA

53923 - Positive bias of O-G at the station level (Figures 61 and 62)

4.3 Stations improved and excluded from the previous consolidated list

YEMEN

41437 - The negative bias of O-G at 850 hPa has improved since May 2024. (Figure 63)

SRI LANKA

43418 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

43479 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

NEPAL

44424 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

44429 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

KOREA, REPUBLIC OF

47102 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

47145 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

47152 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

MYANMAR

48107 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

CHINA

54945 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

56946 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

56951 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

57731 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

58921 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

59632 - Quality has improved with a metadata update in OSCAR/Surface. (Figure omitted)

4.4 Stations removed from the previous consolidated list

INDIA

42056 - Although station 42056 still displays positive biases of O-G at the mean sea level, it was removed from the consolidated list because the number of reports (28) was insufficient for quality checking. (Figure 64)

5. Possible Causes of Remarkable and Sustained Biases

The following are possible causes of remarkable and sustained biases

- (i) The barometer used for observation is not correctly calibrated.
- (ii) The latitude, longitude or altitude of the station in OSCAR/Surface has not been updated in a timely and appropriate manner. This could result in remarkable biases because it may cause incorrect calculated first-guess field values.
- (iii) Biases are specific to the NWP model used in quality monitoring.

Note: Model biases are likely to appear in relatively large areas.

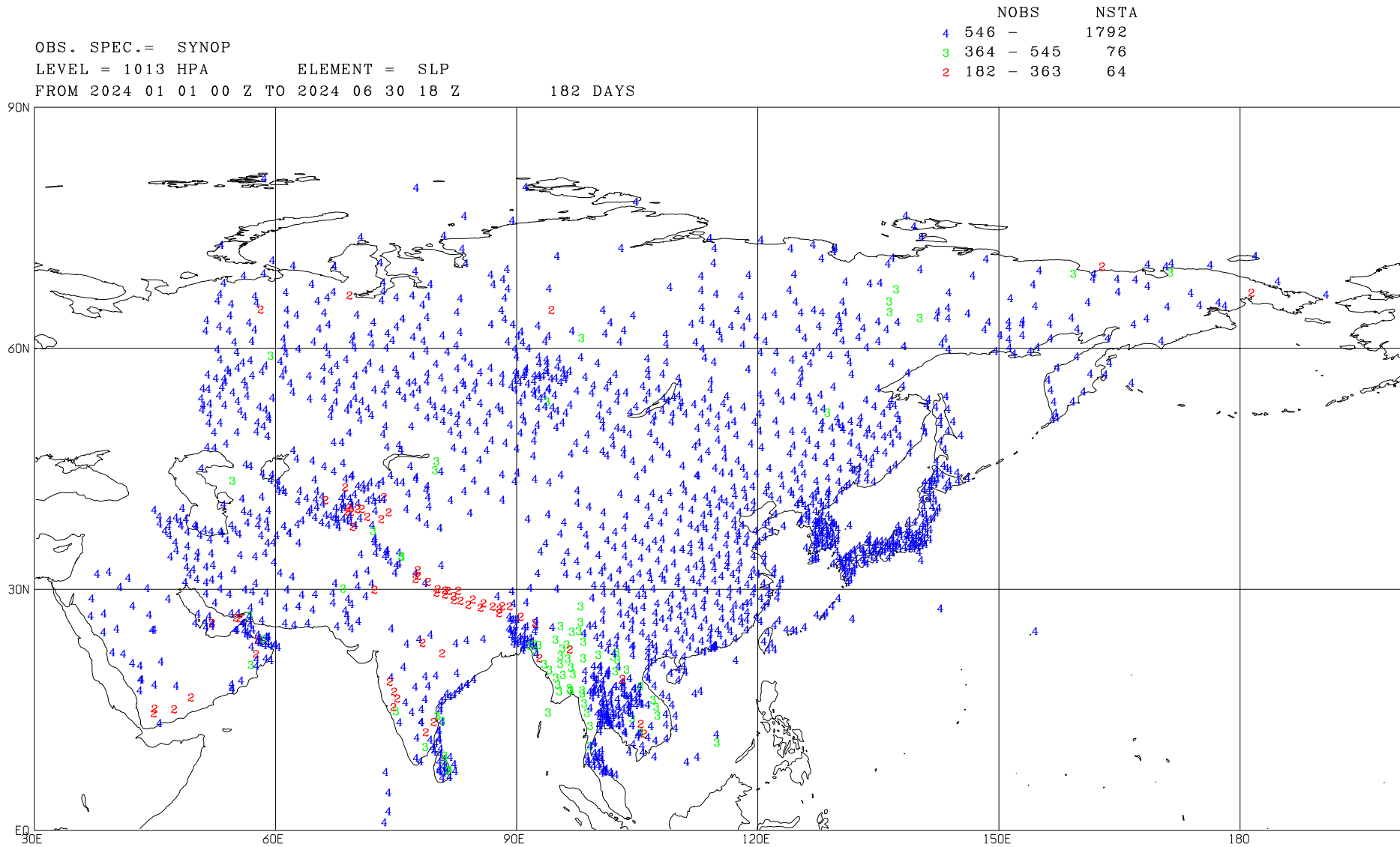


Figure 1(a) Location of all land surface stations reporting station level pressure (SLP) observations in Region II over the six-month period from January to June 2024. Numbers (2, 3, 4) show the total number of observations (NOBS) received at RSMC Tokyo. The total numbers of stations (NSTA) reporting SLP are shown at the top of the figure.

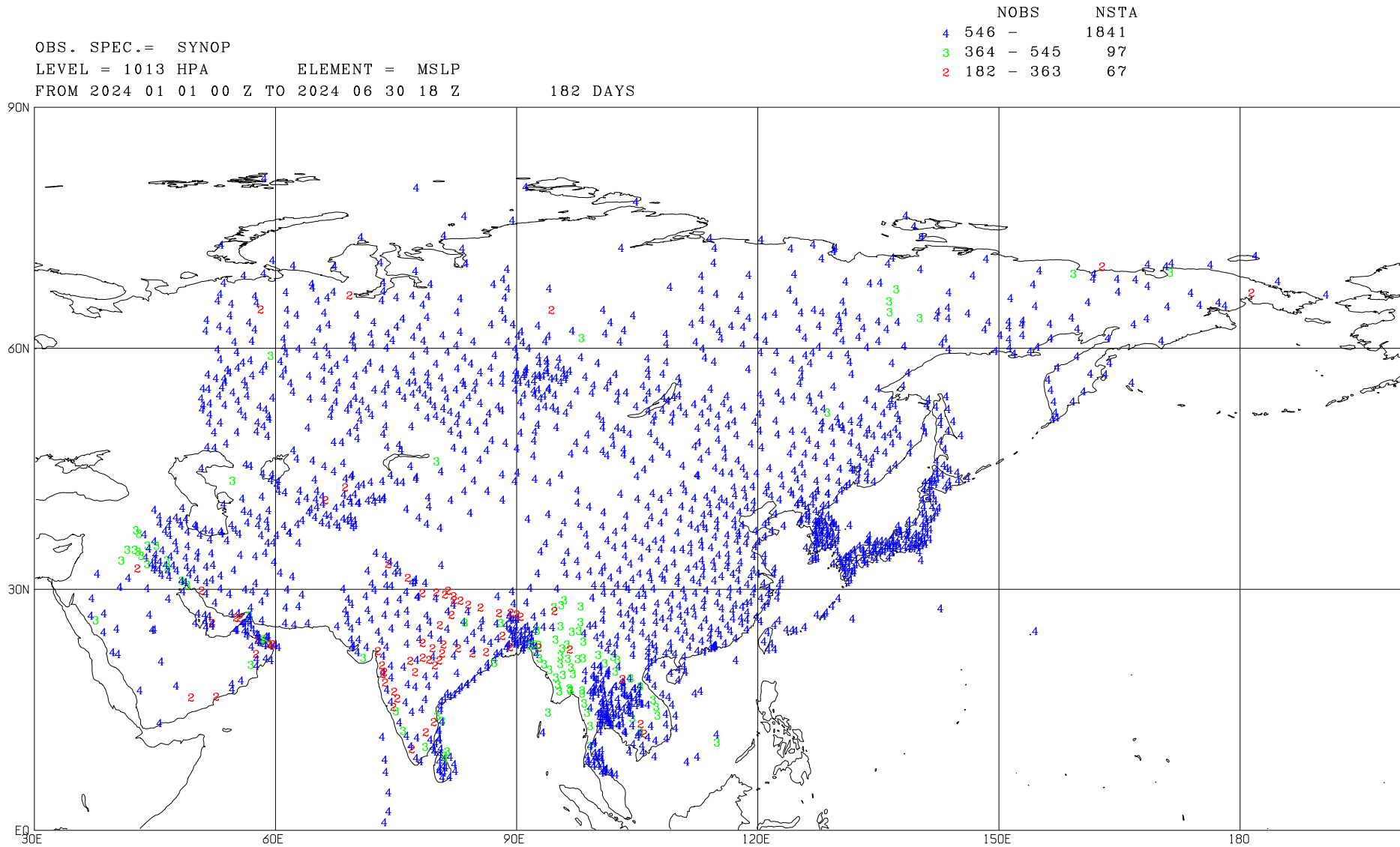


Figure 1(b) Location of all land surface stations reporting mean sea level pressure (MSLP) observations in Region II over the six-month period from January to June 2024. Numbers (2, 3, 4) show the total number of observations (NOBS) received at RSMC Tokyo. The total numbers of stations (NSTA) reporting MSLP are shown at the top of the figure.

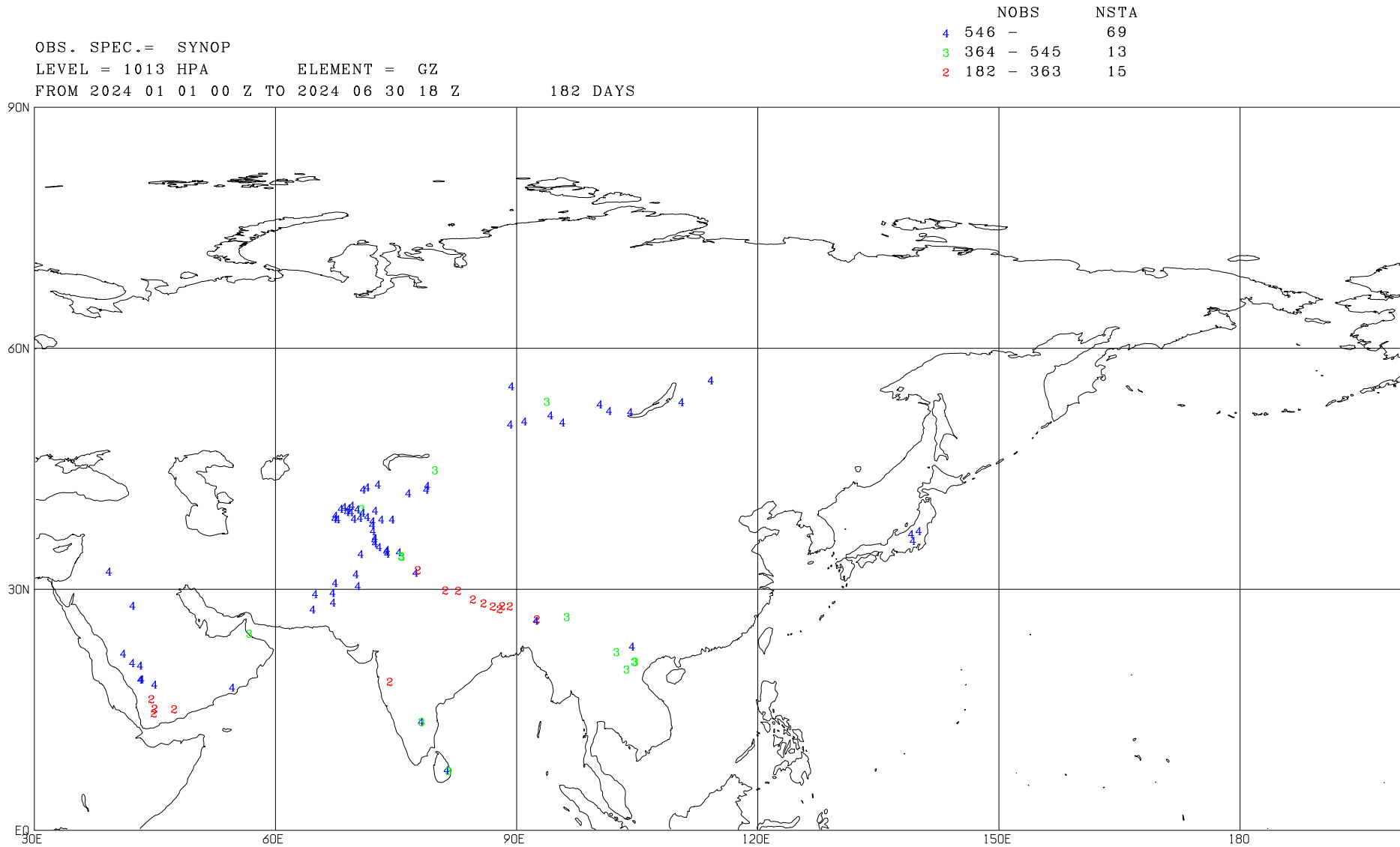


Figure 1(c) Location of all land surface stations reporting geopotential height (GZ) observations in Region II over the six-month period from January to June 2024. Numbers (2, 3, 4) show the total number of observations (NOBS) received at RSMC Tokyo. The total numbers of stations (NSTA) reporting GZ are shown at the top of the figure.

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

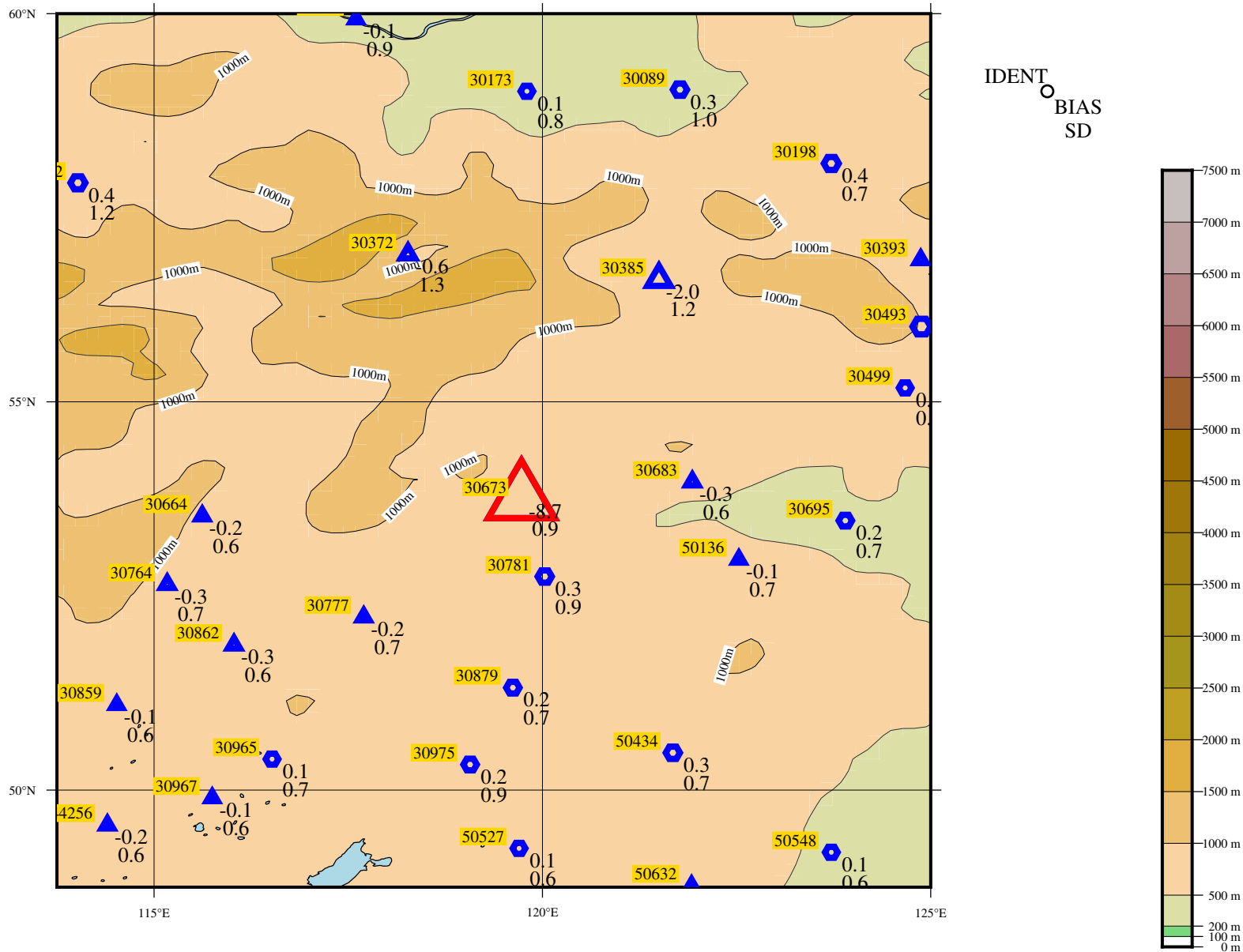
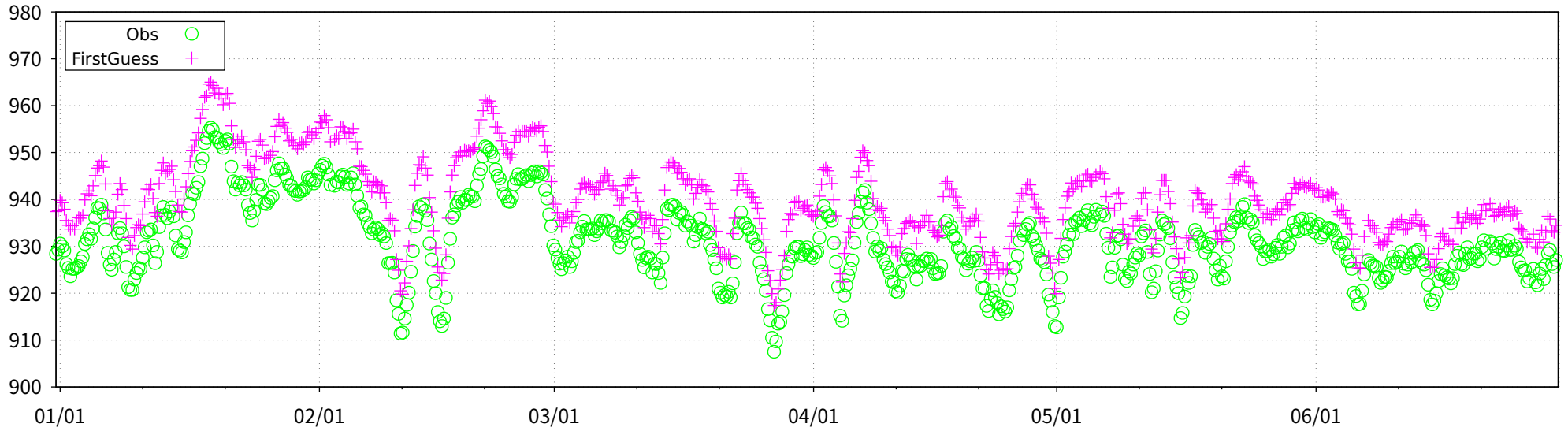


Figure 2 BIAS and SD of SLP for station 30673 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 30673 (lat: 53.8N, lon: 119.7E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

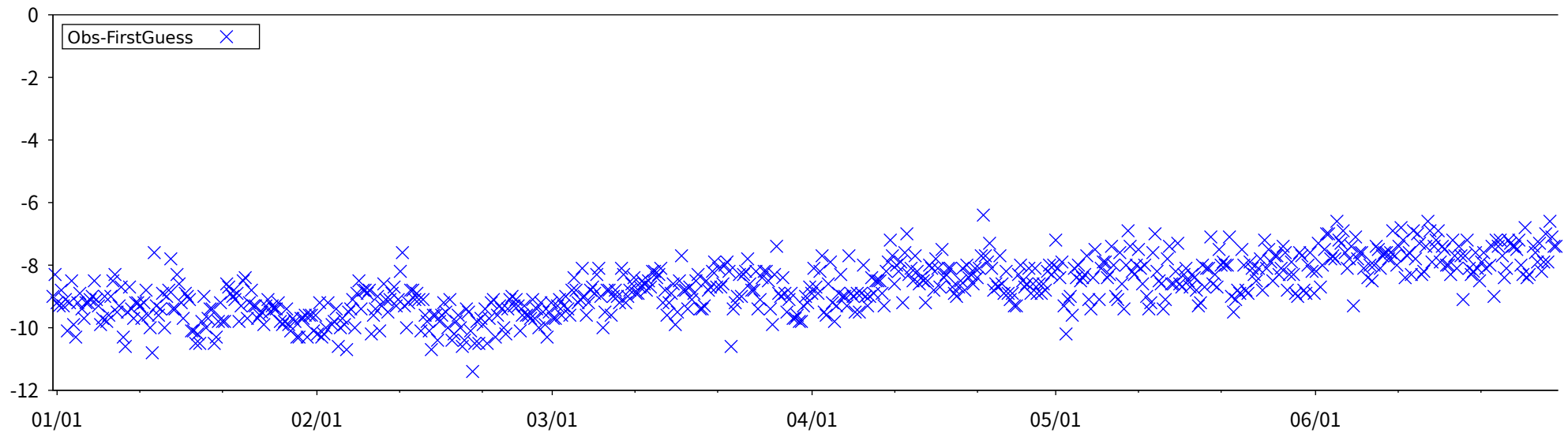


Figure 3 Time-series representation of SLP Obs minus FirstGuess for station 30673

LEVEL = SUR ELEMENT = MSLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

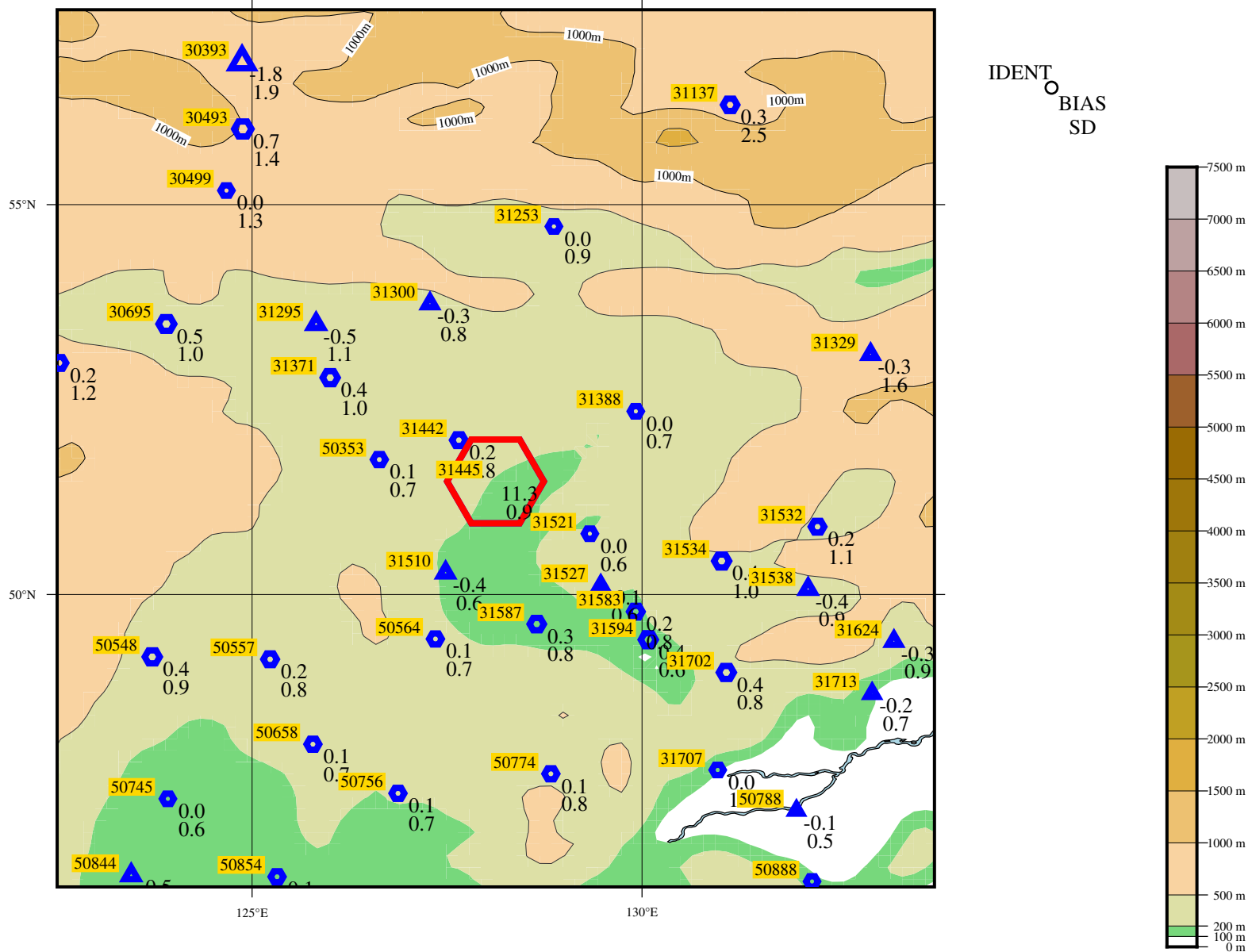
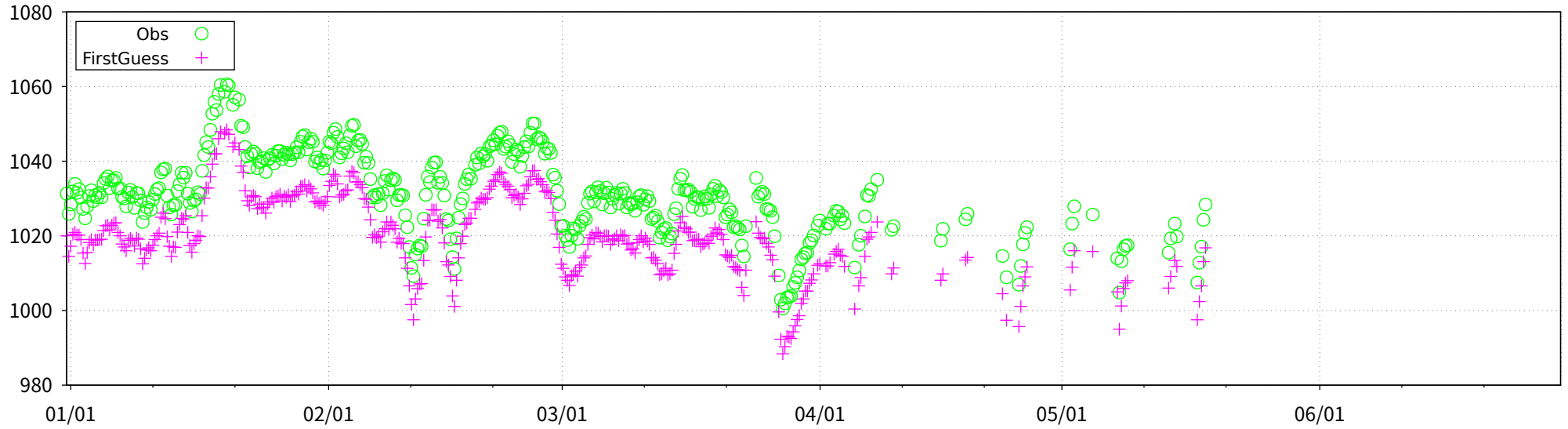


Figure 4 BIAS and SD of MSLP for station 31445 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 31445 (lat: 51.5N, lon: 128.1E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

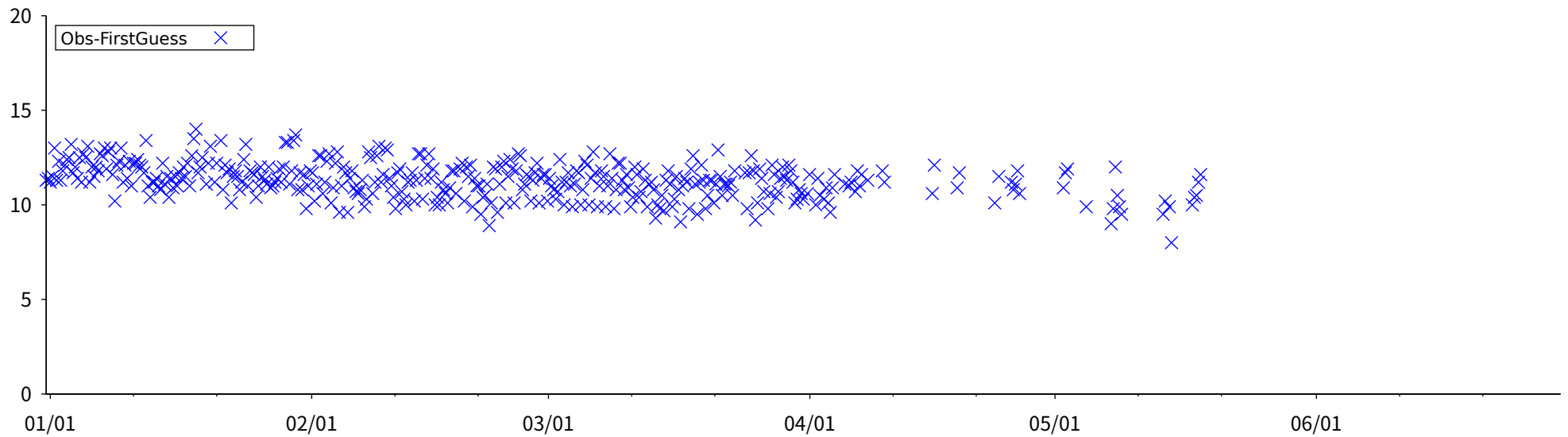


Figure 5 Time-series representation of MSLP Obs minus FirstGuess for station 31445

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

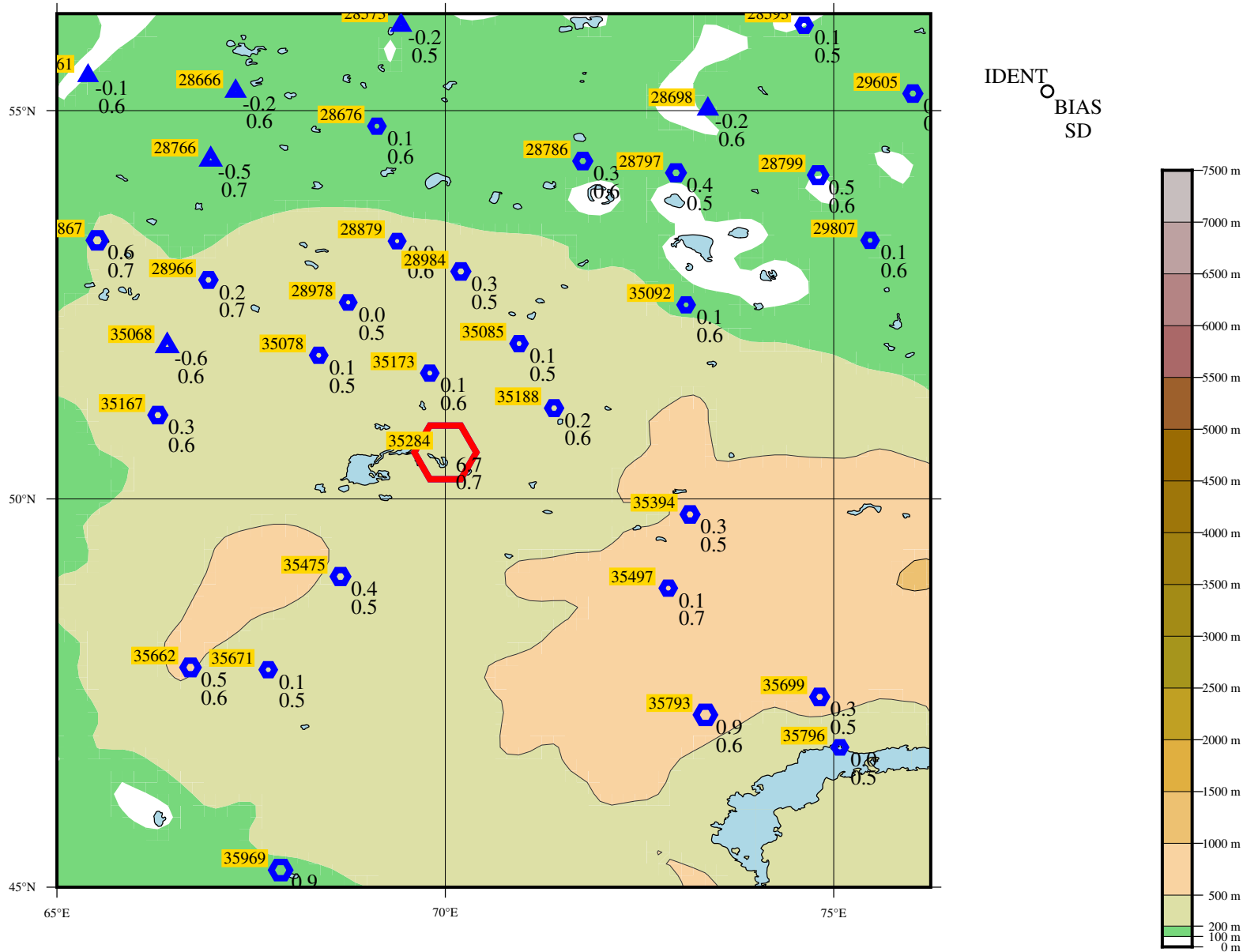
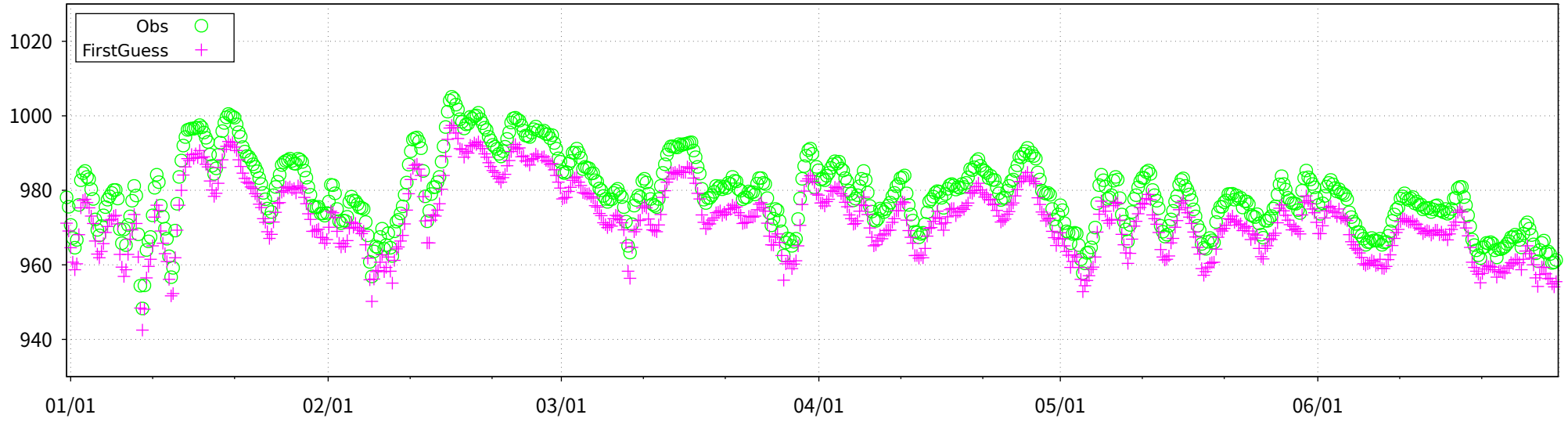


Figure 6 BIAS and SD of SLP for station 35284 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 35284 (lat: 50.6N, lon: 70.0E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

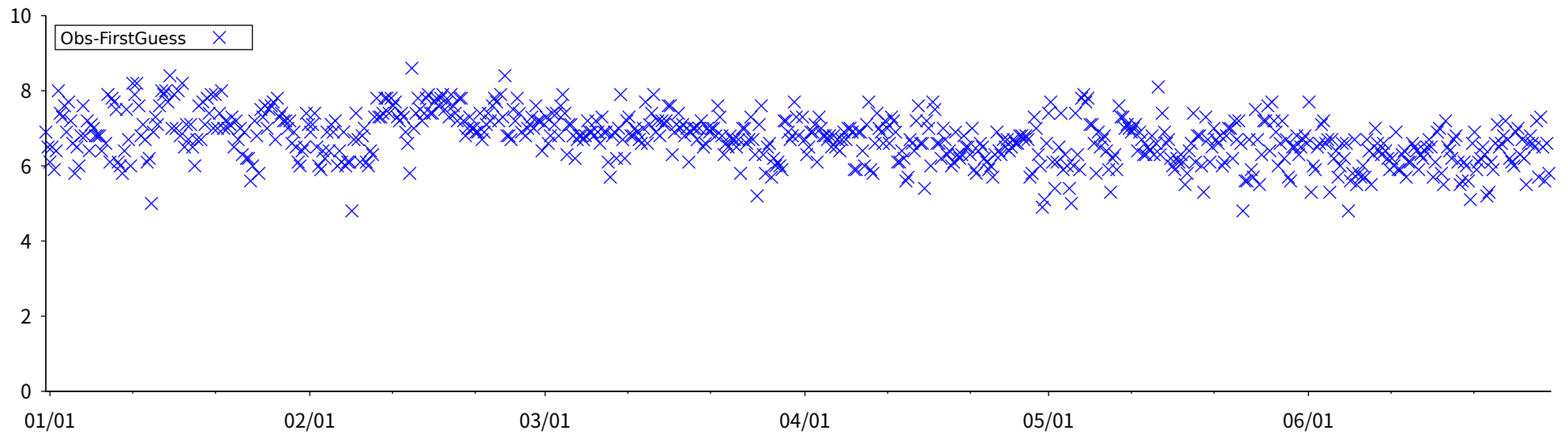


Figure 7 Time-series representation of SLP Obs minus FirstGuess for station 35284

LEVEL = SUR ELEMENT = MSLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

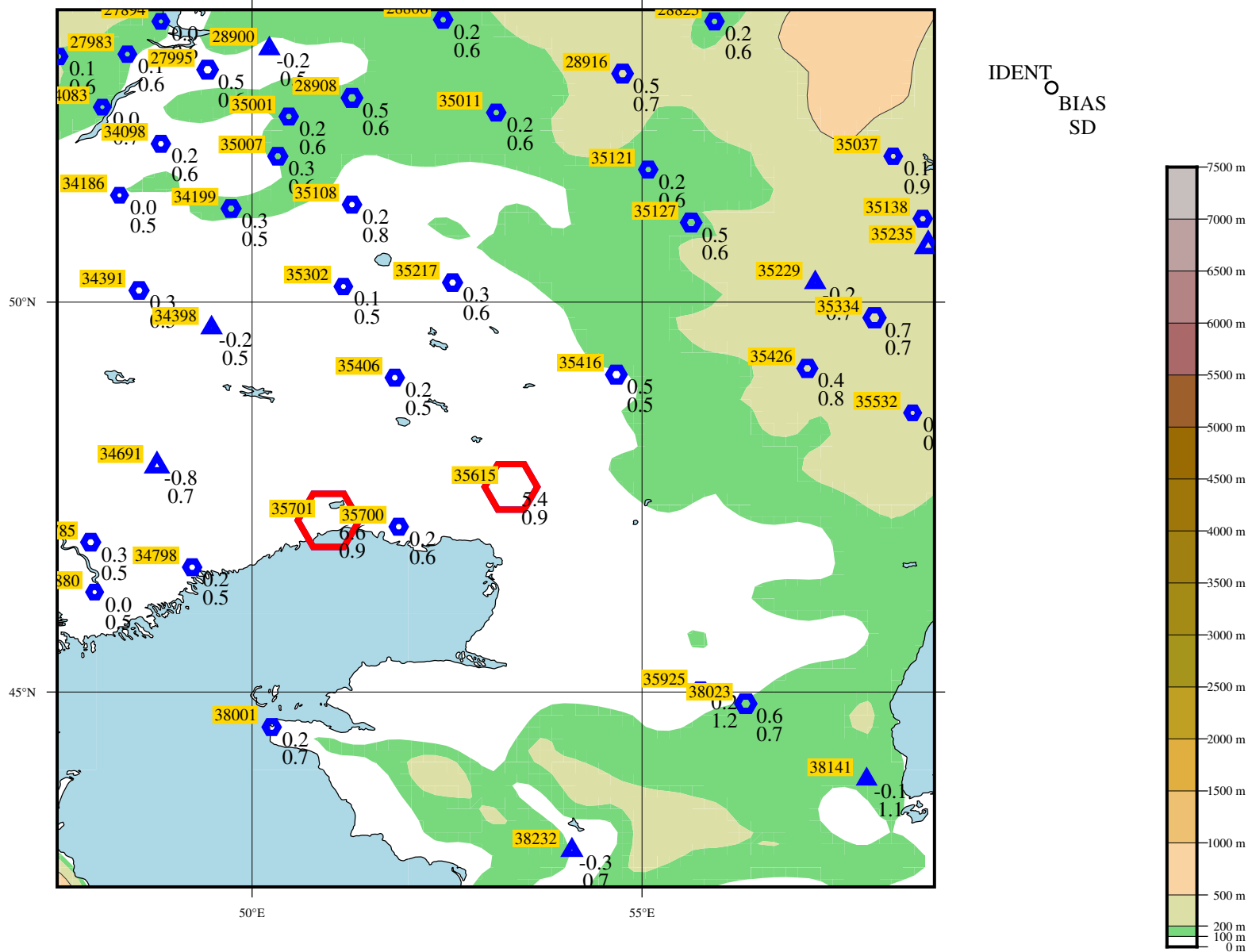
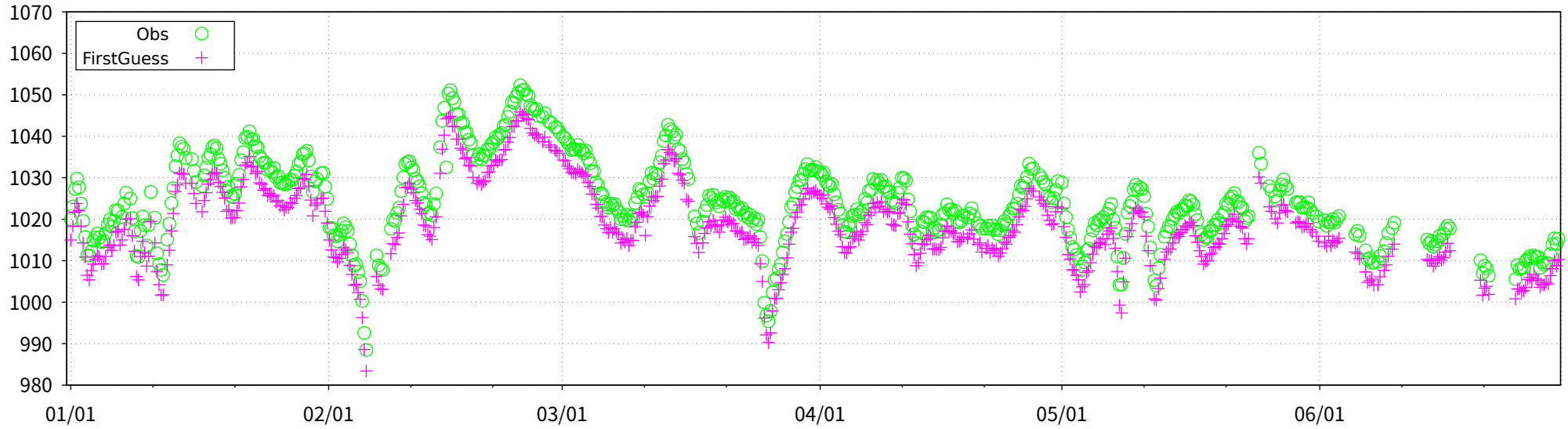


Figure 8 BIAS and SD of MSLP for station 35615, 35701 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 35615 (lat: 47.6N, lon: 53.3E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

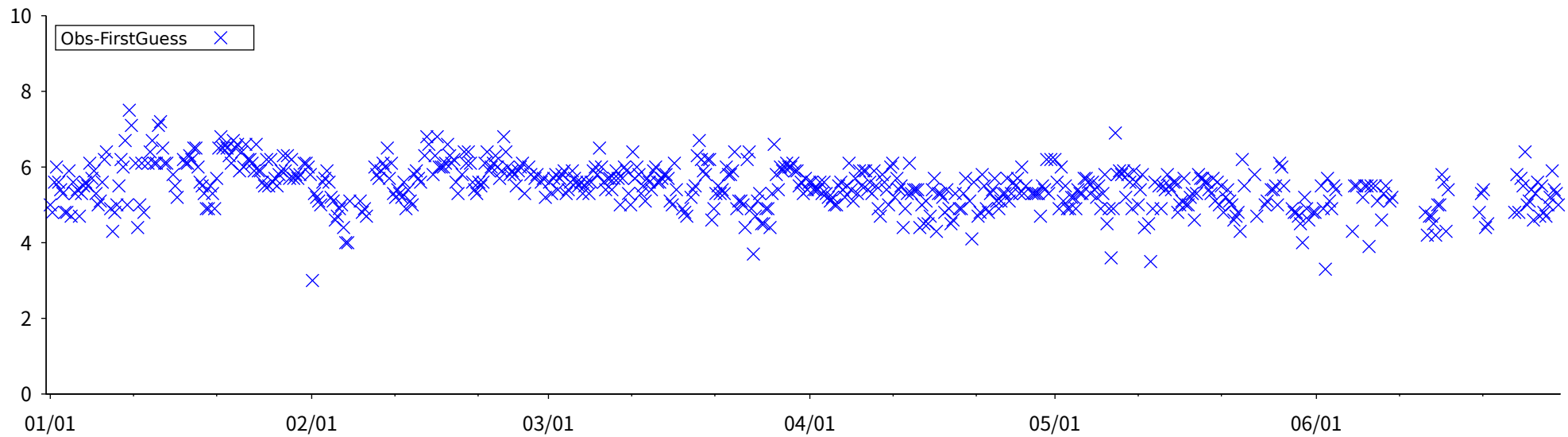
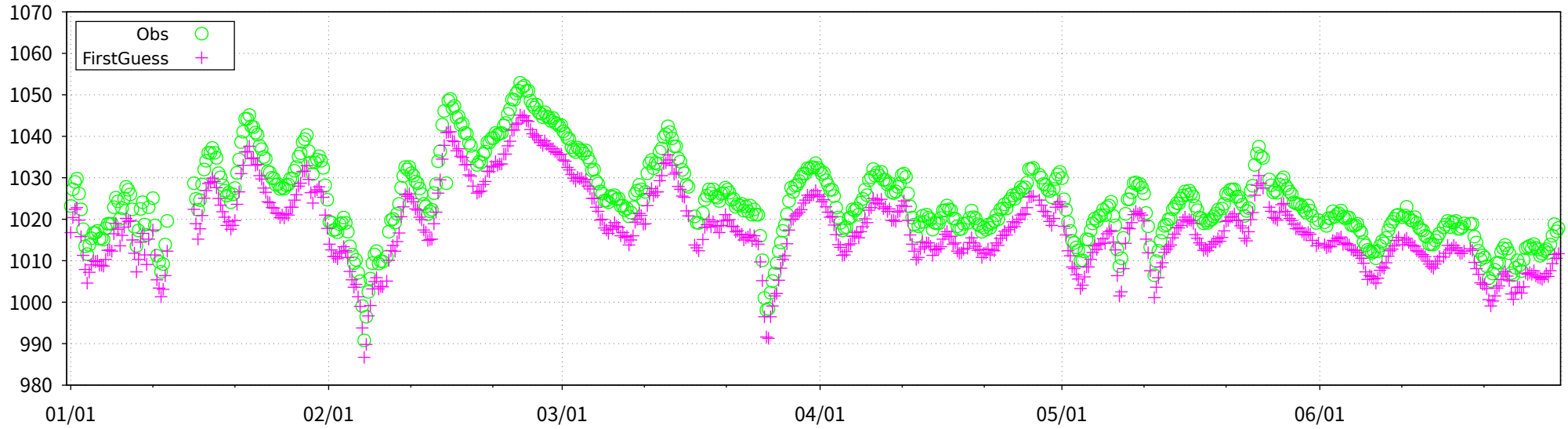


Figure 9 Time-series representation of MSLP Obs minus FirstGuess for station 35615

ID: 35701 (lat: 47.2N, lon: 51.0E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

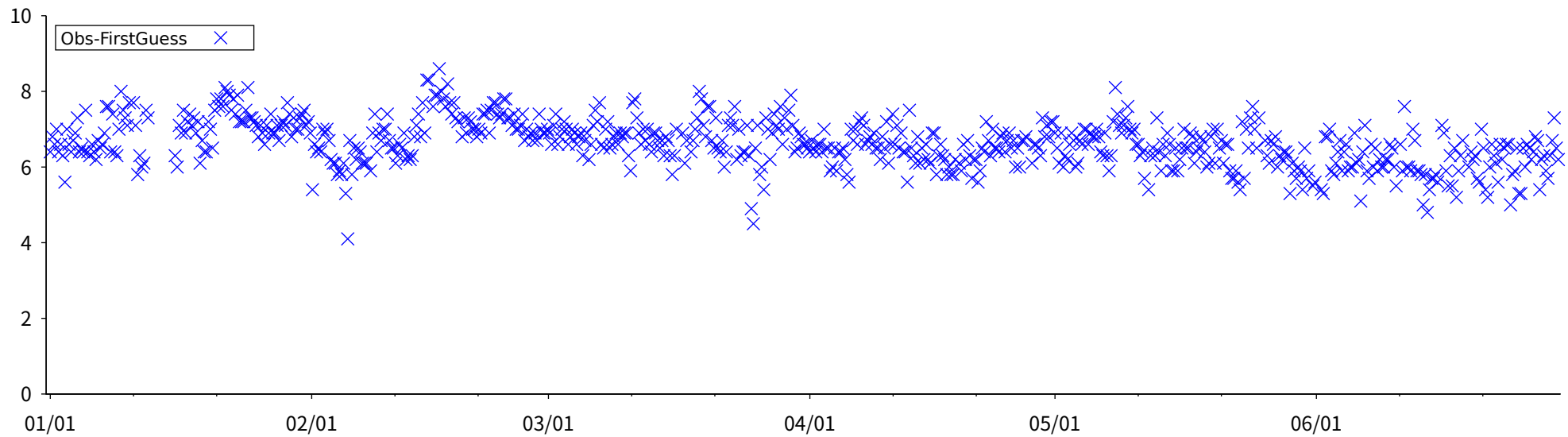


Figure 10 Time-series representation of MSLP Obs minus FirstGuess for station 35701

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

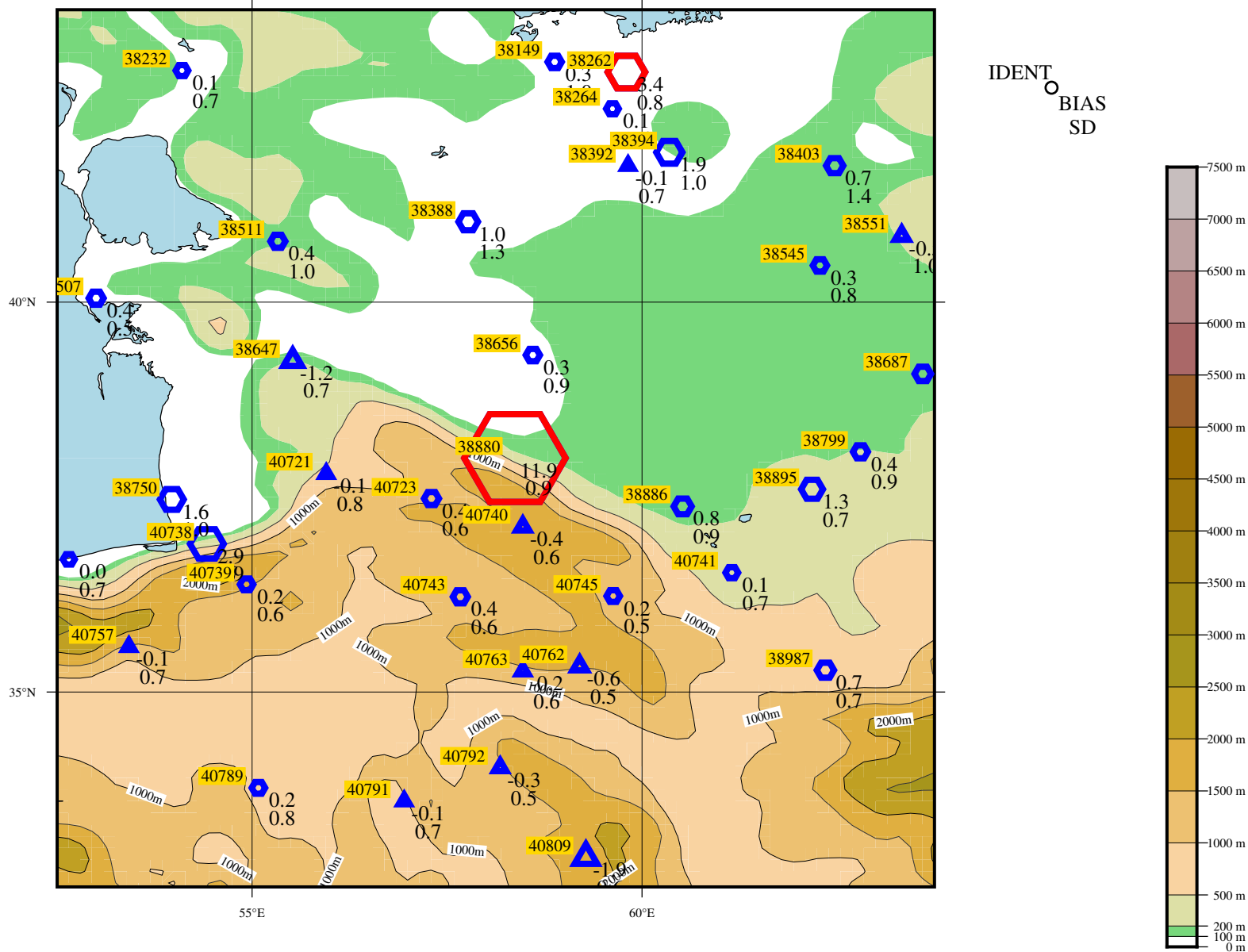
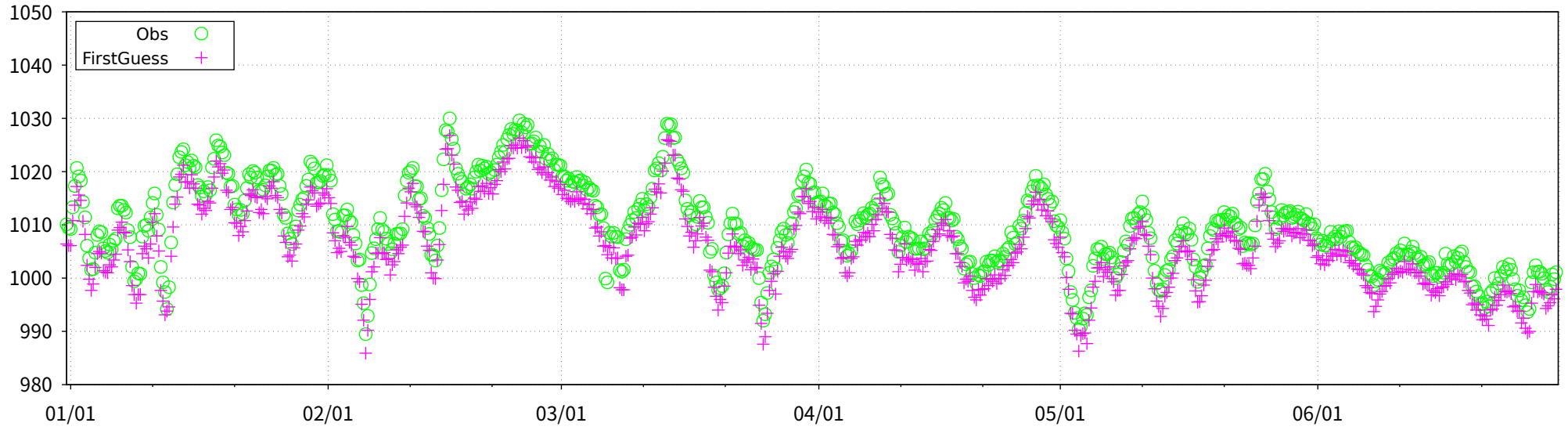


Figure 11 BIAS and SD of SLP for station 38262, 38880 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 38262 (lat: 43.0N, lon: 59.8E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

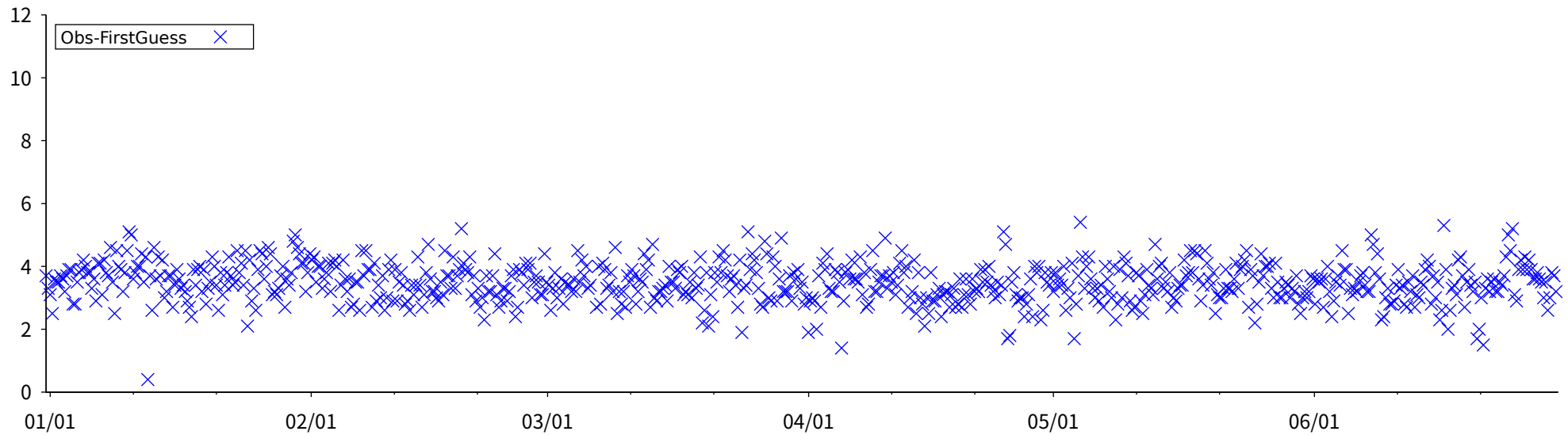


Figure 12 Time-series representation of SLP Obs minus FirstGuess for station 38262

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

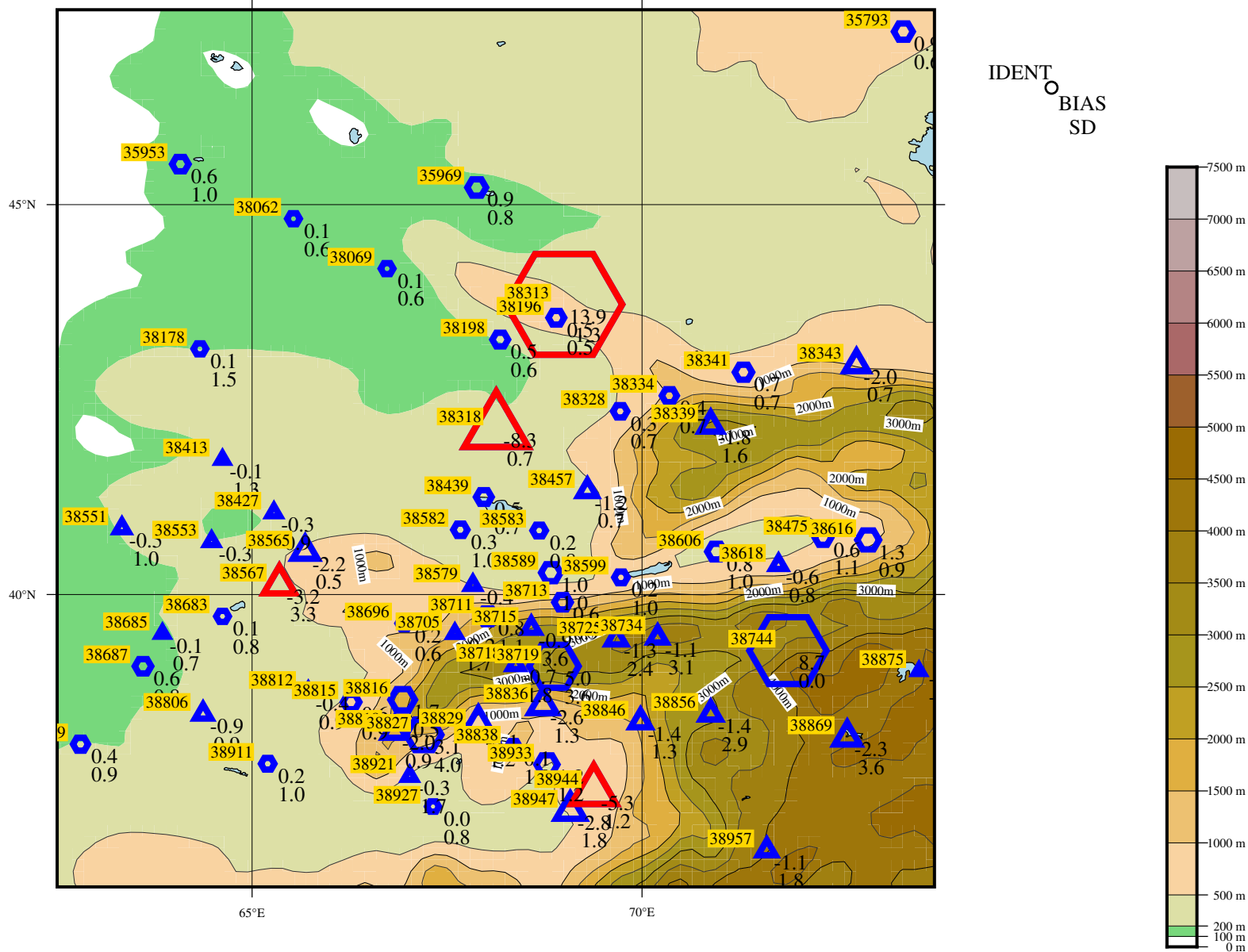
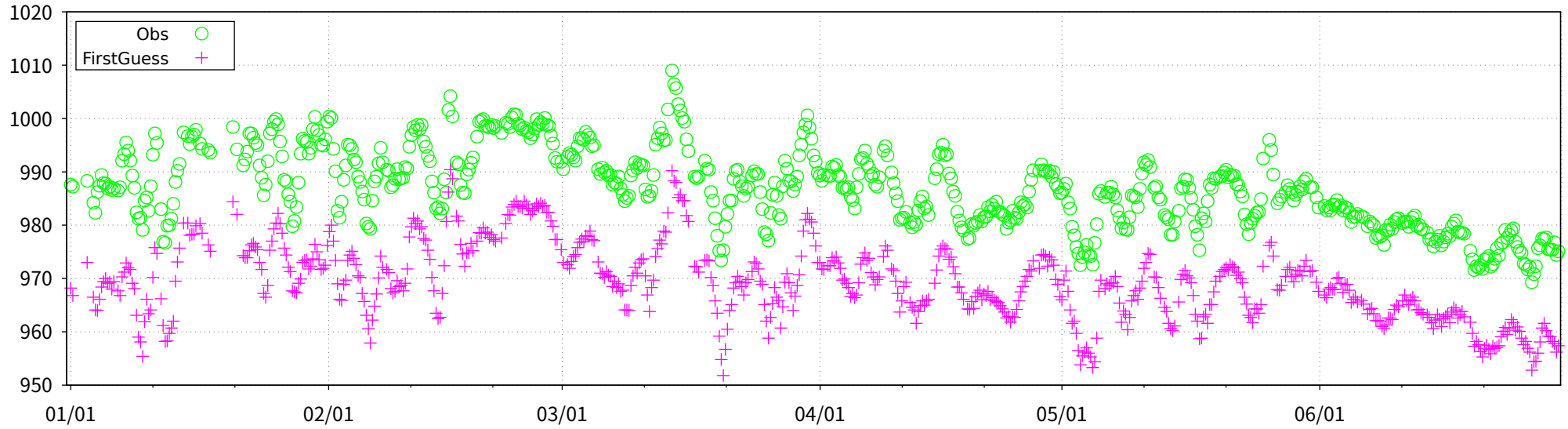


Figure 13 BIAS and SD of SLP for station 38313, 38318, 38567, 38944 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 38313 (lat: 43.7N, lon: 69.0E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

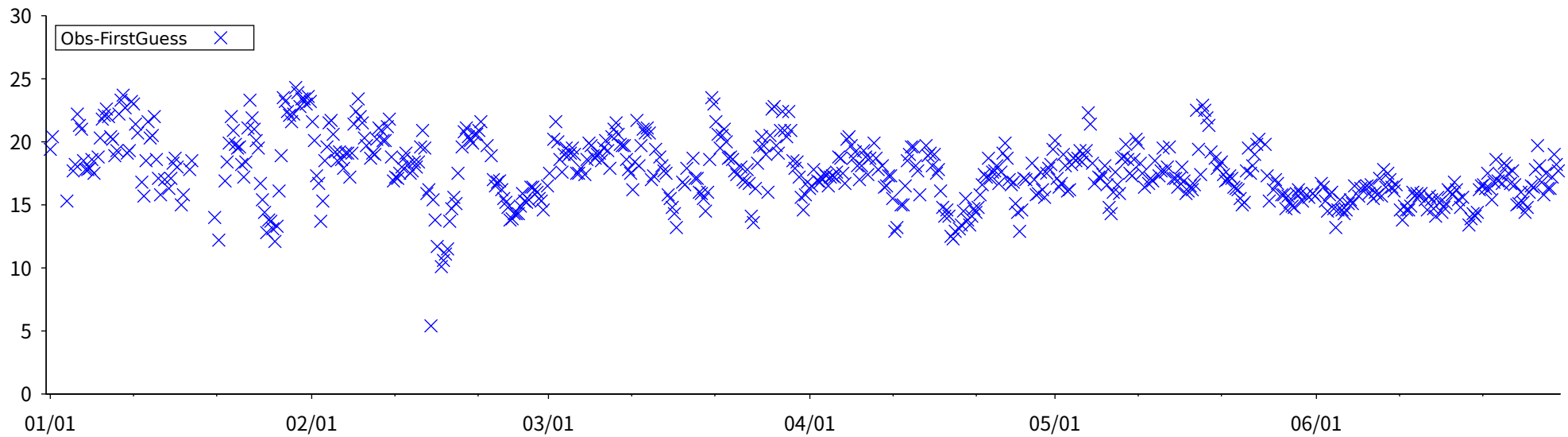


Figure 14 Time-series representation of SLP Obs minus FirstGuess for station 38313

LEVEL = SUR ELEMENT = MSLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

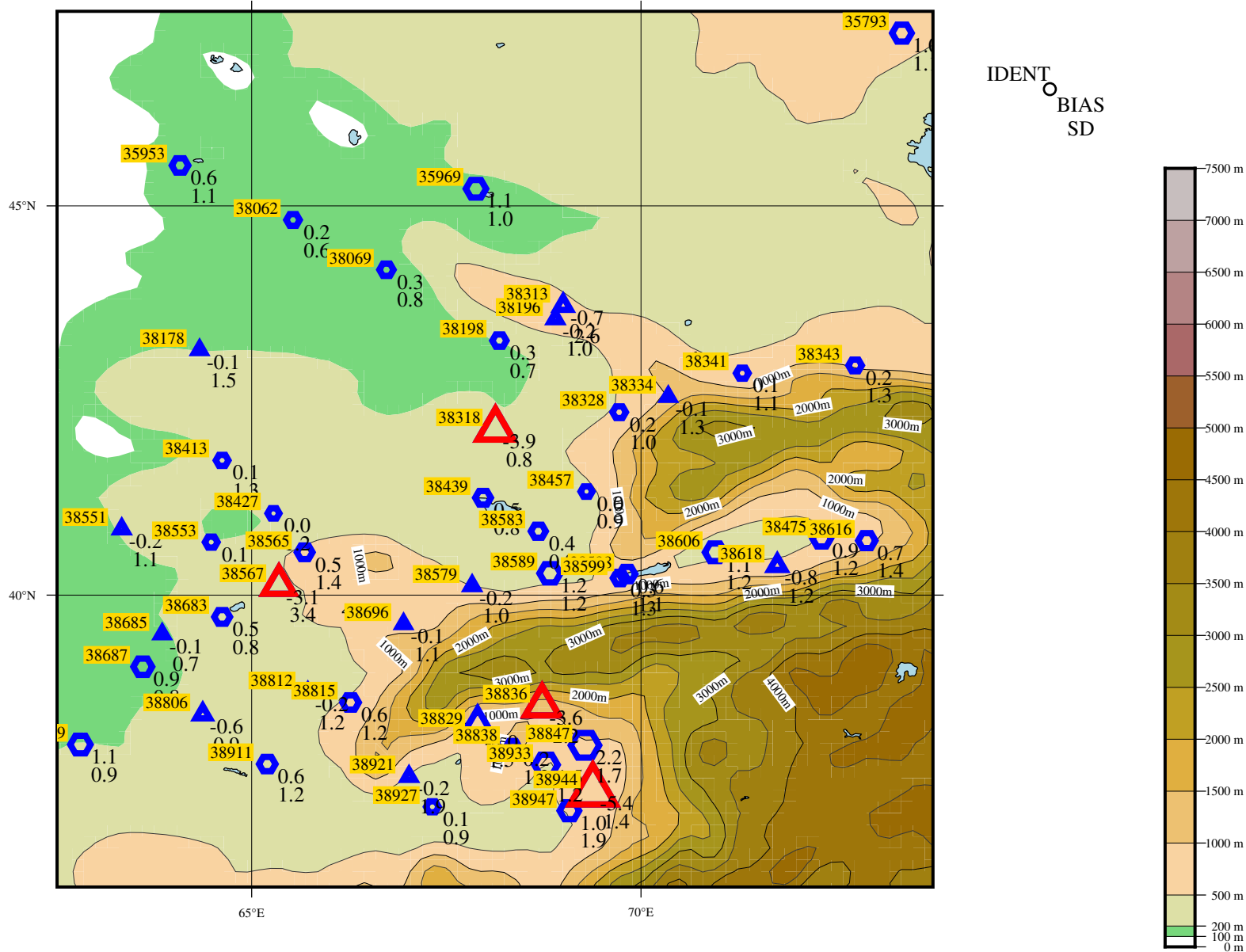
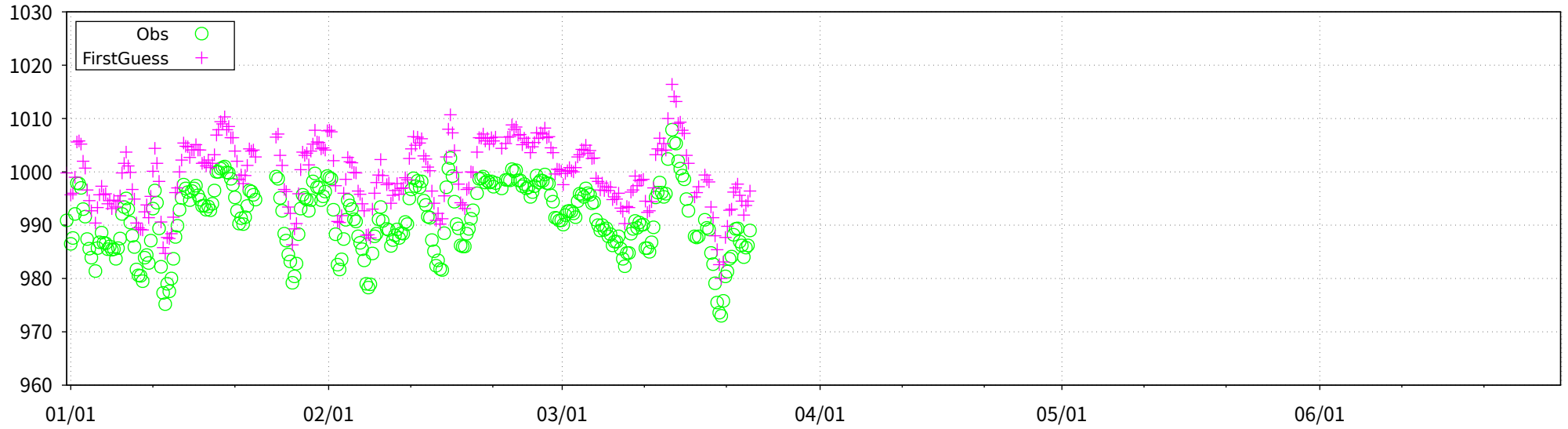


Figure 15 BIAS and SD of MSLP for station 38318, 38567, 38836, 38944 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 38318 (lat: 42.1N, lon: 68.1E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

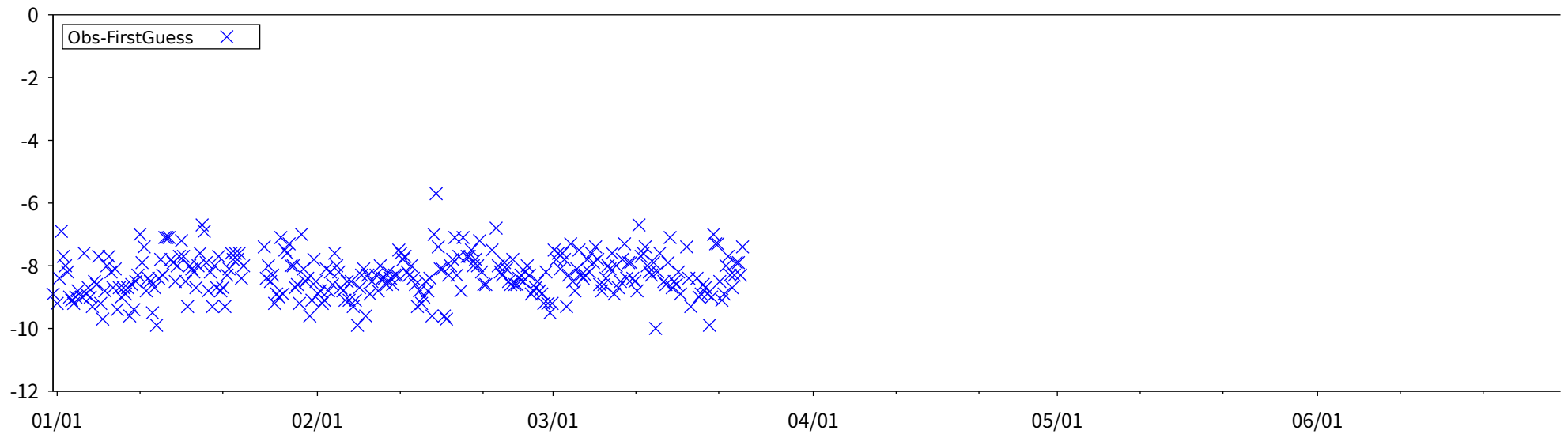
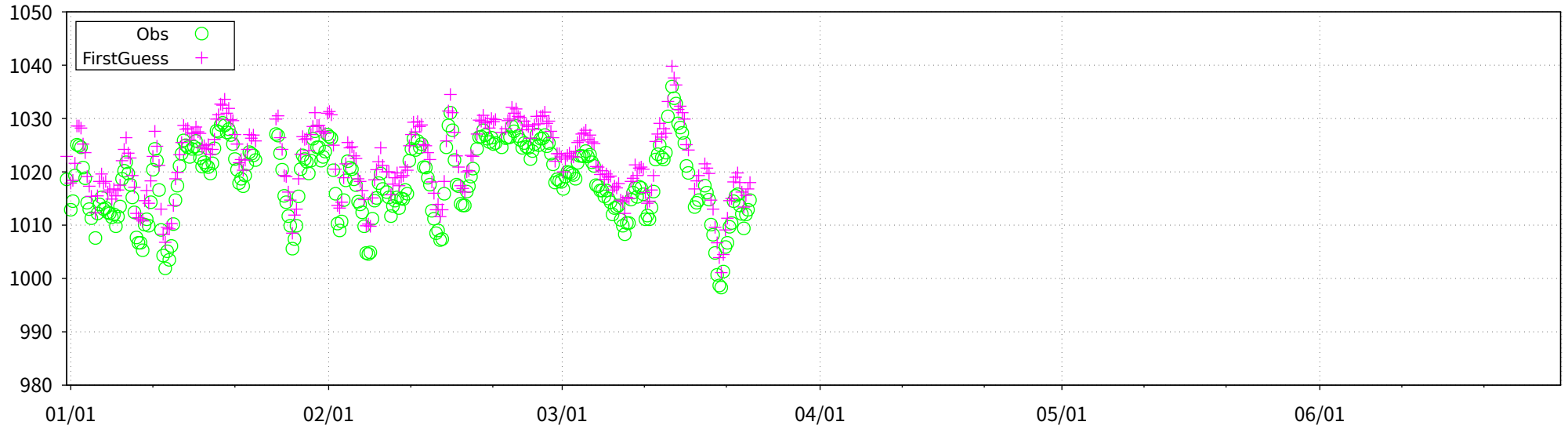


Figure 16(a) Time-series representation of SLP Obs minus FirstGuess for station 38318

ID: 38318 (lat: 42.1N, lon: 68.1E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

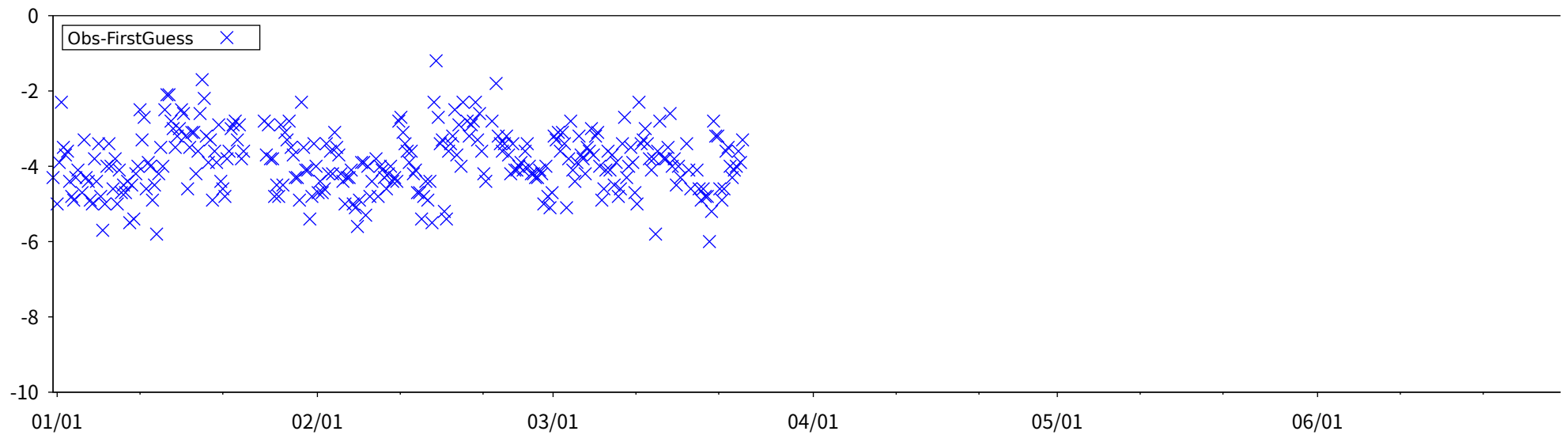
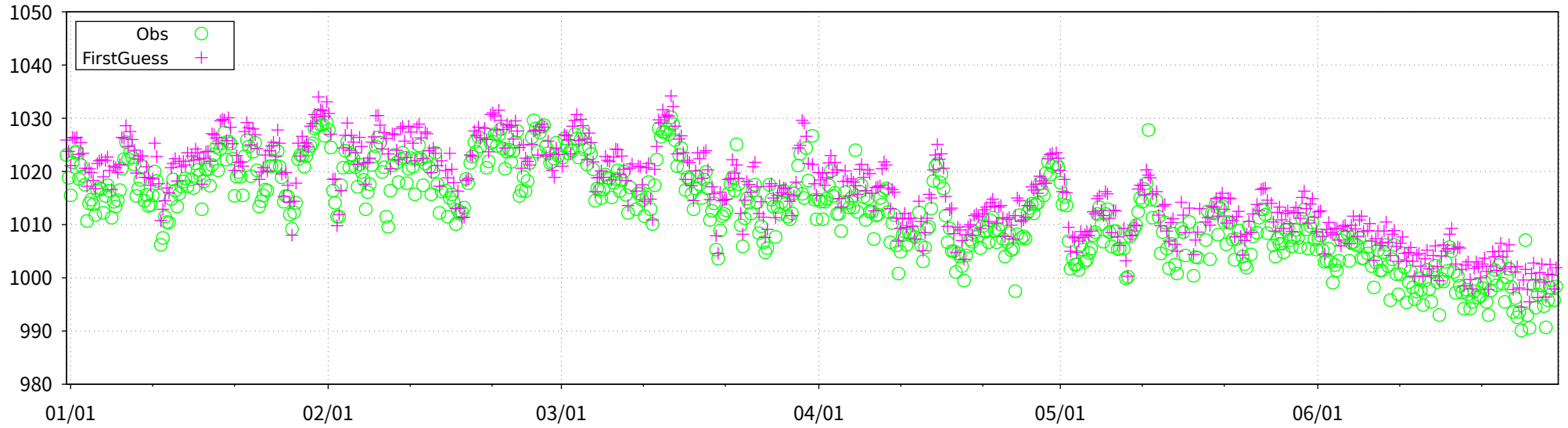


Figure 16(b) Time-series representation of MSLP Obs minus FirstGuess for station 38318

ID: 38836 (lat: 38.6N, lon: 68.7E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

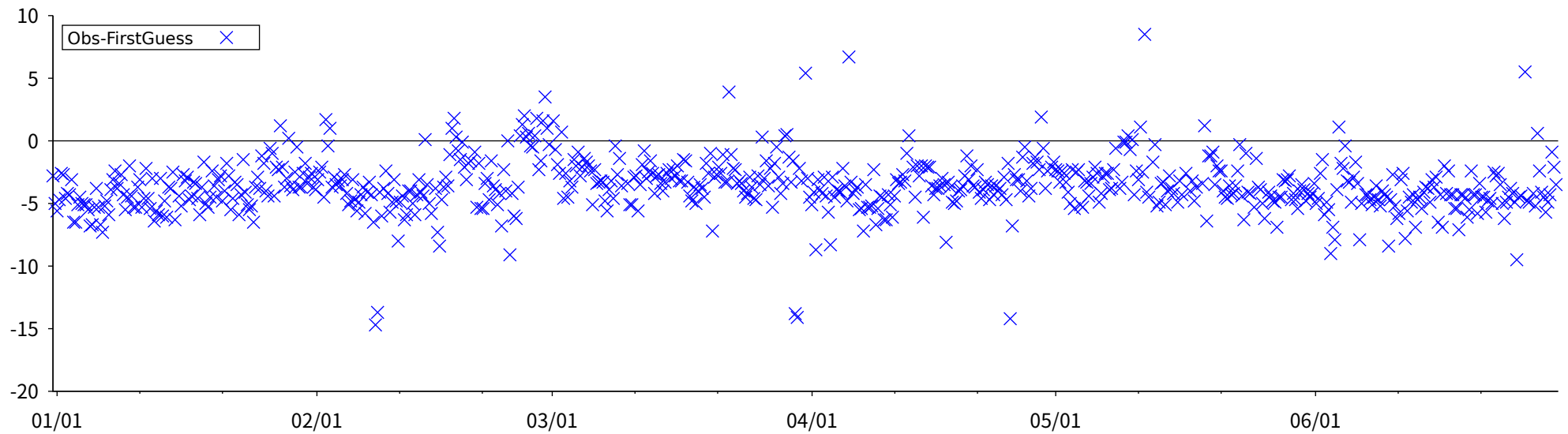
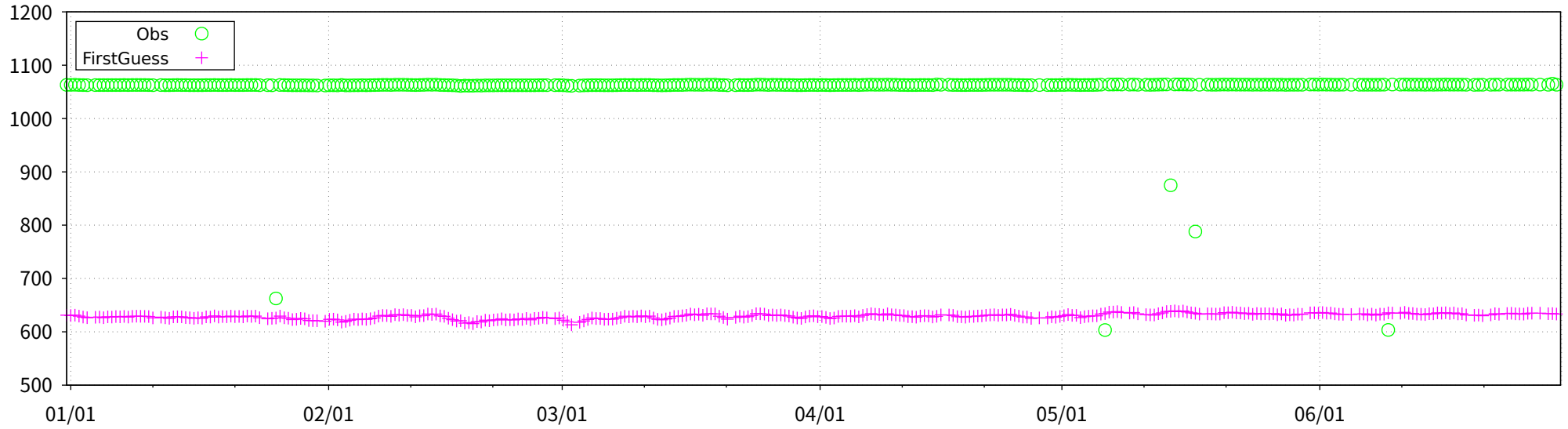


Figure 17 Time-series representation of MSLP Obs minus FirstGuess for station 38836

ID: 38875 (lat: 39.0N, lon: 73.6E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

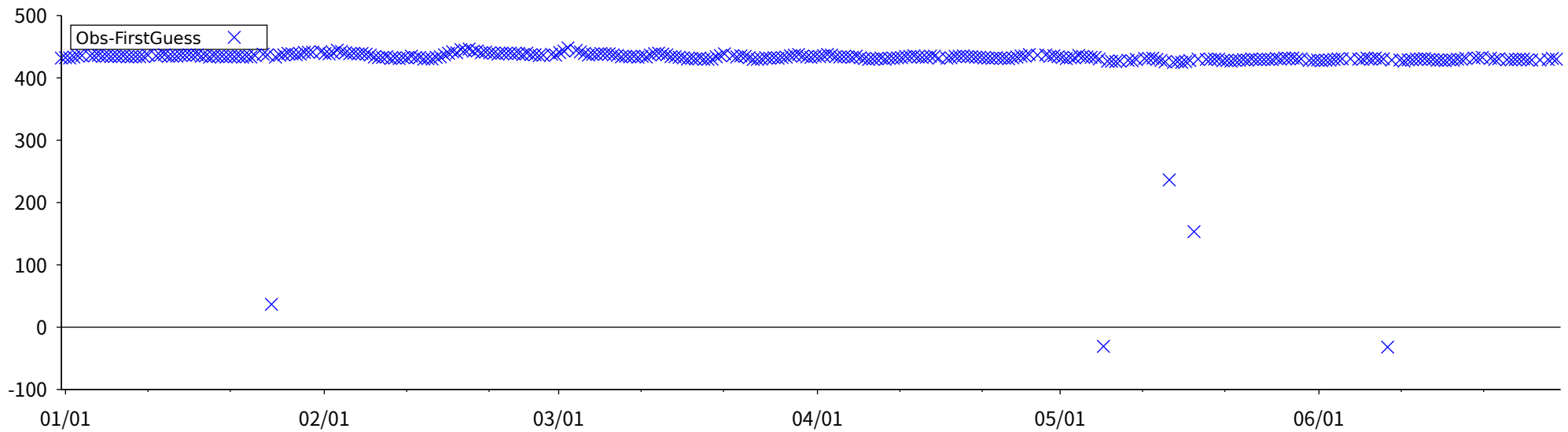
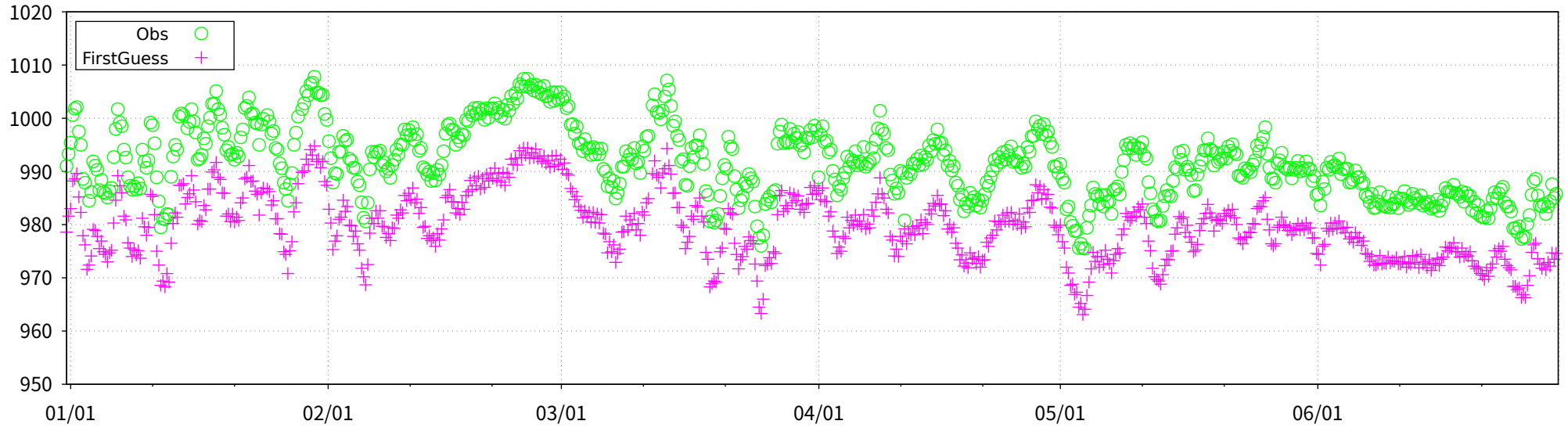


Figure 18 Time-series representation of SLP Obs minus FirstGuess for station 38875

ID: 38880 (lat: 38.0N, lon: 58.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

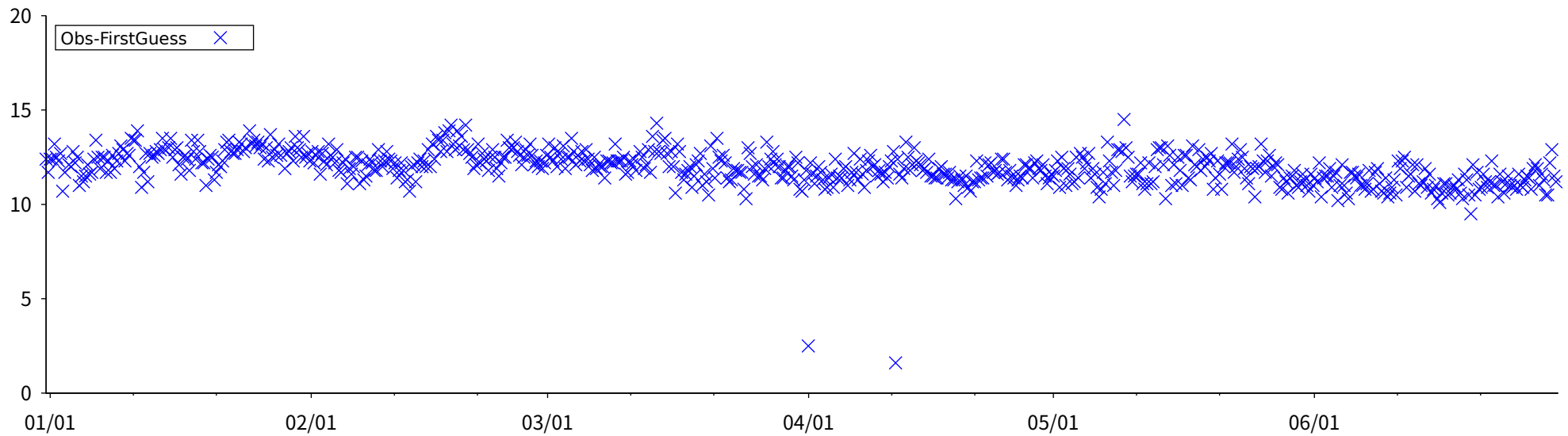
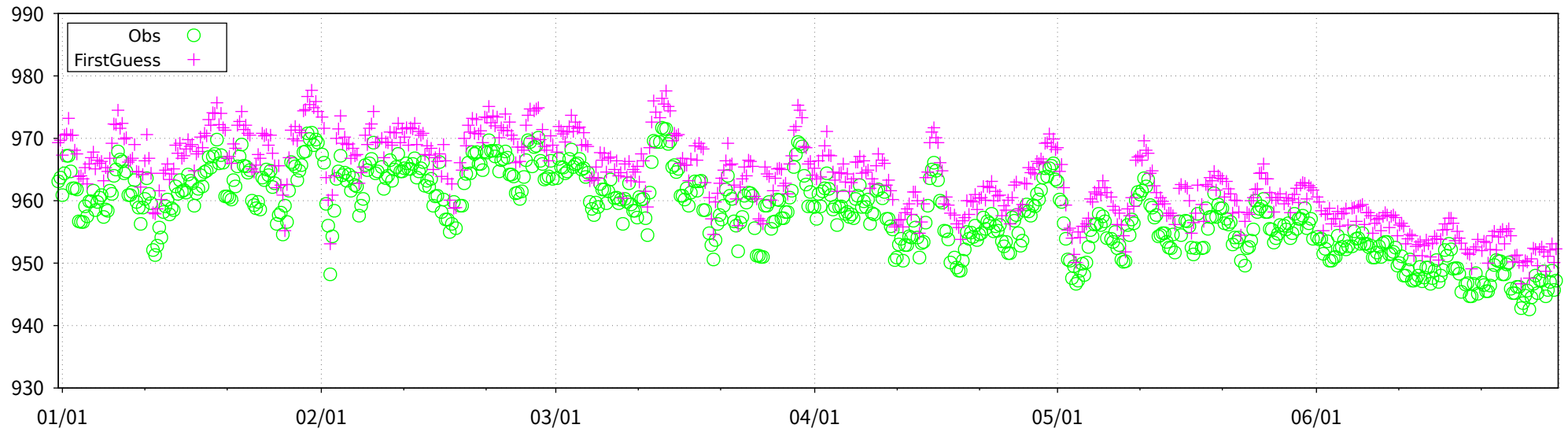


Figure 19 Time-series representation of SLP Obs minus FirstGuess for station 38880

ID: 38944 (lat: 37.5N, lon: 69.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

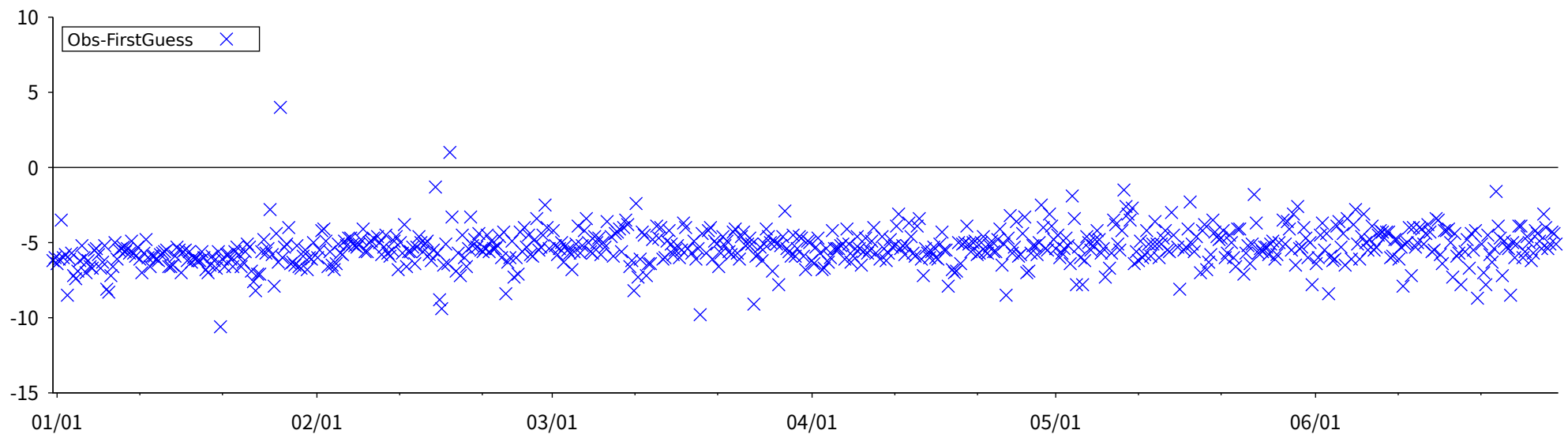
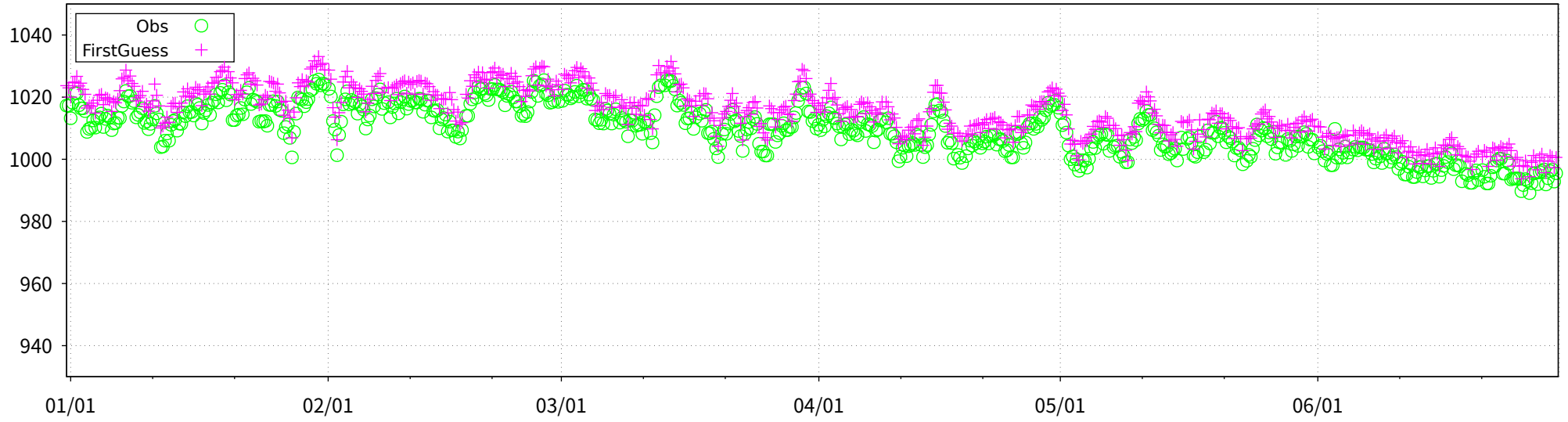


Figure 20(a) Time-series representation of SLP Obs minus FirstGuess for station 38944

ID: 38944 (lat: 37.5N, lon: 69.4E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

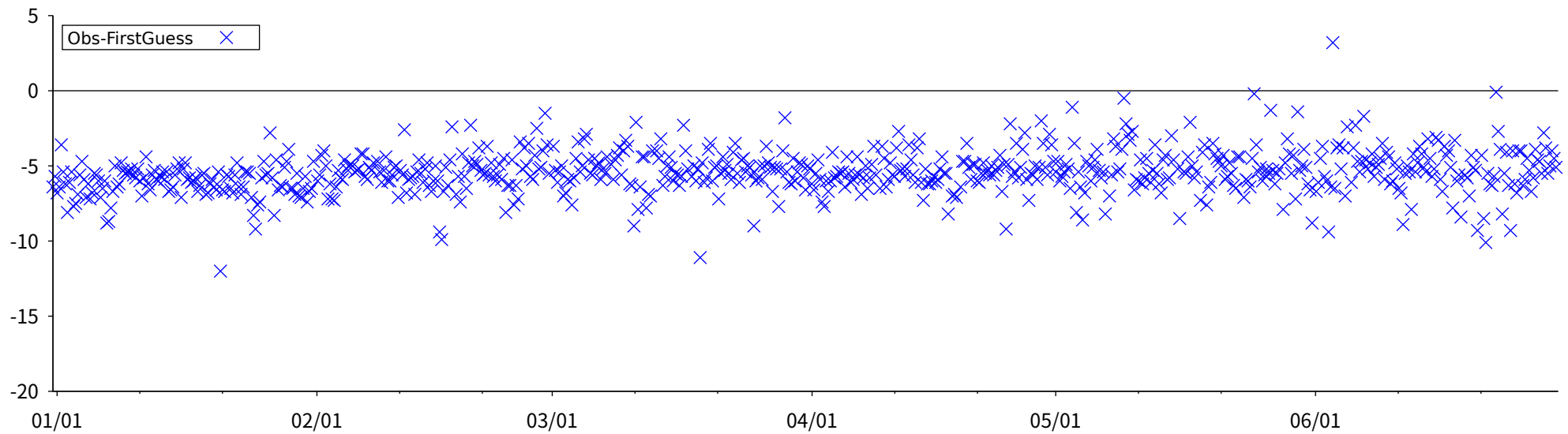
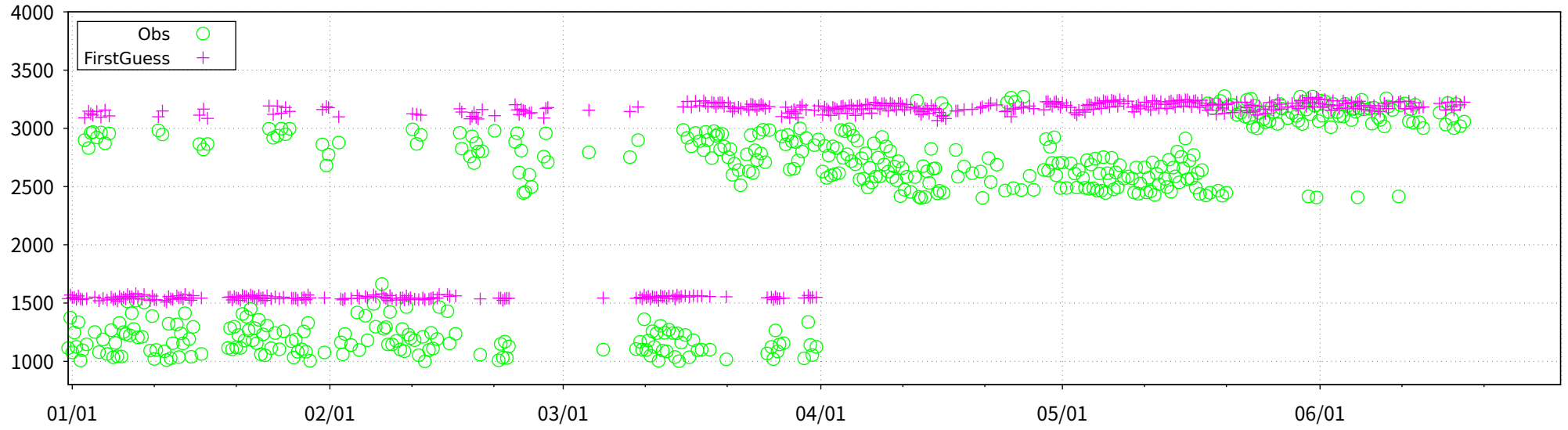


Figure 20(b) Time-series representation of MSLP Obs minus FirstGuess for station 38944

ID: 41249 (lat: 23.9N, lon: 56.2E)

GZ850 or GZ700 [m]



GZ850 or GZ700 [m] (Obs-FirstGuess)

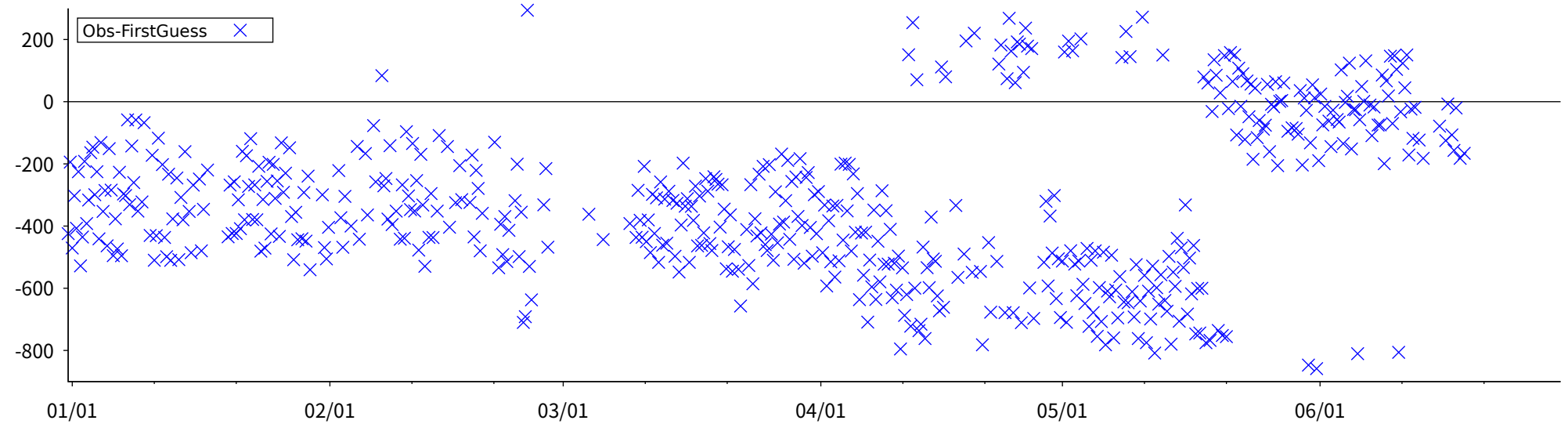


Figure 21 Time-series representation of GZ850 or GZ700 Obs minus FirstGuess for station 41249

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

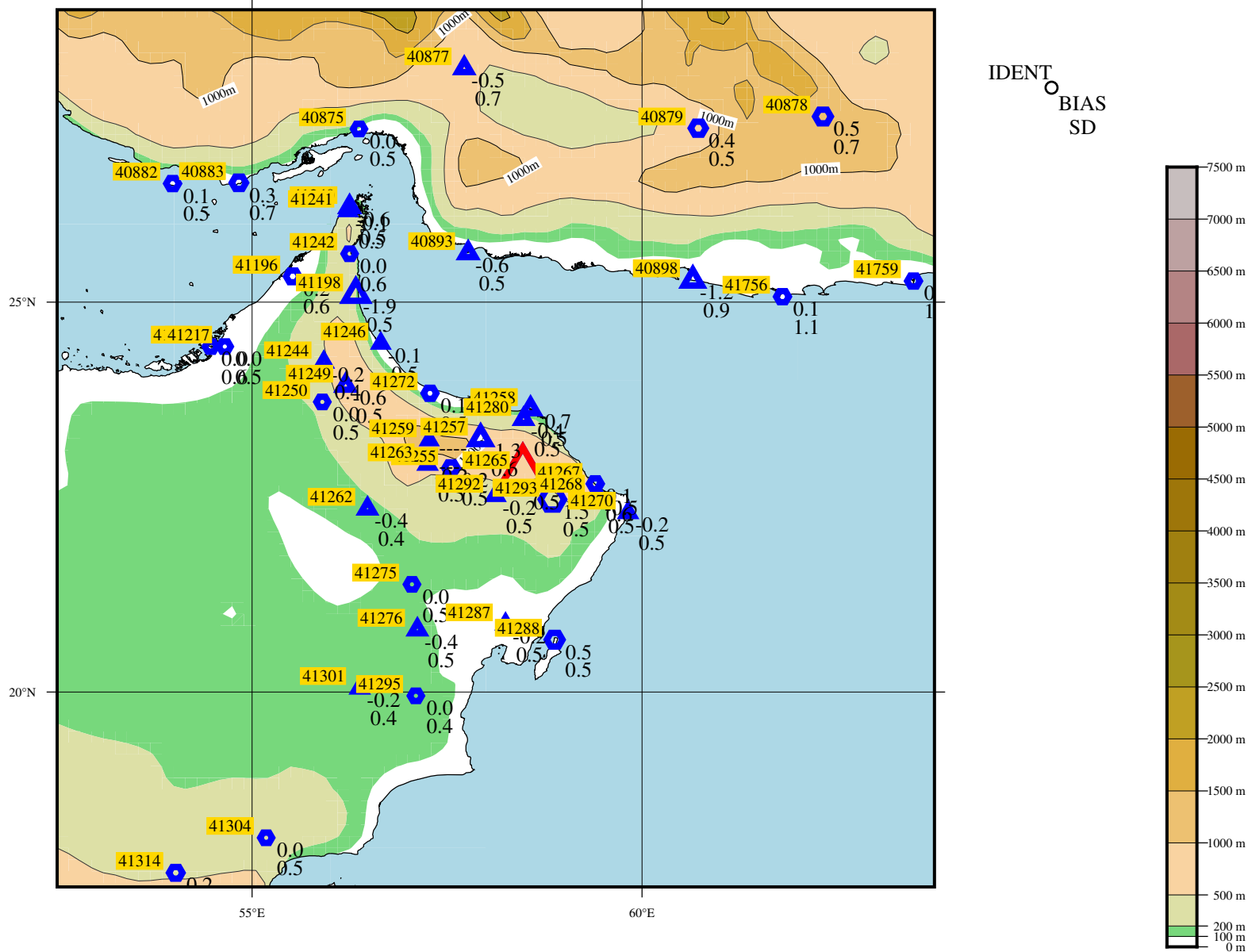
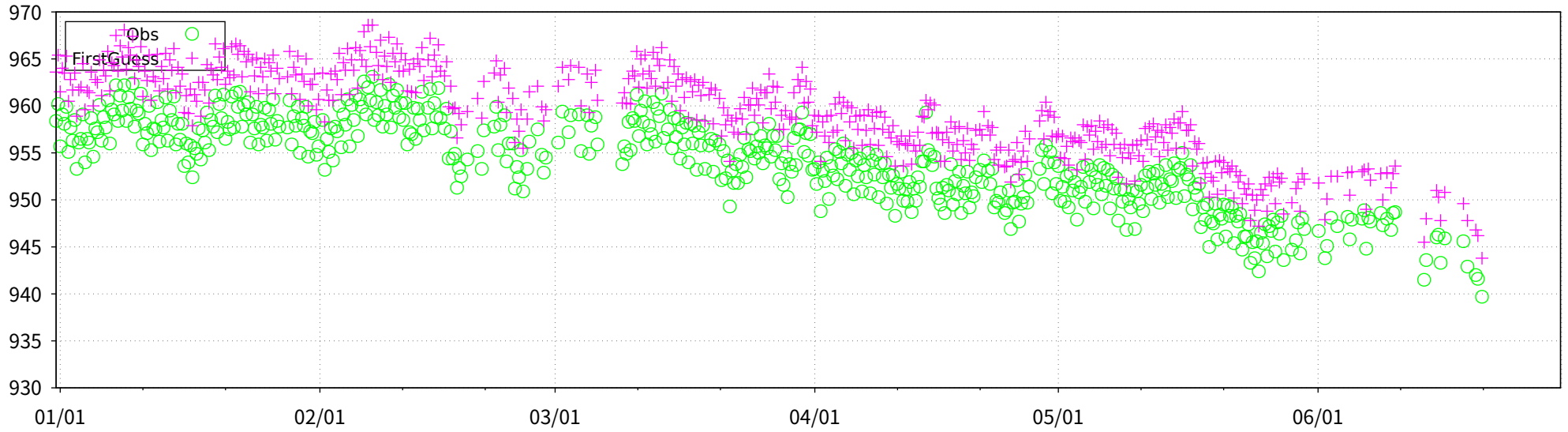


Figure 22 BIAS and SD of SLP for station 41265 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 41265 (lat: 22.8N, lon: 58.5E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

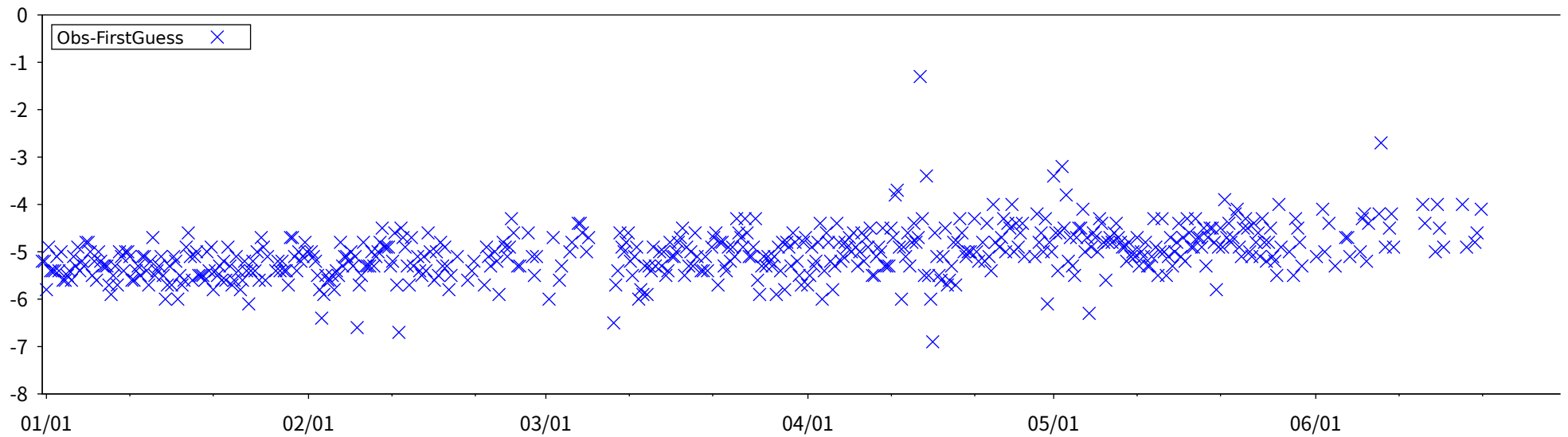


Figure 23 Time-series representation of SLP Obs minus FirstGuess for station 41265

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

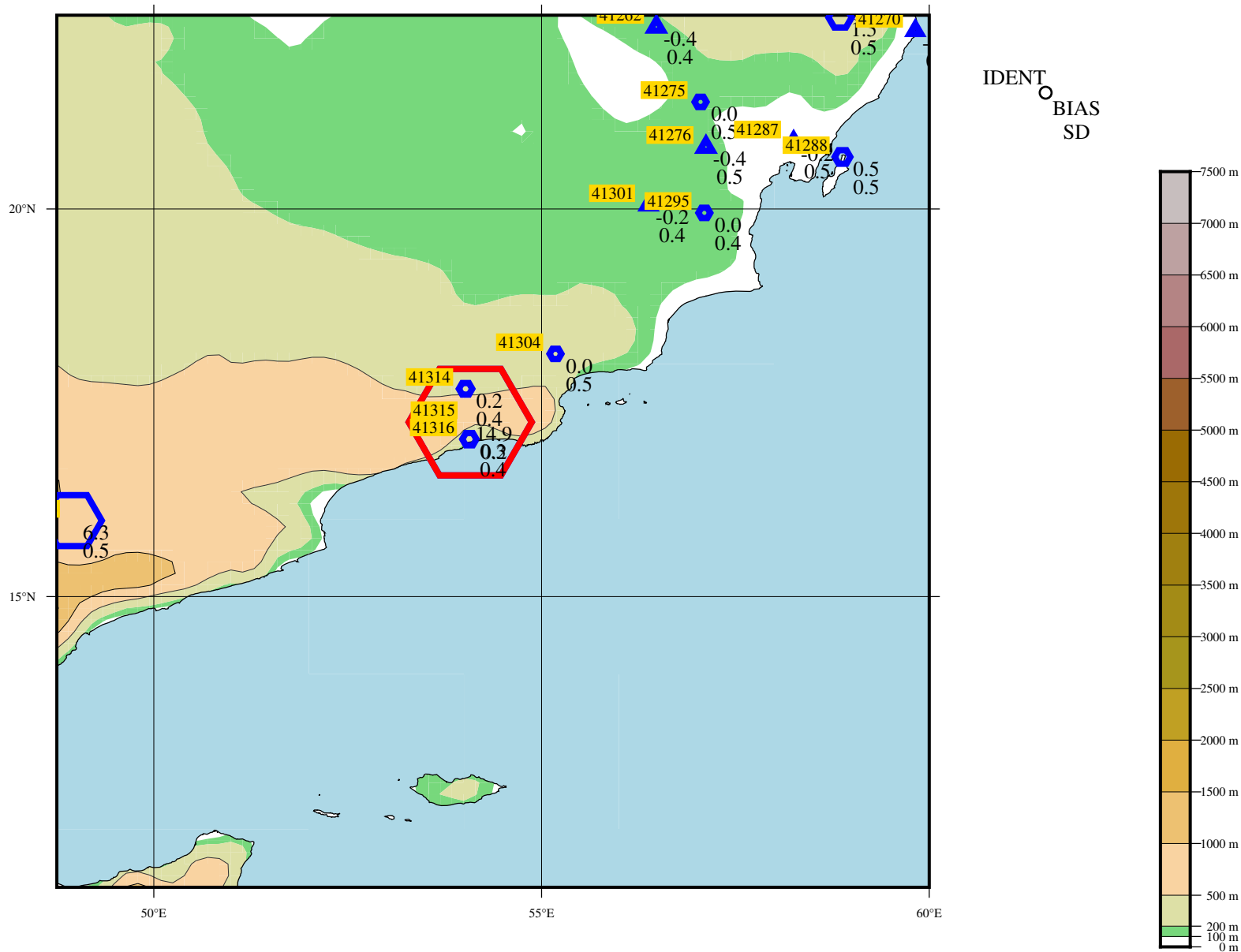
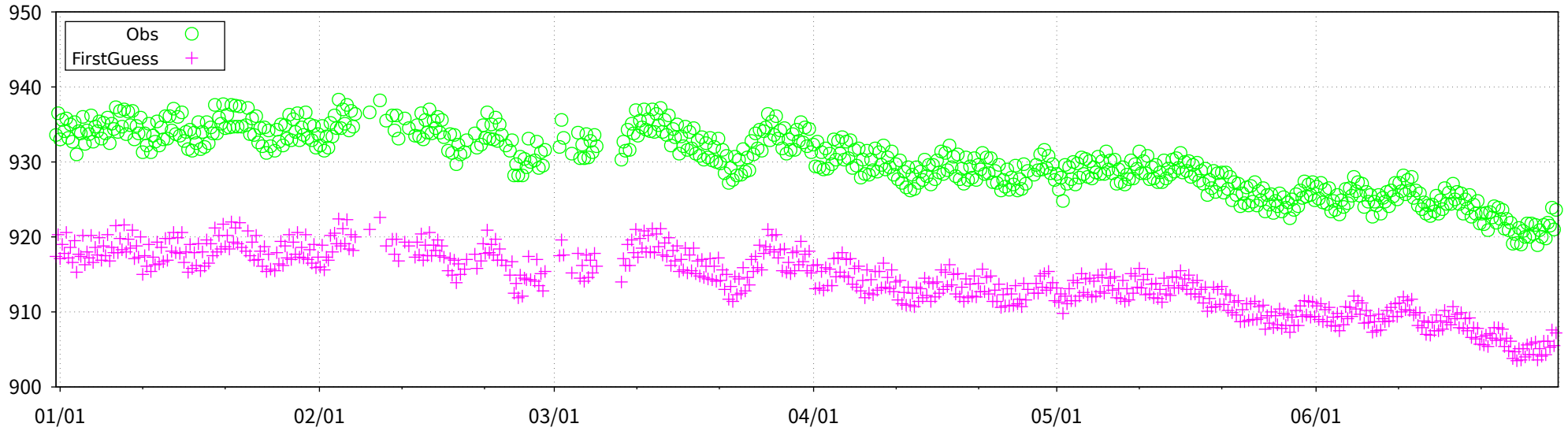


Figure 24 BIAS and SD of SLP for station 41315 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 41315 (lat: 17.3N, lon: 54.1E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

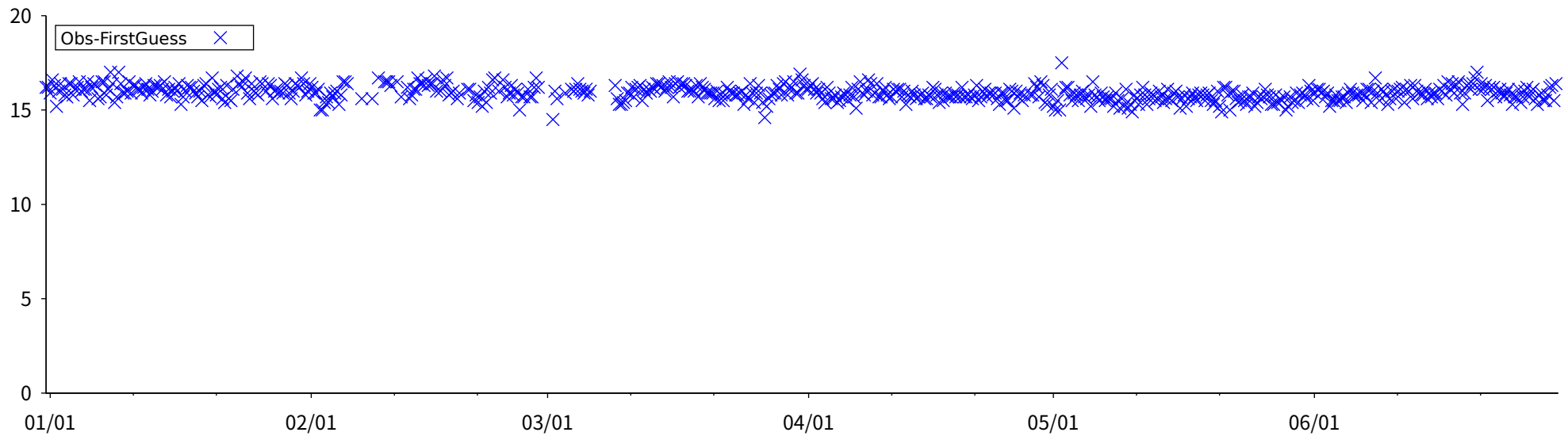
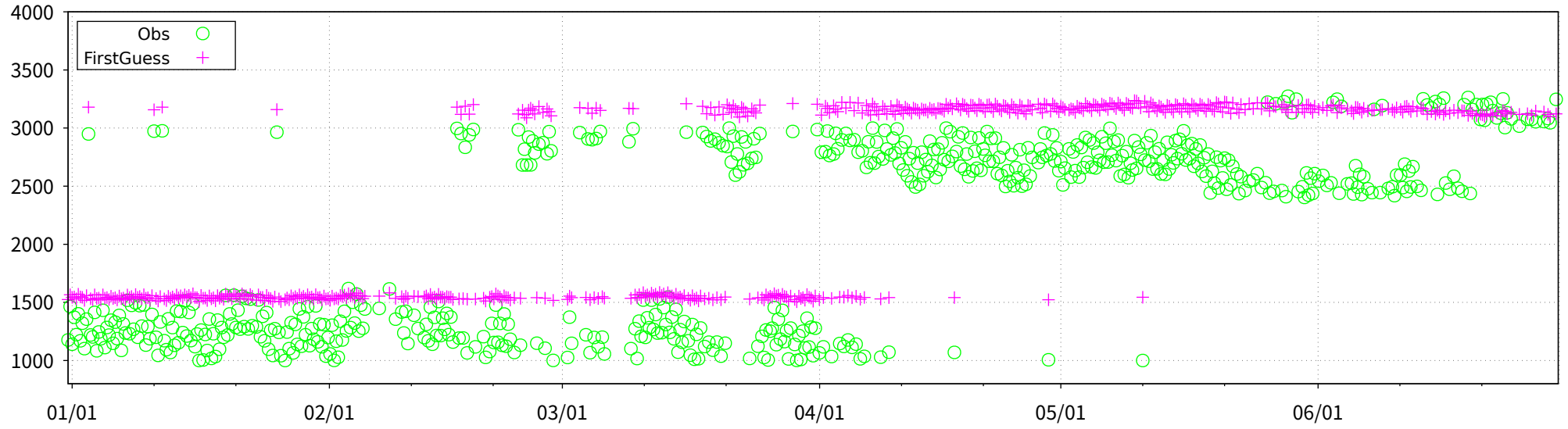


Figure 25(a) Time-series representation of SLP Obs minus FirstGuess for station 41315

ID: 41315 (lat: 17.3N, lon: 54.1E)

GZ850 or GZ700 [m]



GZ850 or GZ700 [m] (Obs-FirstGuess)

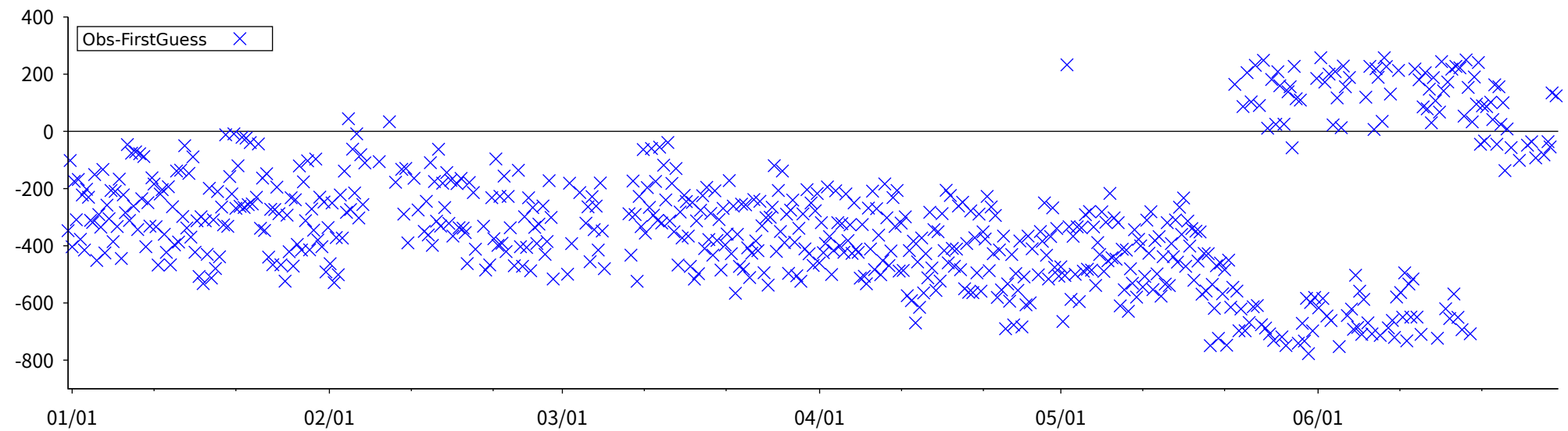


Figure 25(b) Time-series representation of GZ850 or GZ700 Obs minus FirstGuess for station 41315

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

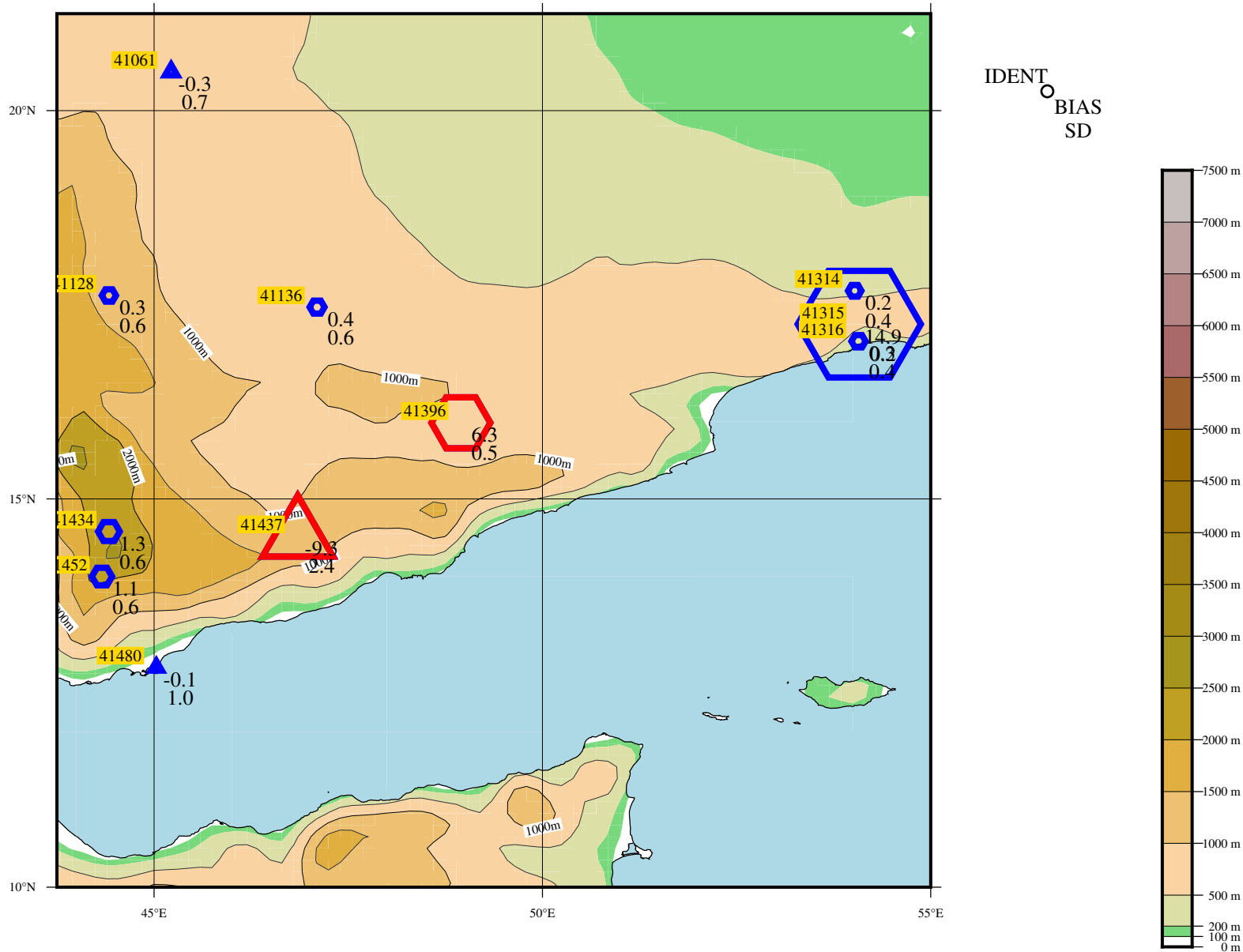
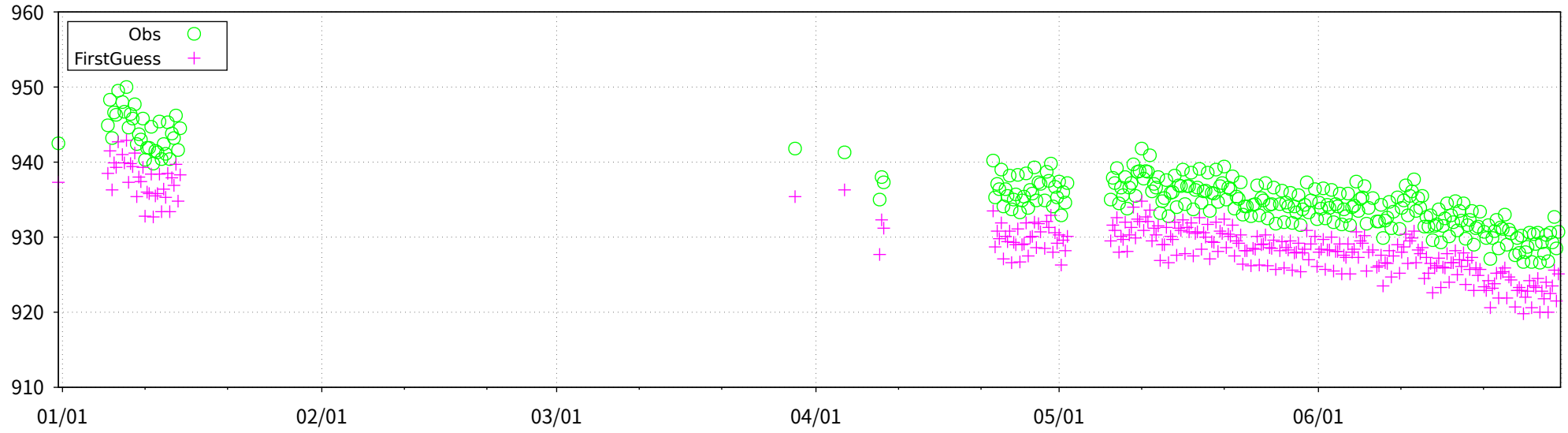


Figure 26 BIAS and SD of SLP for station 41396, 41437 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 41396 (lat: 16.0N, lon: 49.0E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

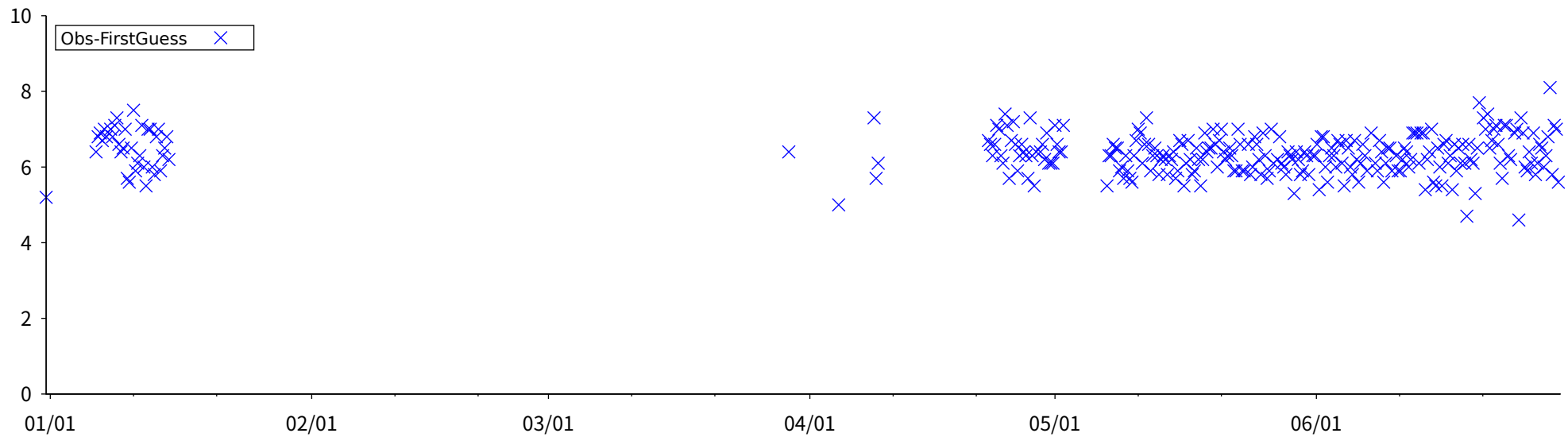
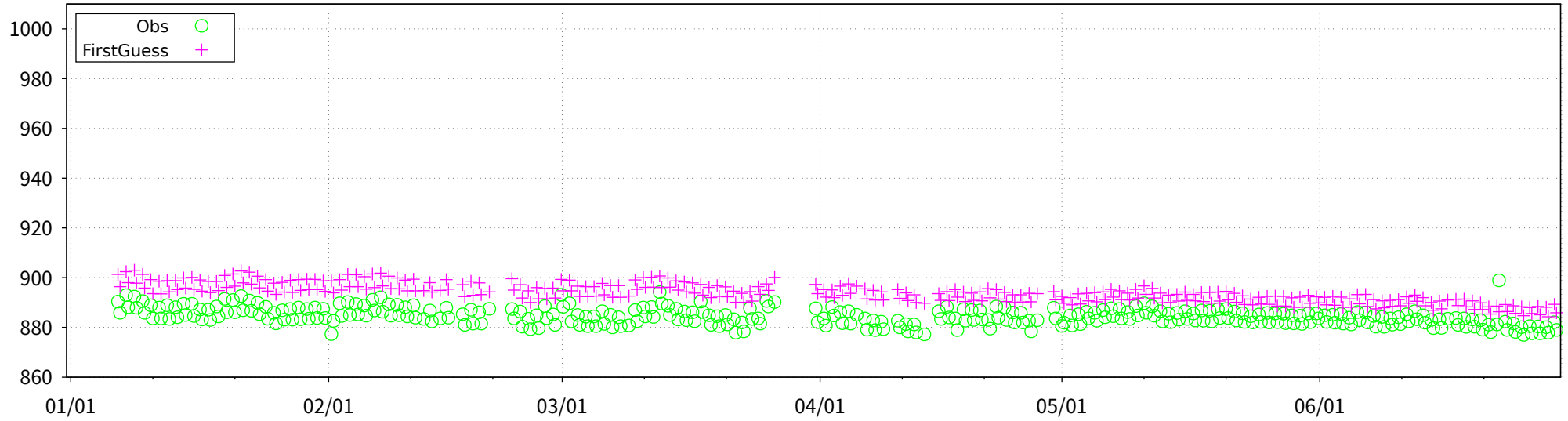


Figure 27 Time-series representation of SLP Obs minus FirstGuess for station 41396

ID: 41437 (lat: 14.5N, lon: 46.9E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

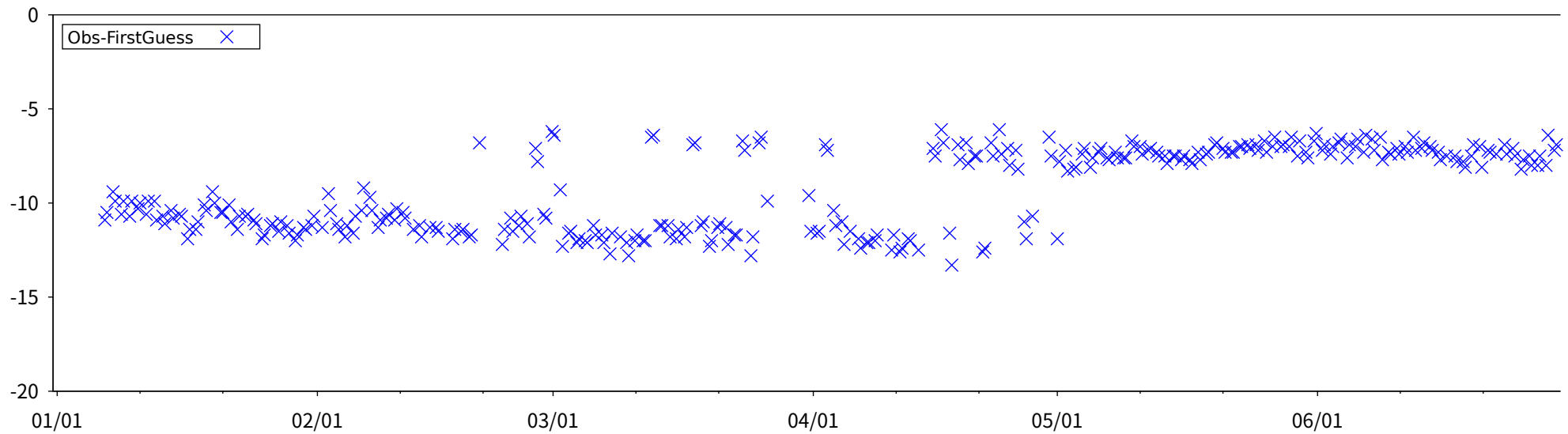


Figure 28 Time-series representation of SLP Obs minus FirstGuess for station 41437

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

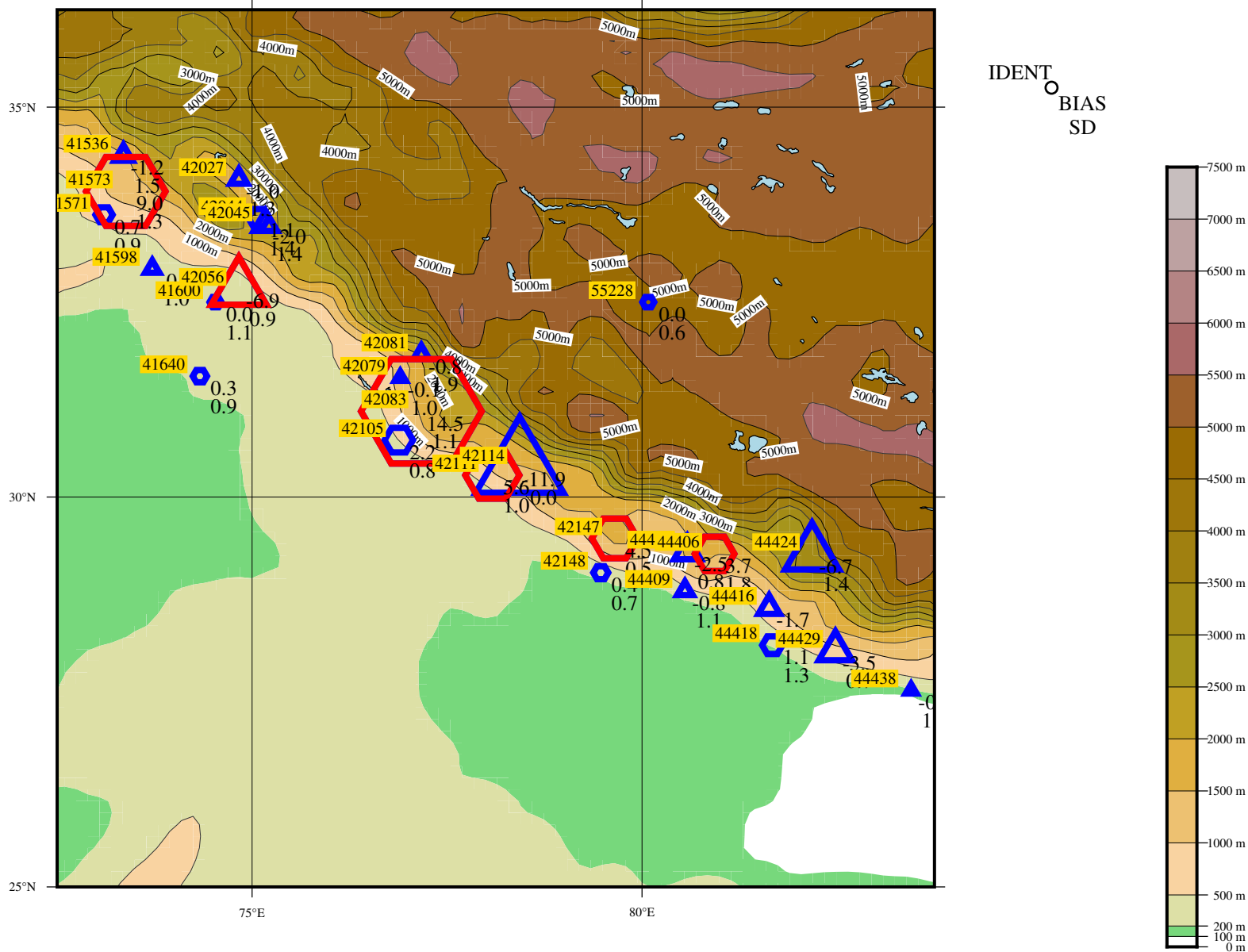
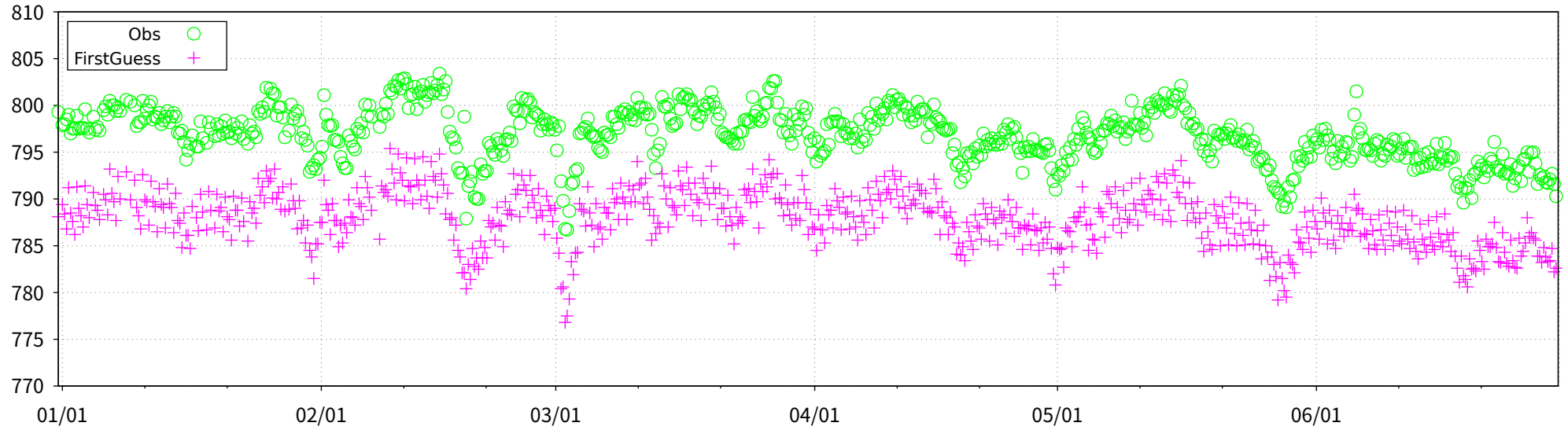


Figure 29 BIAS and SD of SLP for station 41573, 42056, 42083, 42111, 42147, 44406 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 41573 (lat: 33.9N, lon: 73.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

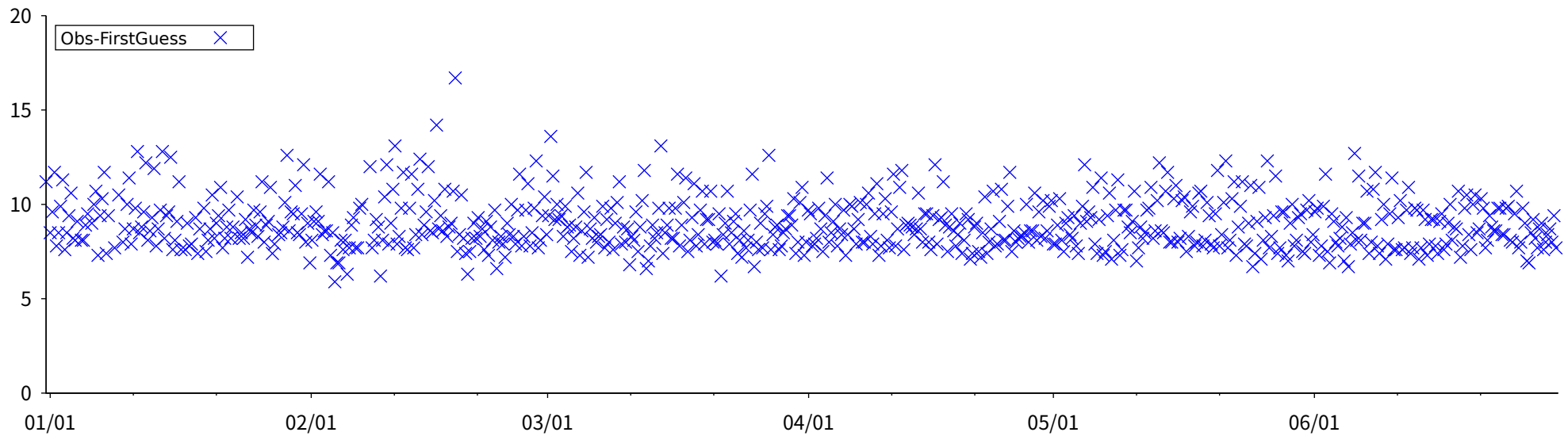
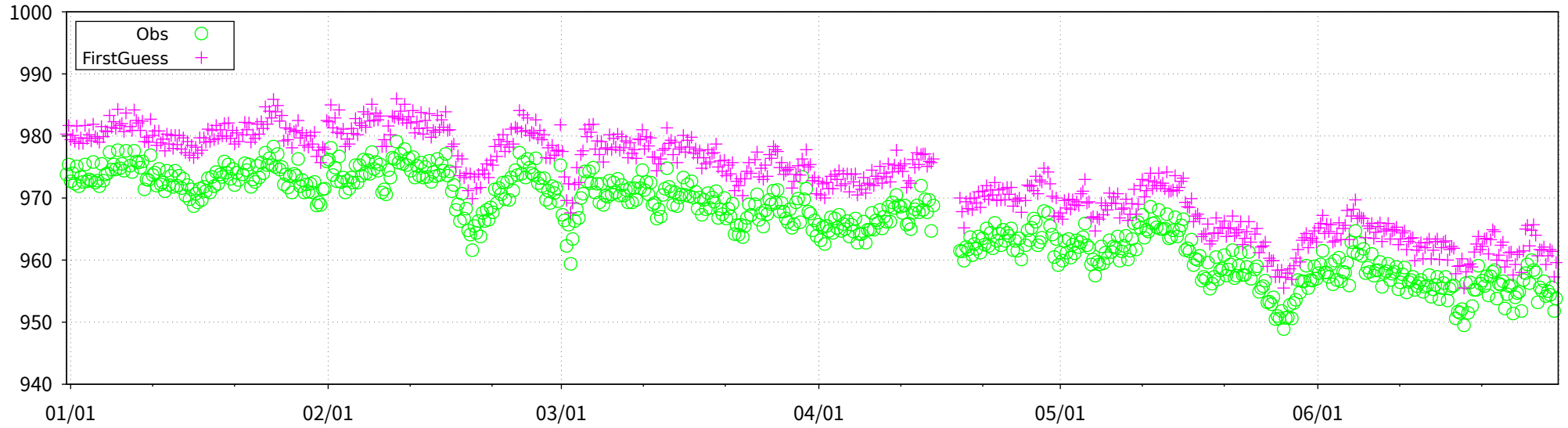


Figure 30 Time-series representation of SLP Obs minus FirstGuess for station 41573

ID: 42056 (lat: 32.7N, lon: 74.8E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

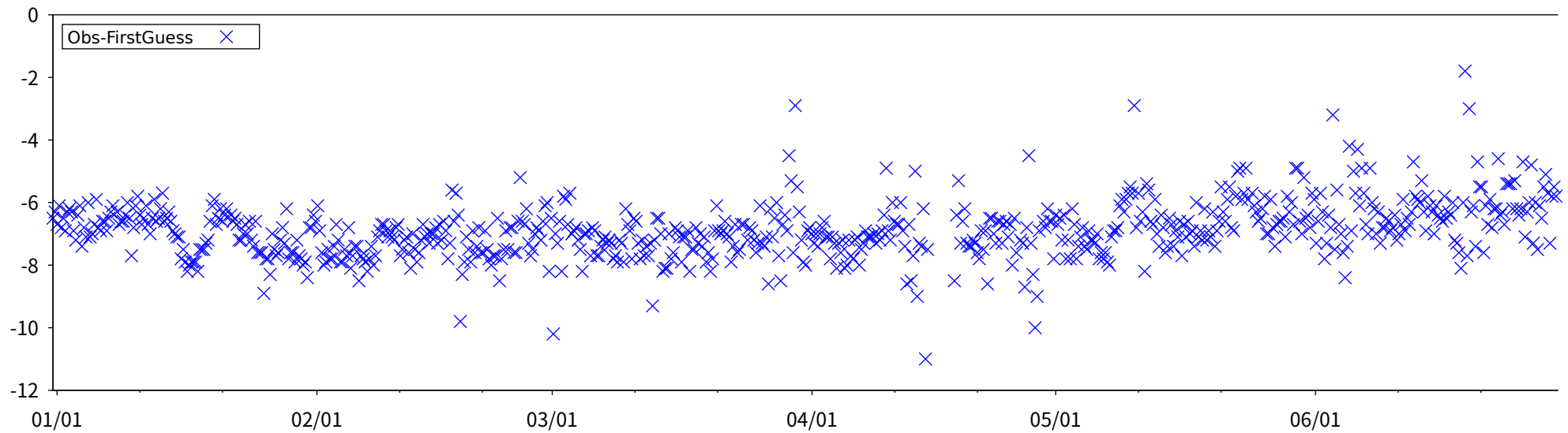
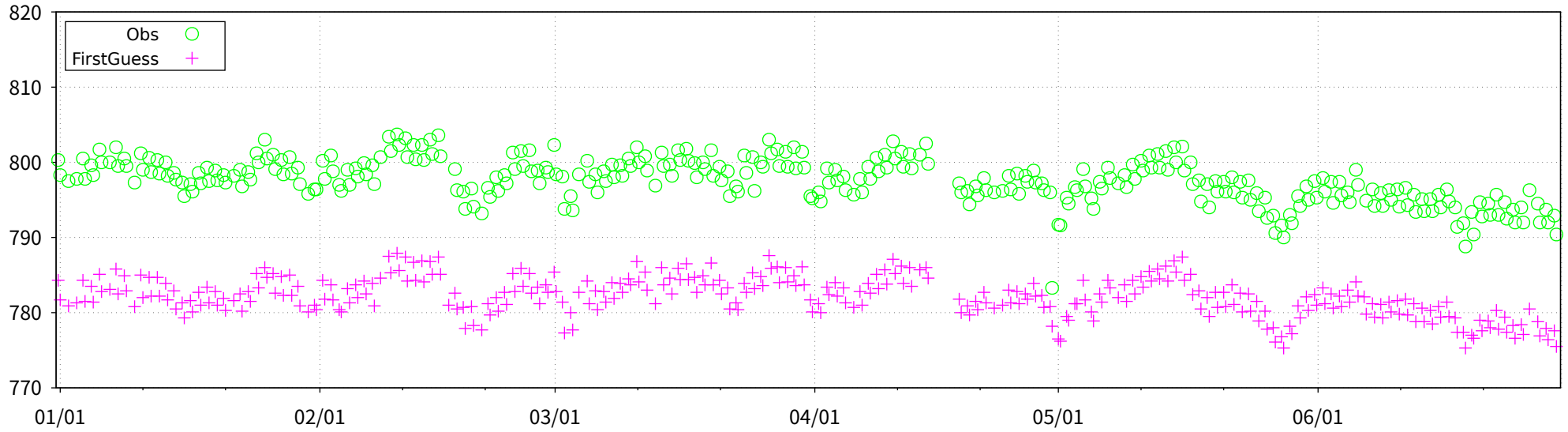


Figure 31 Time-series representation of SLP Obs minus FirstGuess for station 42056

ID: 42083 (lat: 31.1N, lon: 77.2E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

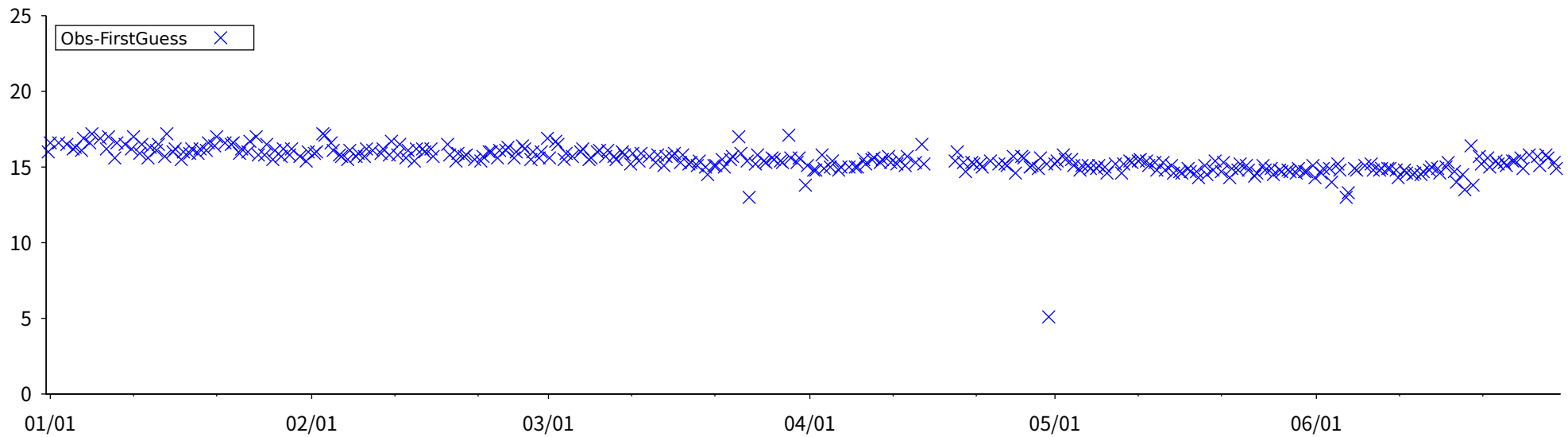
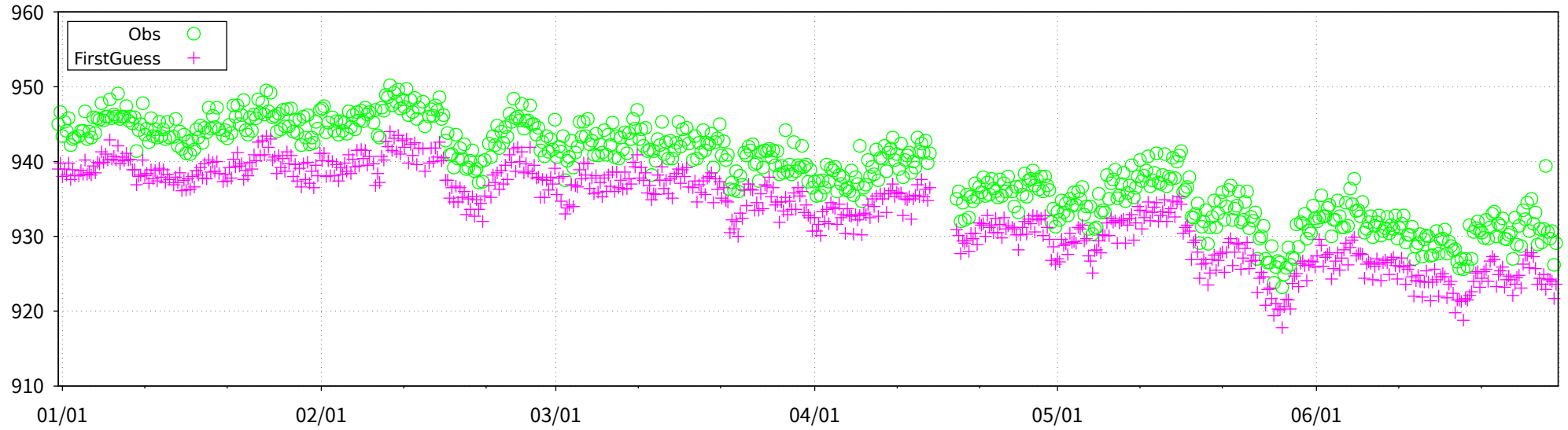


Figure 32 Time-series representation of SLP Obs minus FirstGuess for station 42083

ID: 42111 (lat: 30.3N, lon: 78.1E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

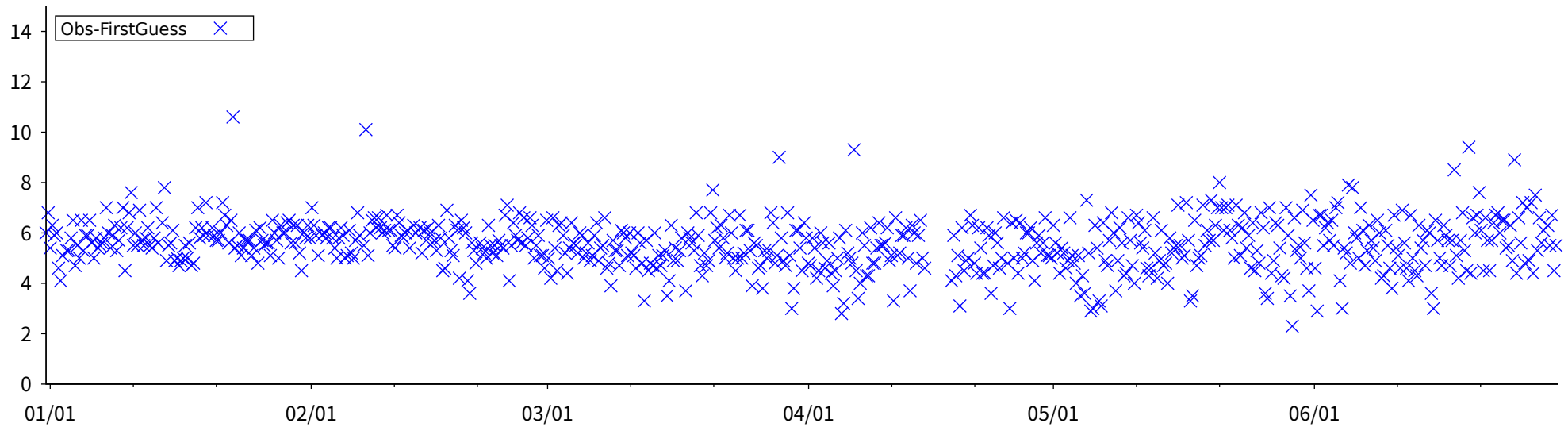
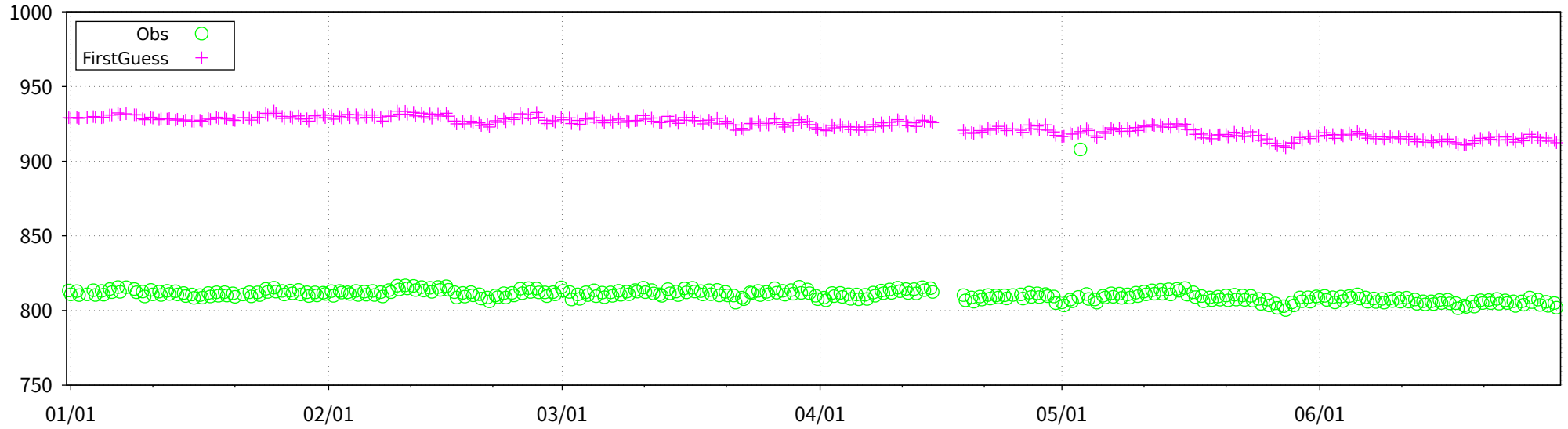


Figure 33 Time-series representation of SLP Obs minus FirstGuess for station 42111

ID: 42114 (lat: 30.4N, lon: 78.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

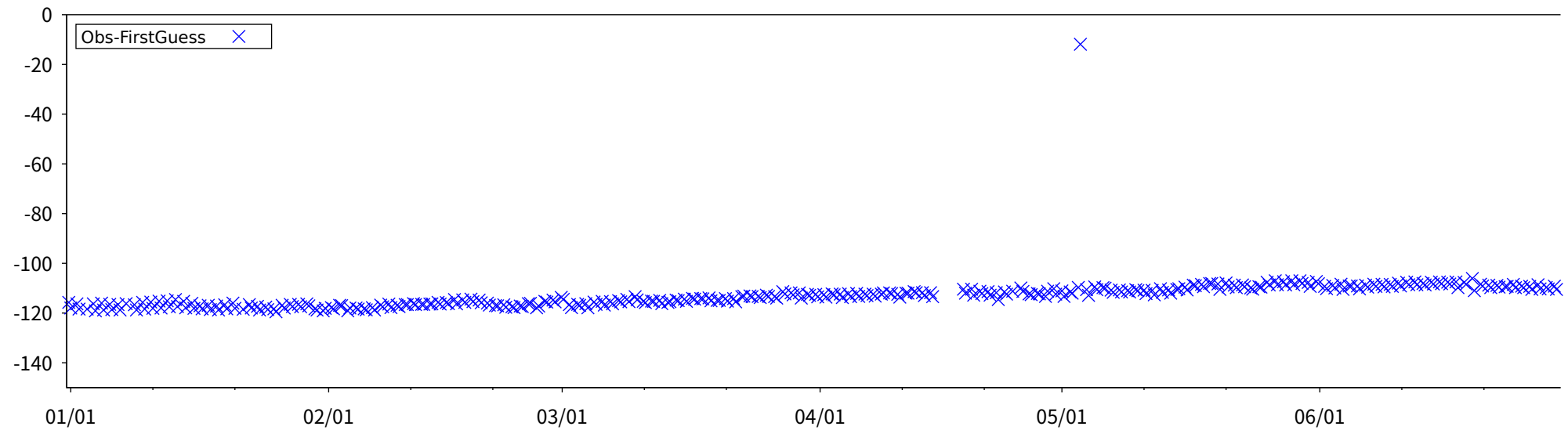
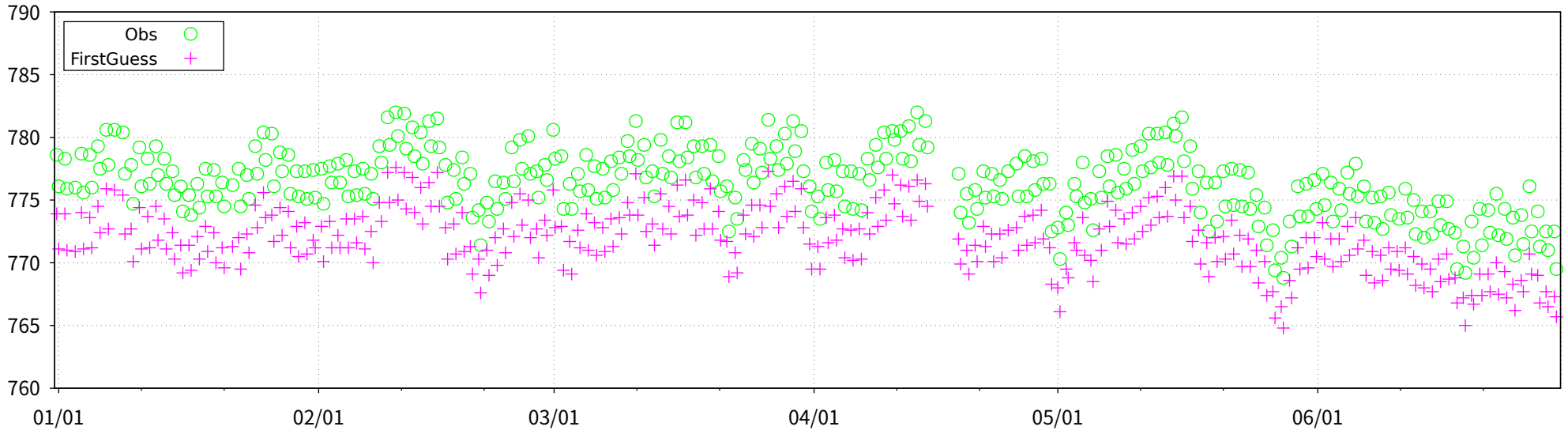


Figure 34 Time-series representation of SLP Obs minus FirstGuess for station 42114

ID: 42147 (lat: 29.5N, lon: 79.7E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

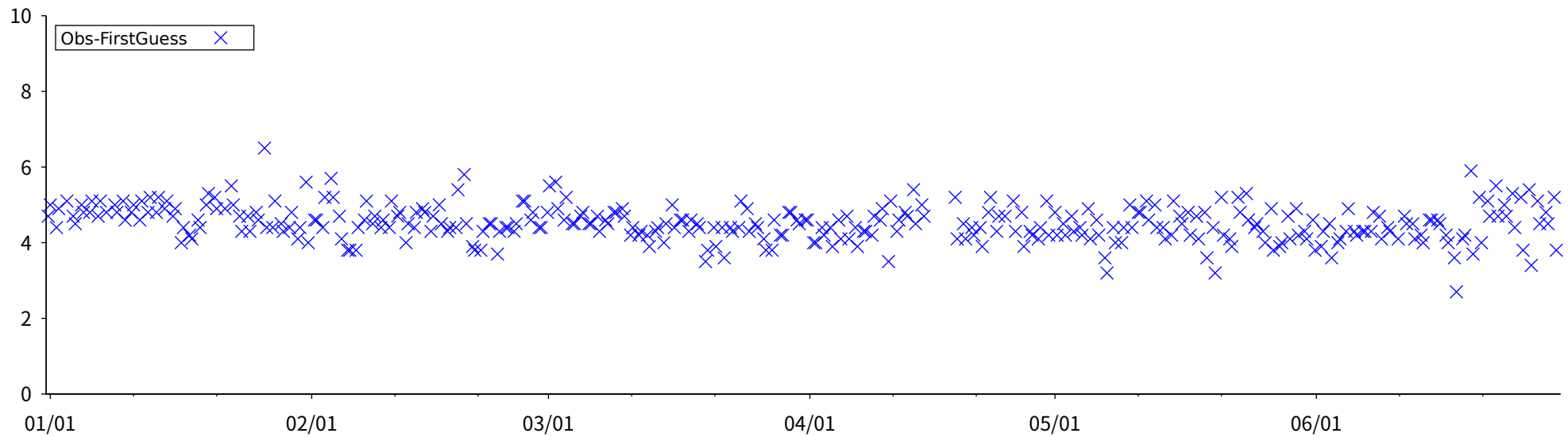


Figure 35 Time-series representation of SLP Obs minus FirstGuess for station 42147

LEVEL = SUR ELEMENT = GZ
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

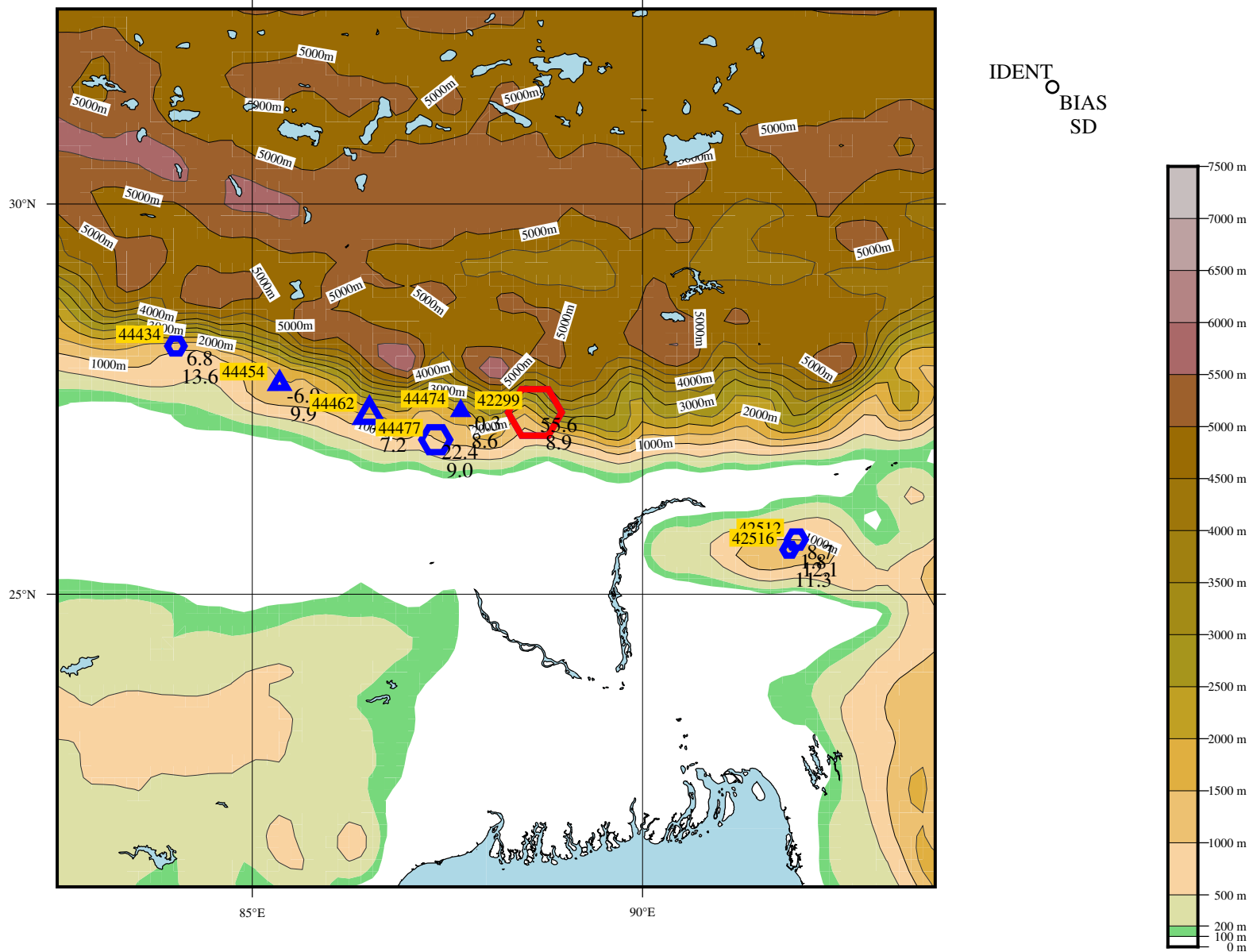
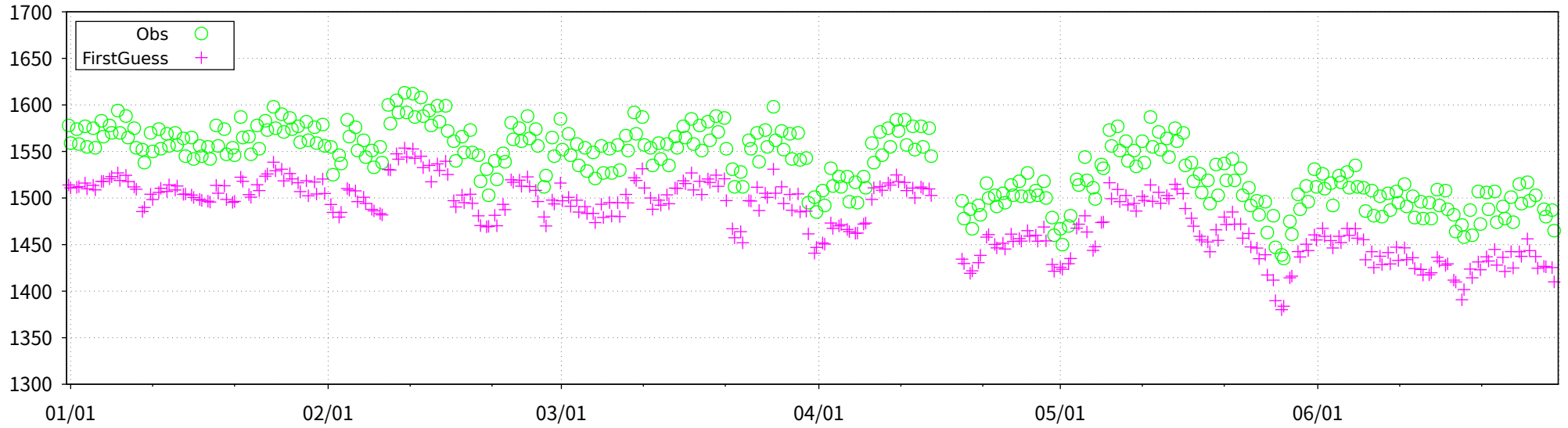


Figure 36 BIAS and SD of GZ for station 42299 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 42299 (lat: 27.3N, lon: 88.6E)

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

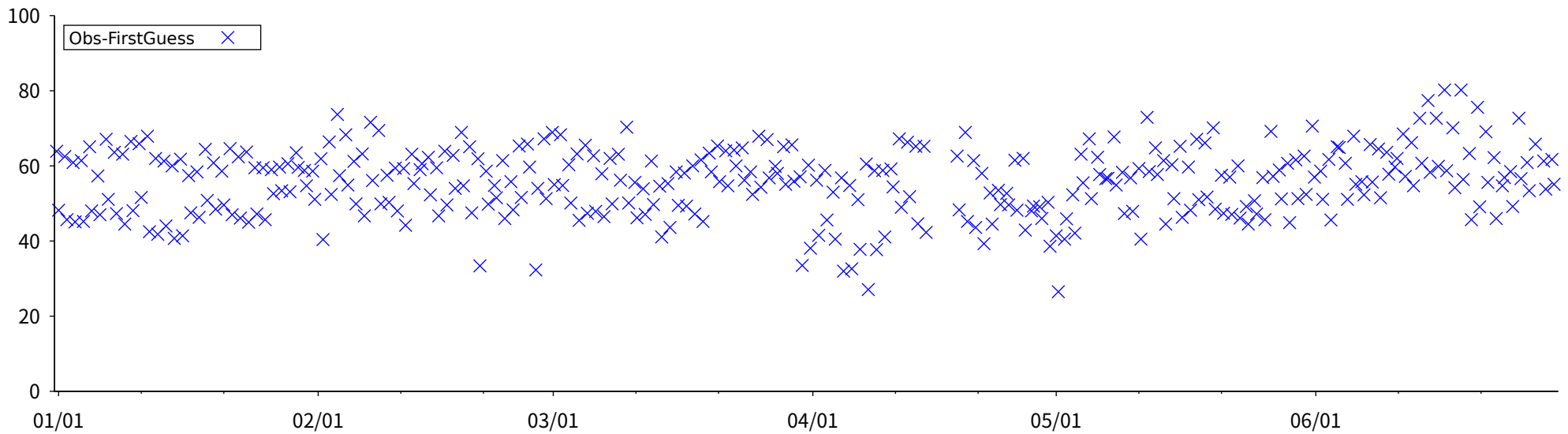
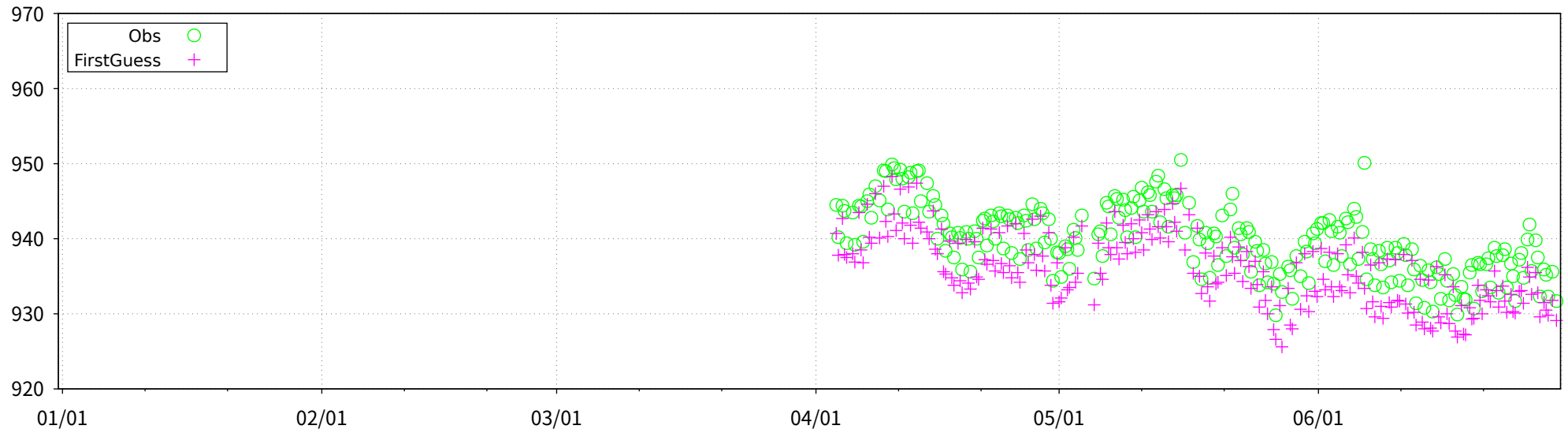


Figure 37 Time-series representation of GZ850 Obs minus FirstGuess for station 42299

ID: 44406 (lat: 29.3N, lon: 80.9E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

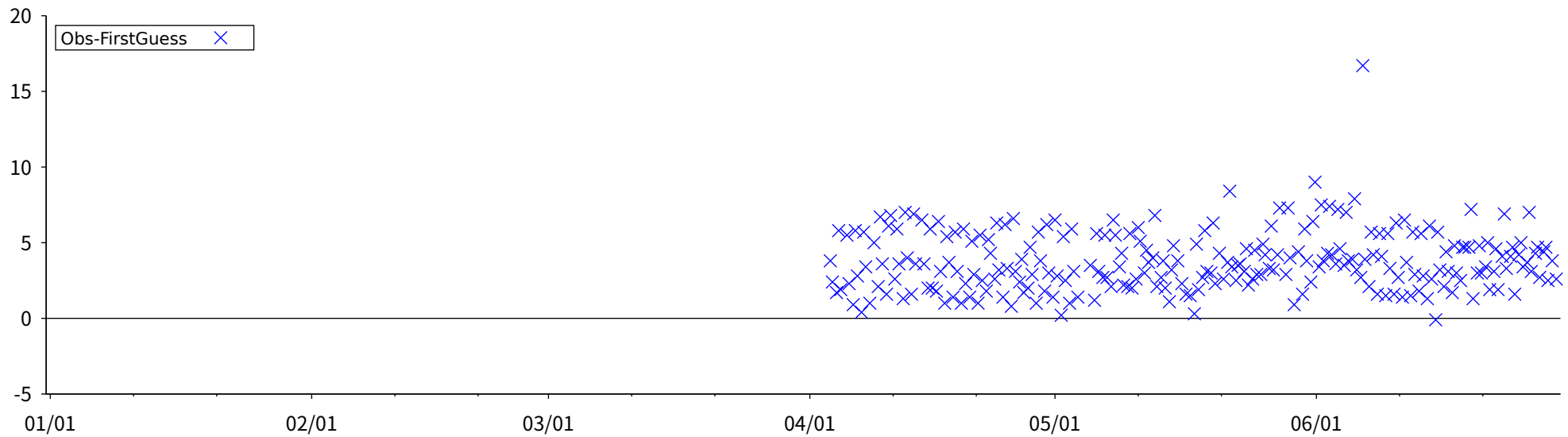


Figure 38 Time-series representation of SLP Obs minus FirstGuess for station 44406

LEVEL = SUR ELEMENT = MSLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

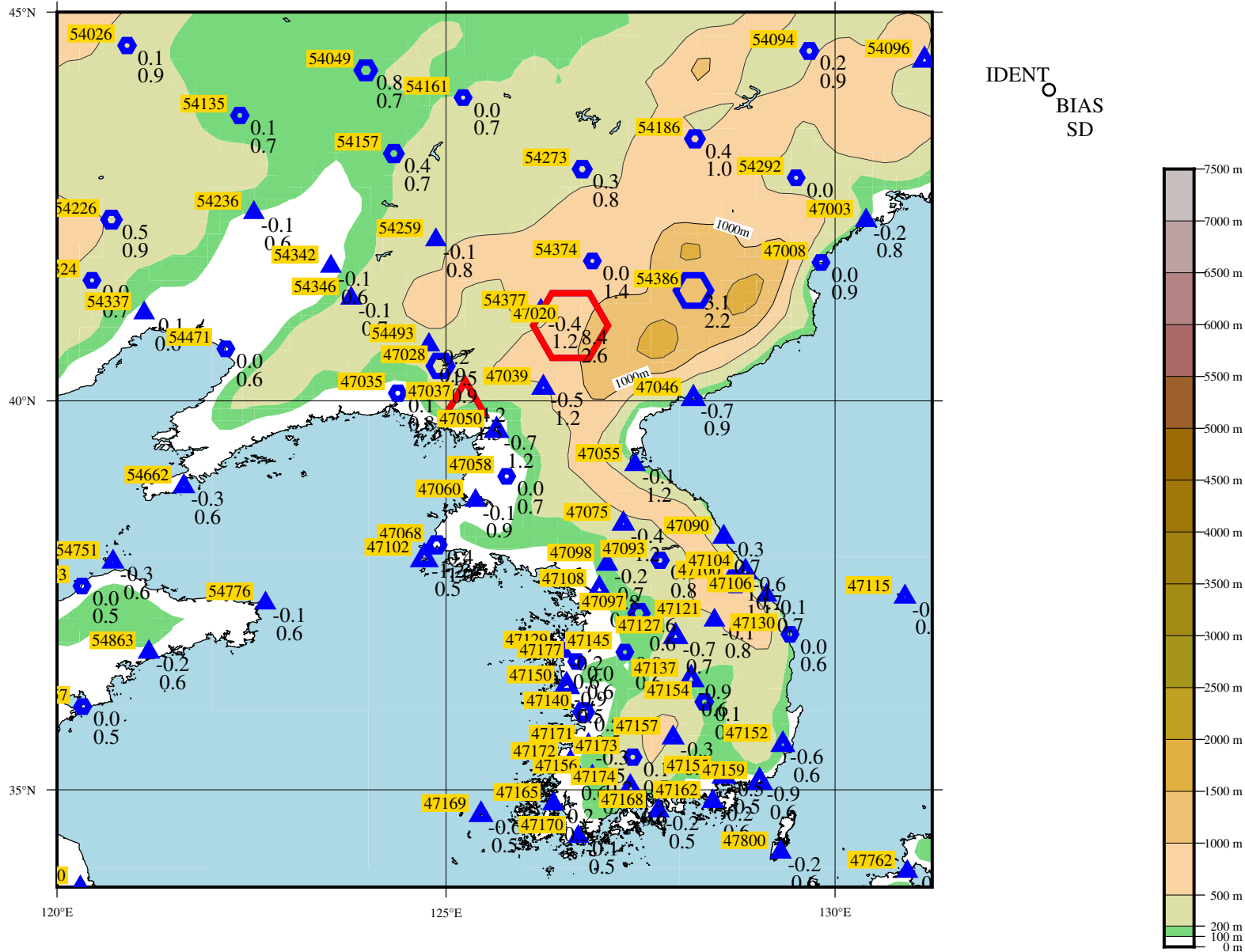
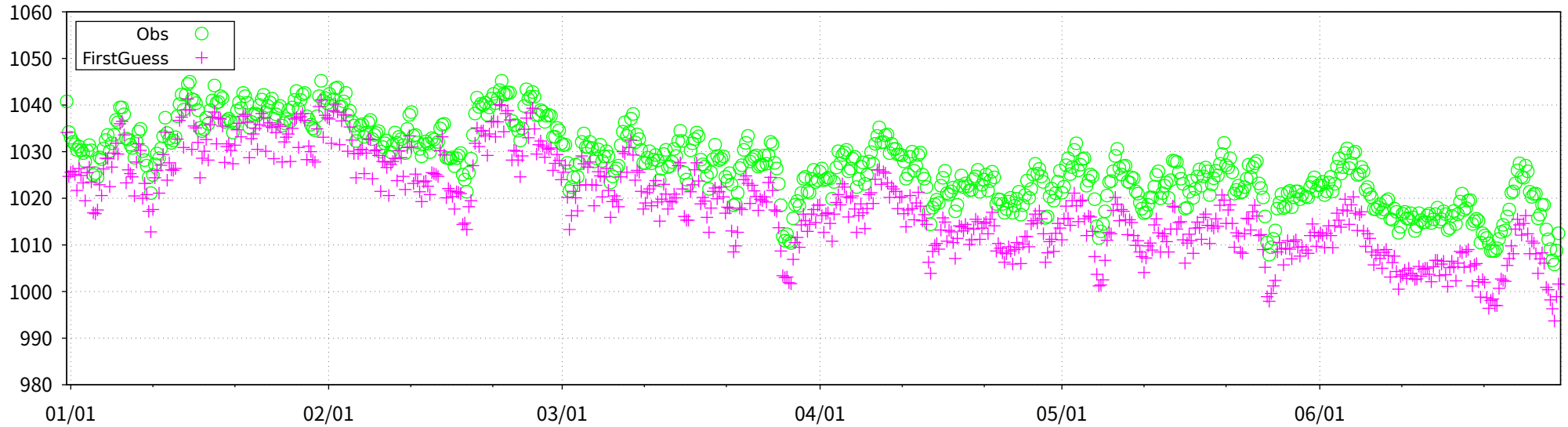


Figure 39 BIAS and SD of MSLP for station 47020, 47037 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 47020 (lat: 41.0N, lon: 126.6E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

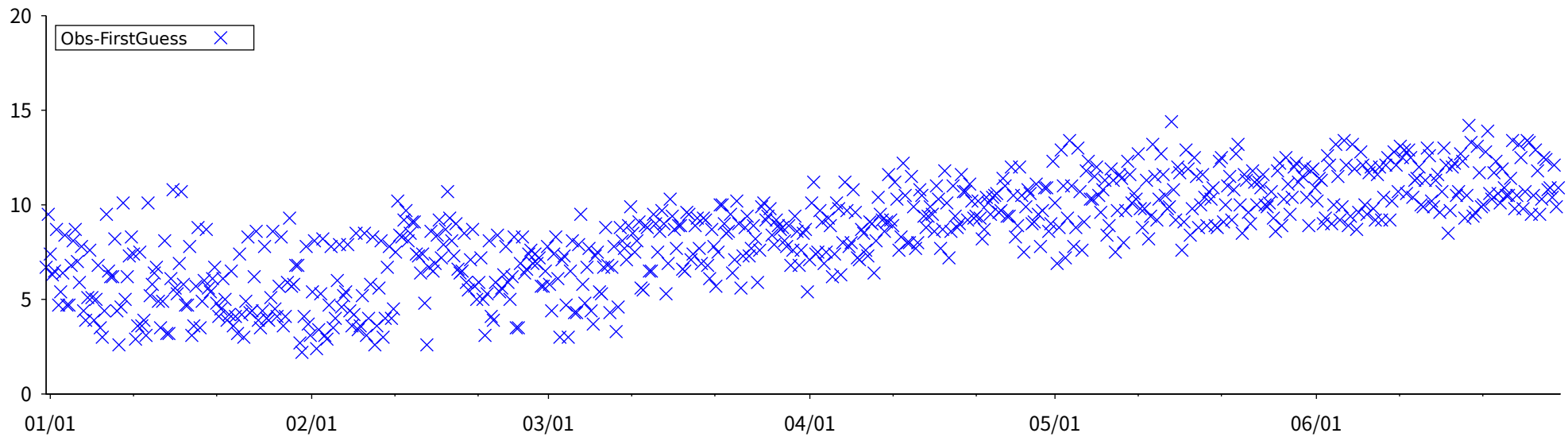


Figure 40 Time-series representation of MSLP Obs minus FirstGuess for station 47020

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

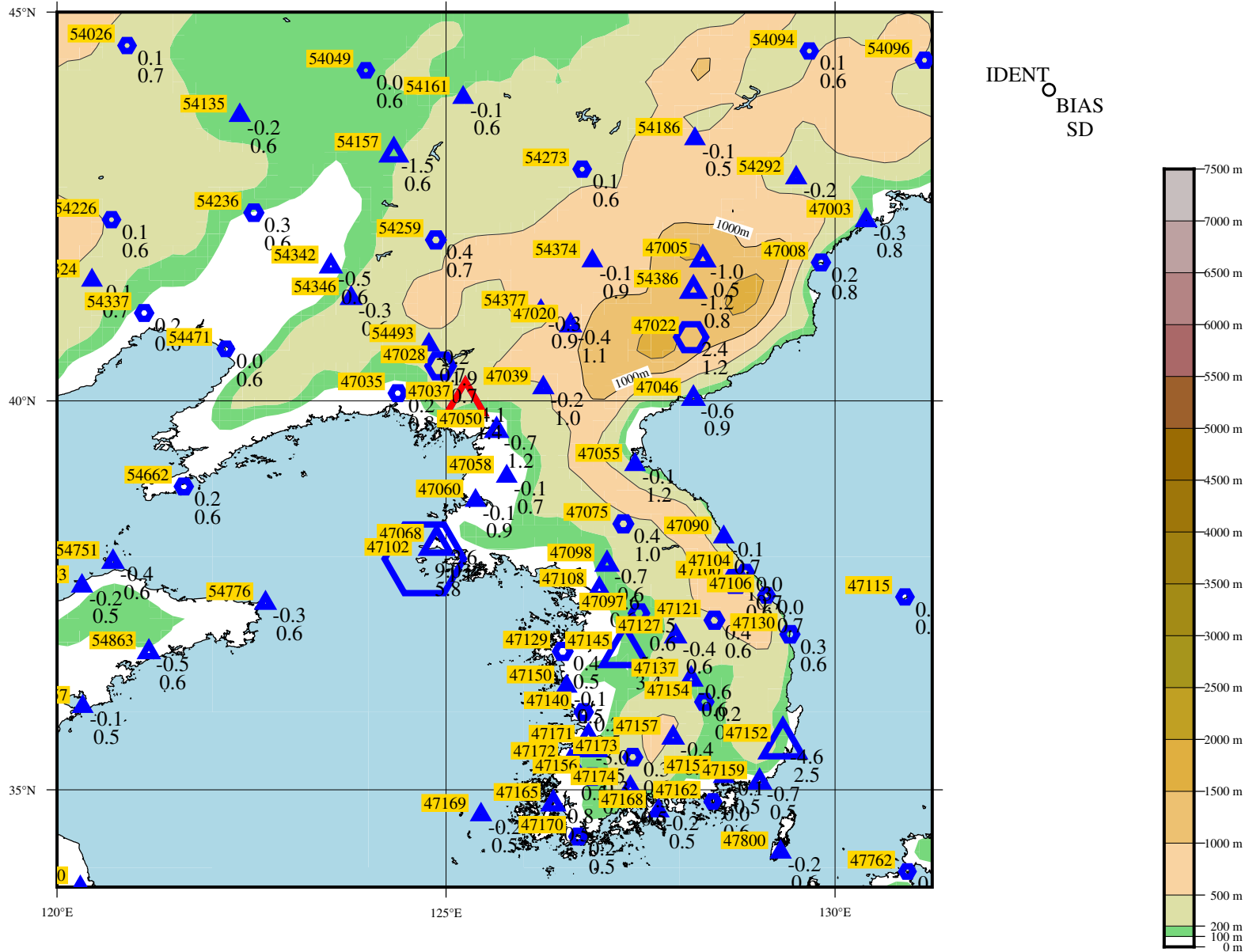
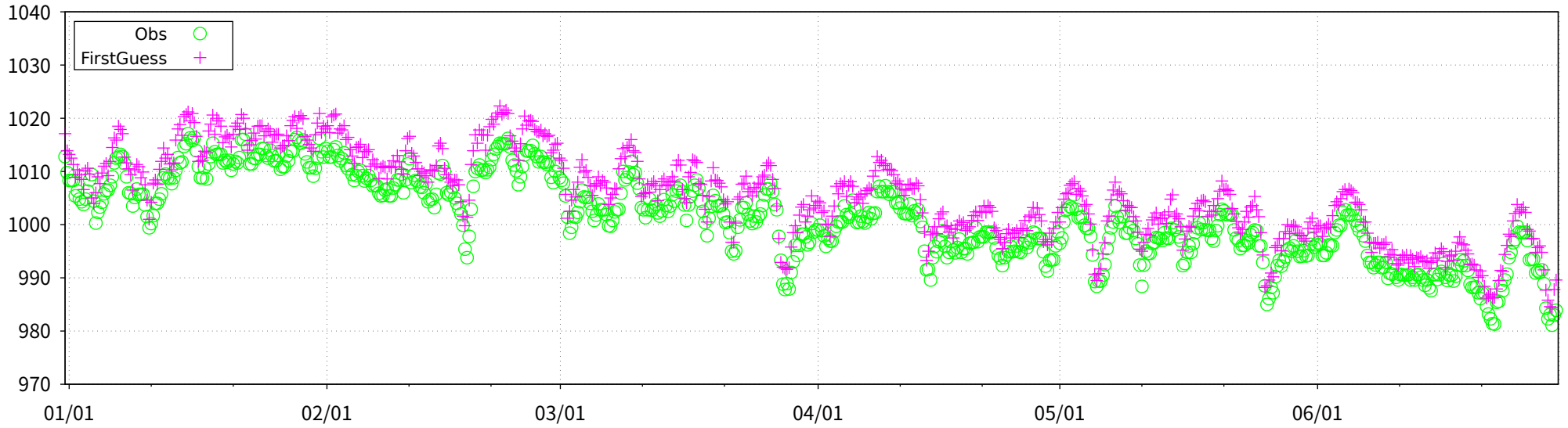


Figure 41 BIAS and SD of SLP for station 47037 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 47037 (lat: 40.0N, lon: 125.3E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

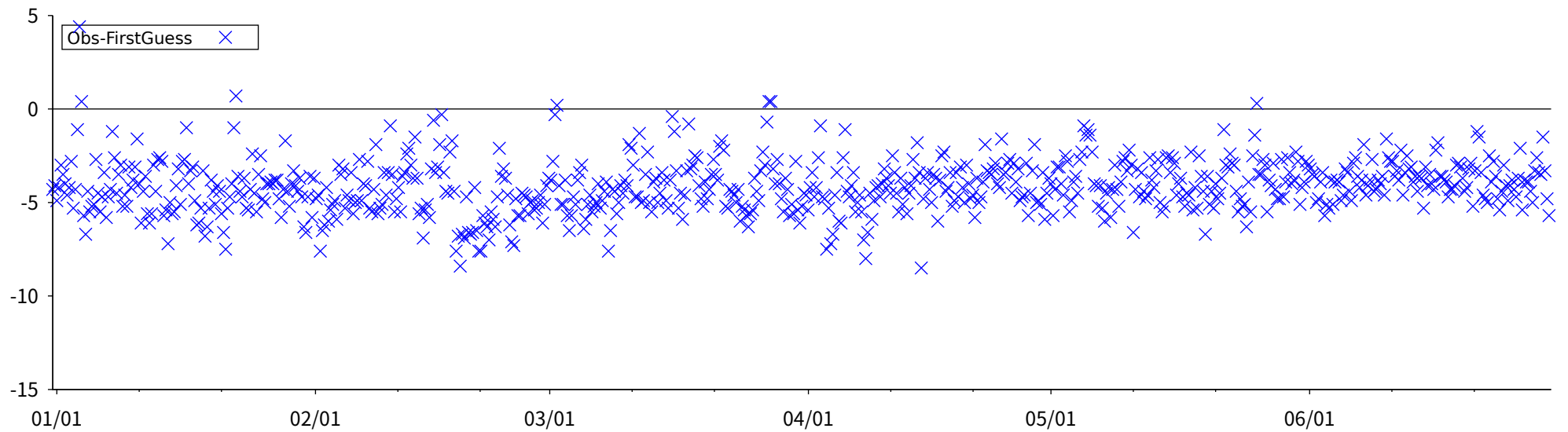
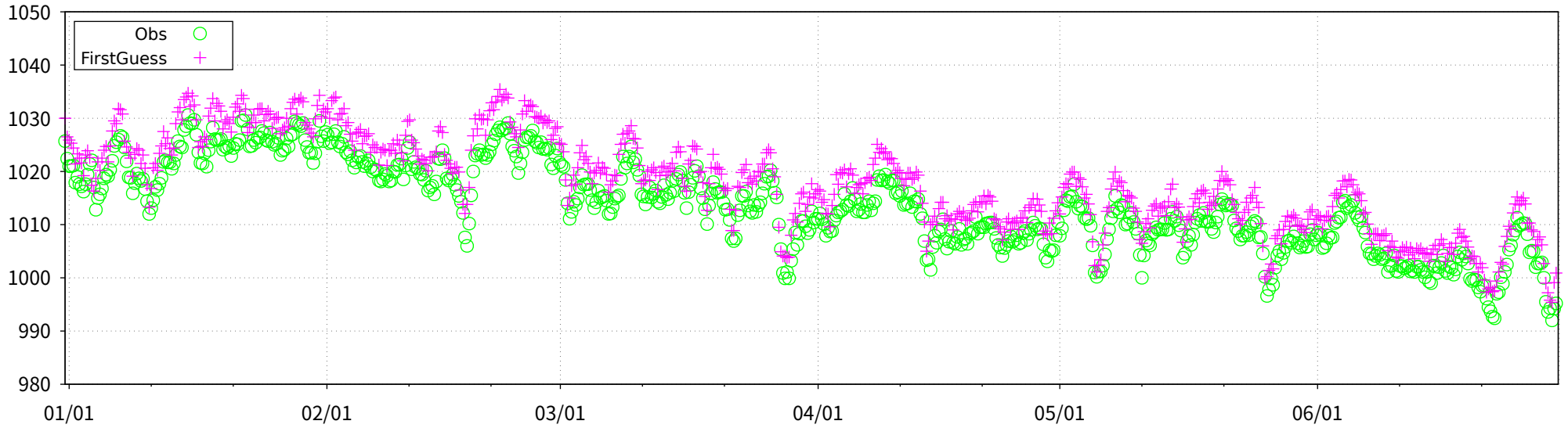


Figure 42(a) Time-series representation of SLP Obs minus FirstGuess for station 47037

ID: 47037 (lat: 40.0N, lon: 125.3E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

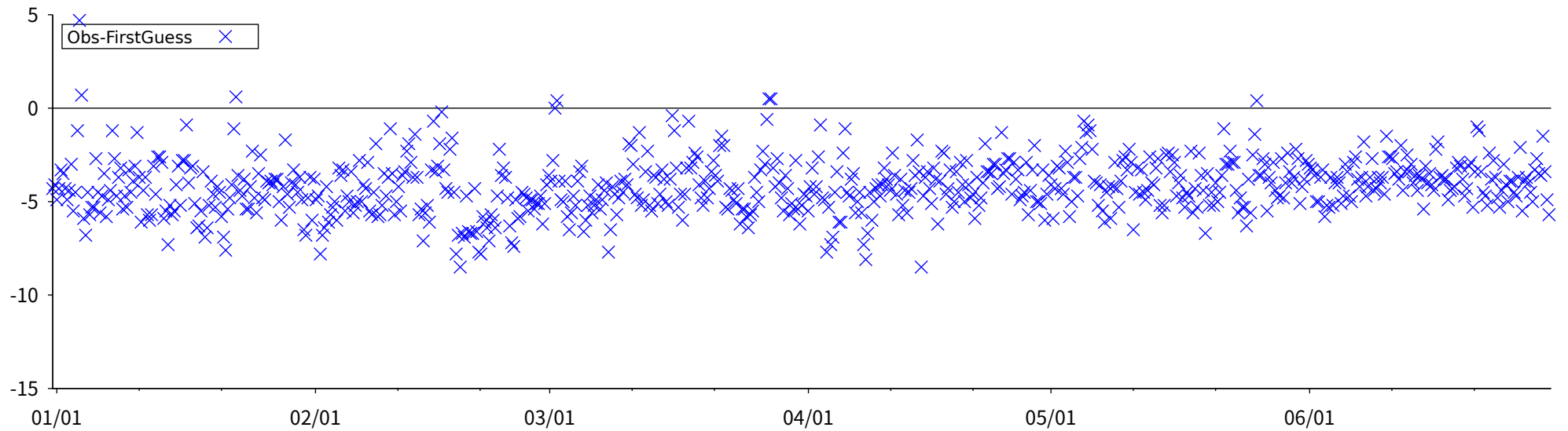


Figure 42(b) Time-series representation of MSLP Obs minus FirstGuess for station 47037

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

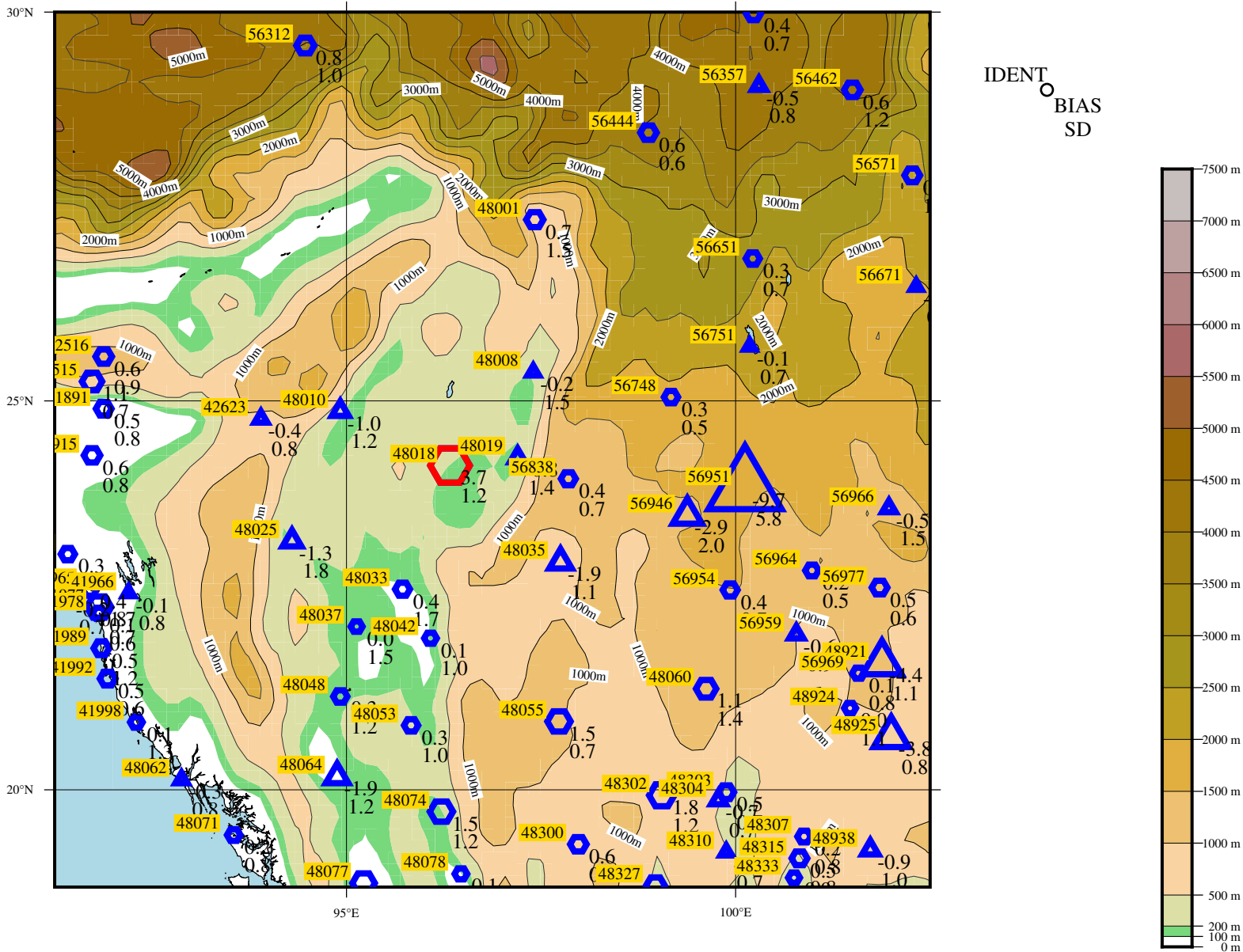
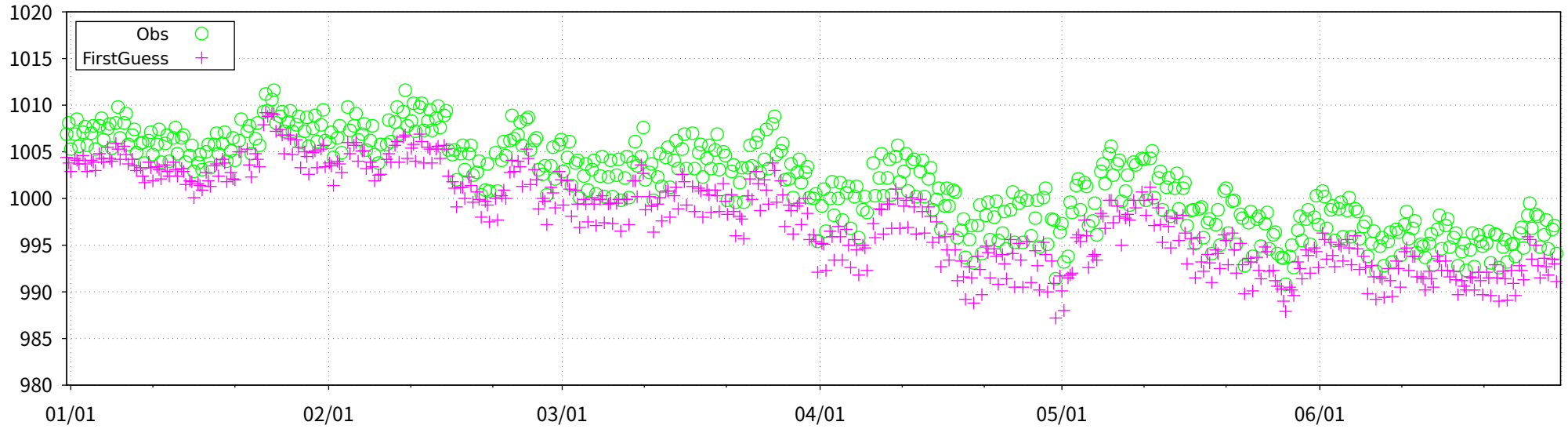


Figure 43 BIAS and SD of SLP for station 48018 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 48018 (lat: 24.2N, lon: 96.3E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

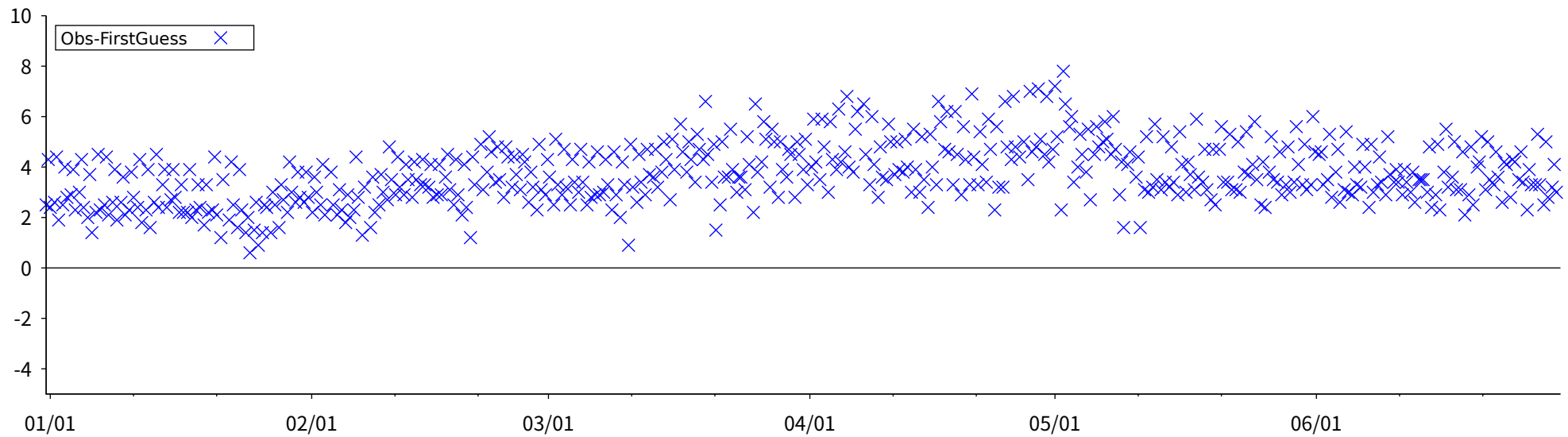


Figure 44 Time-series representation of SLP Obs minus FirstGuess for station 48018

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

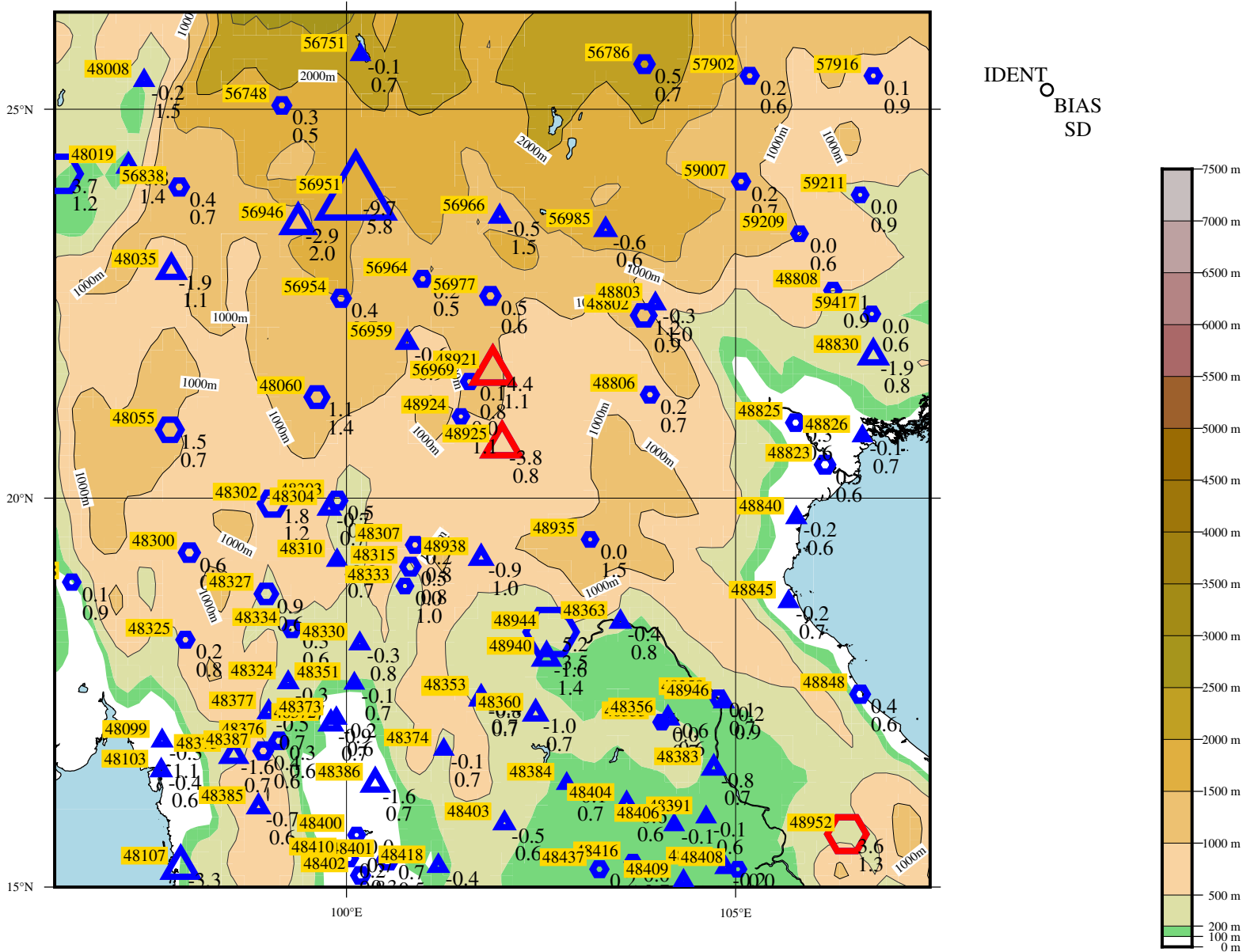
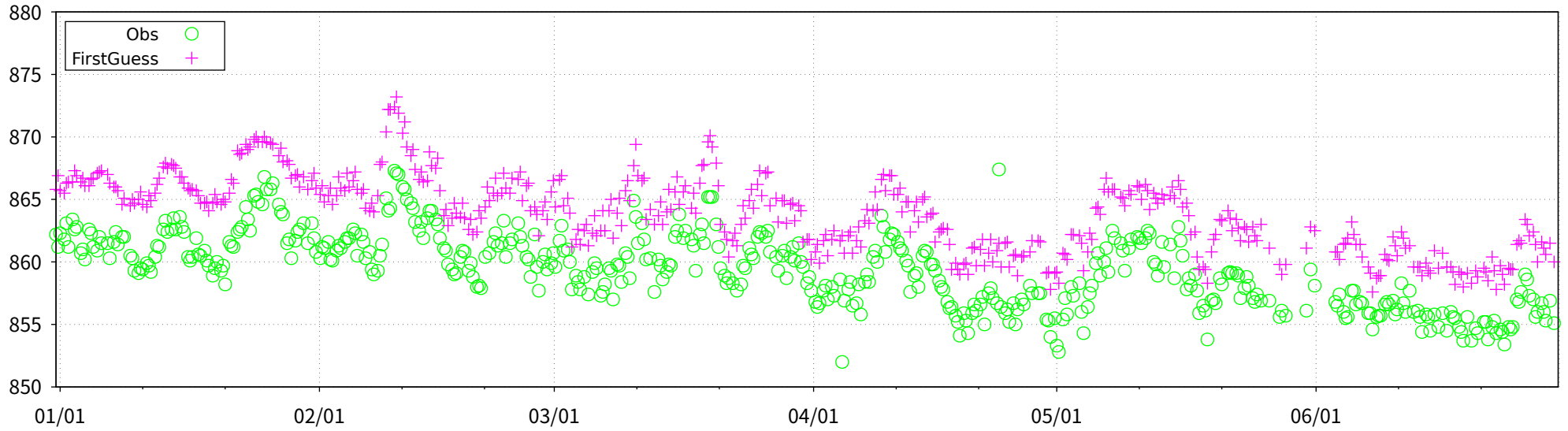


Figure 45 BIAS and SD of SLP for station 48921, 48925, 48952 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 48921 (lat: 21.6N, lon: 101.9E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

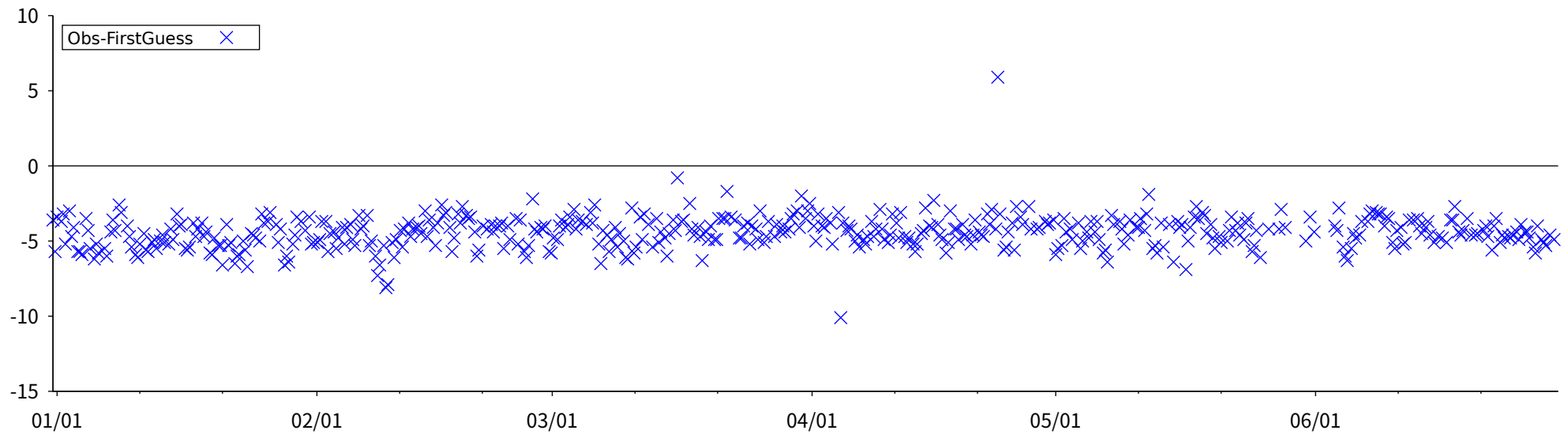
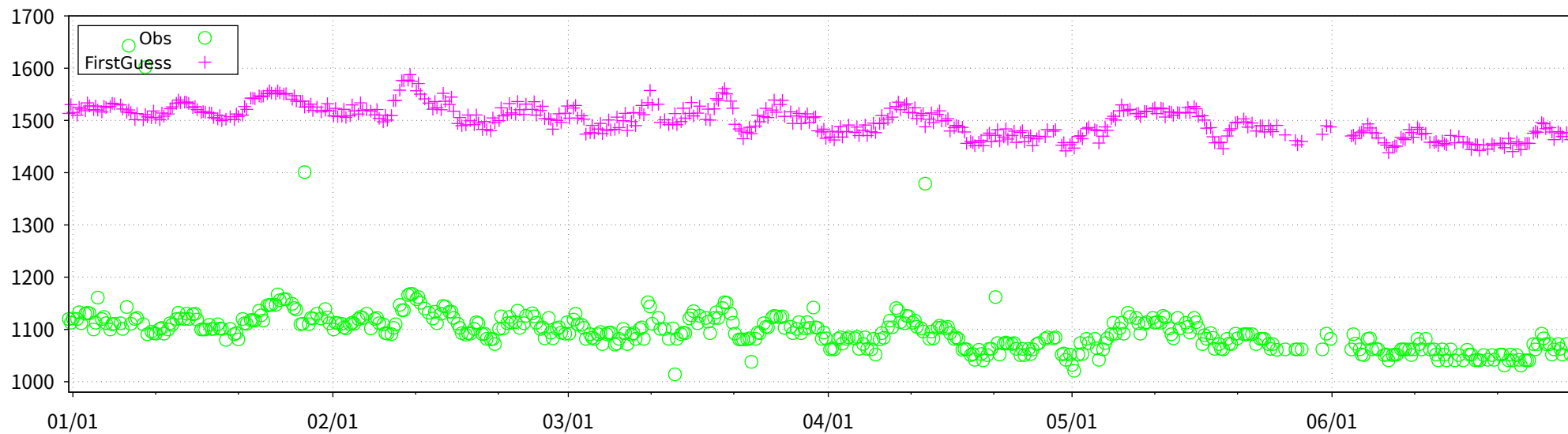


Figure 46(a) Time-series representation of SLP Obs minus FirstGuess for station 48921

ID: 48921 (lat: 21.6N, lon: 101.9E)

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

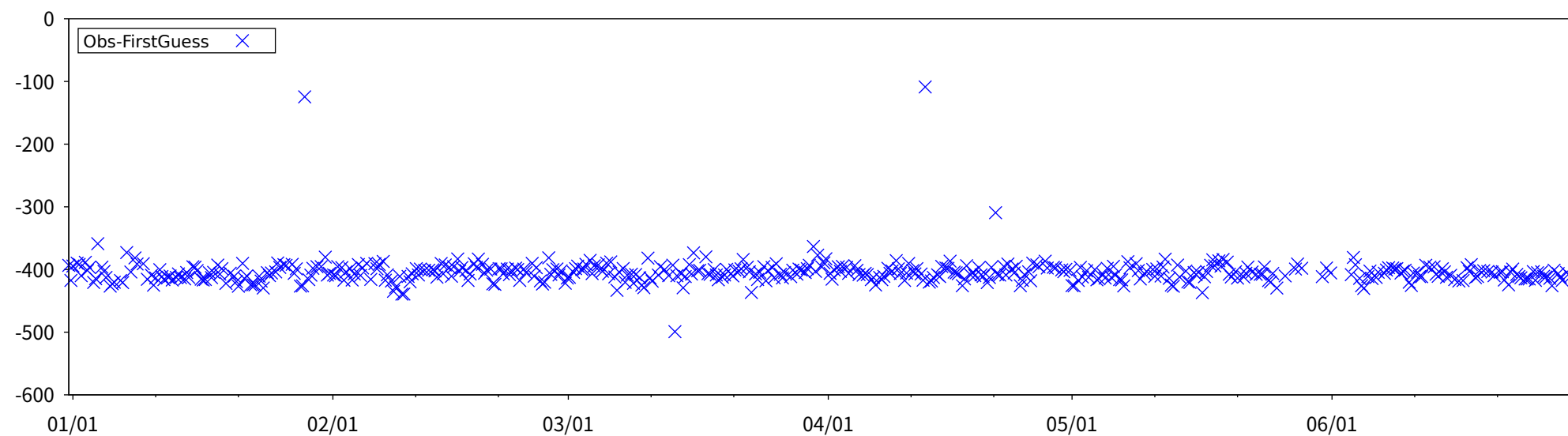
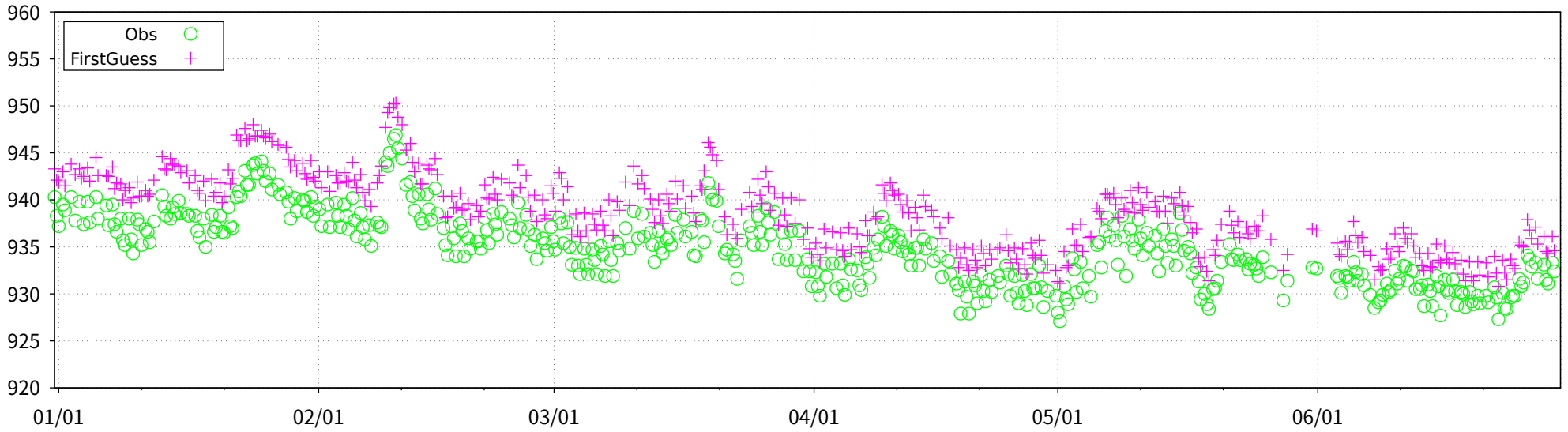


Figure 46(b) Time-series representation of GZ850 Obs minus FirstGuess for station 48921

ID: 48925 (lat: 20.7N, lon: 102.0E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

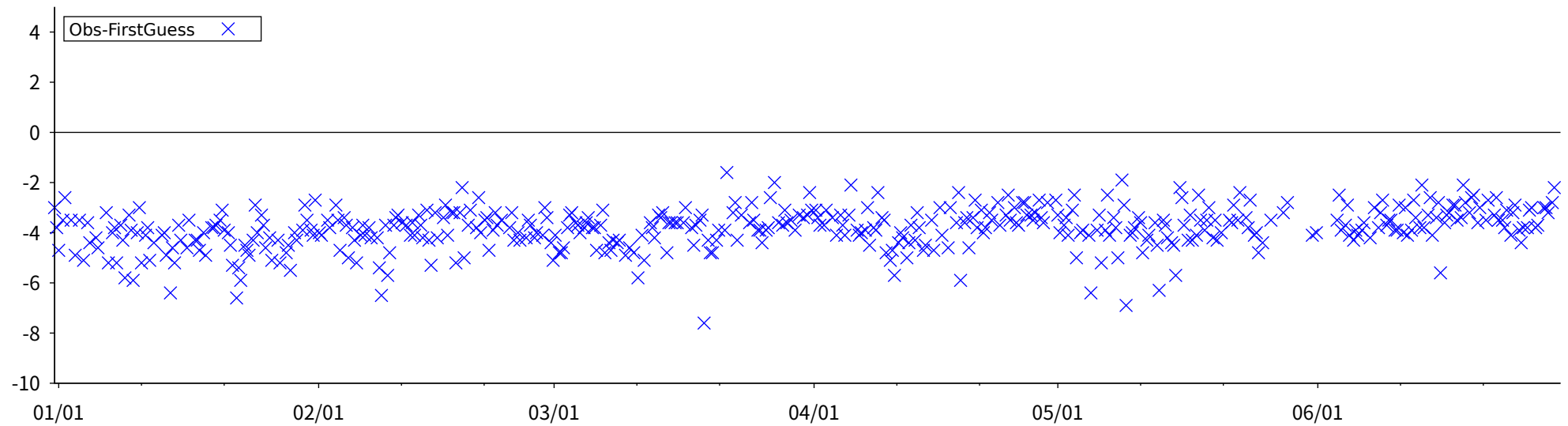


Figure 47 Time-series representation of SLP Obs minus FirstGuess for station 48925

LEVEL = SUR ELEMENT = GZ
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

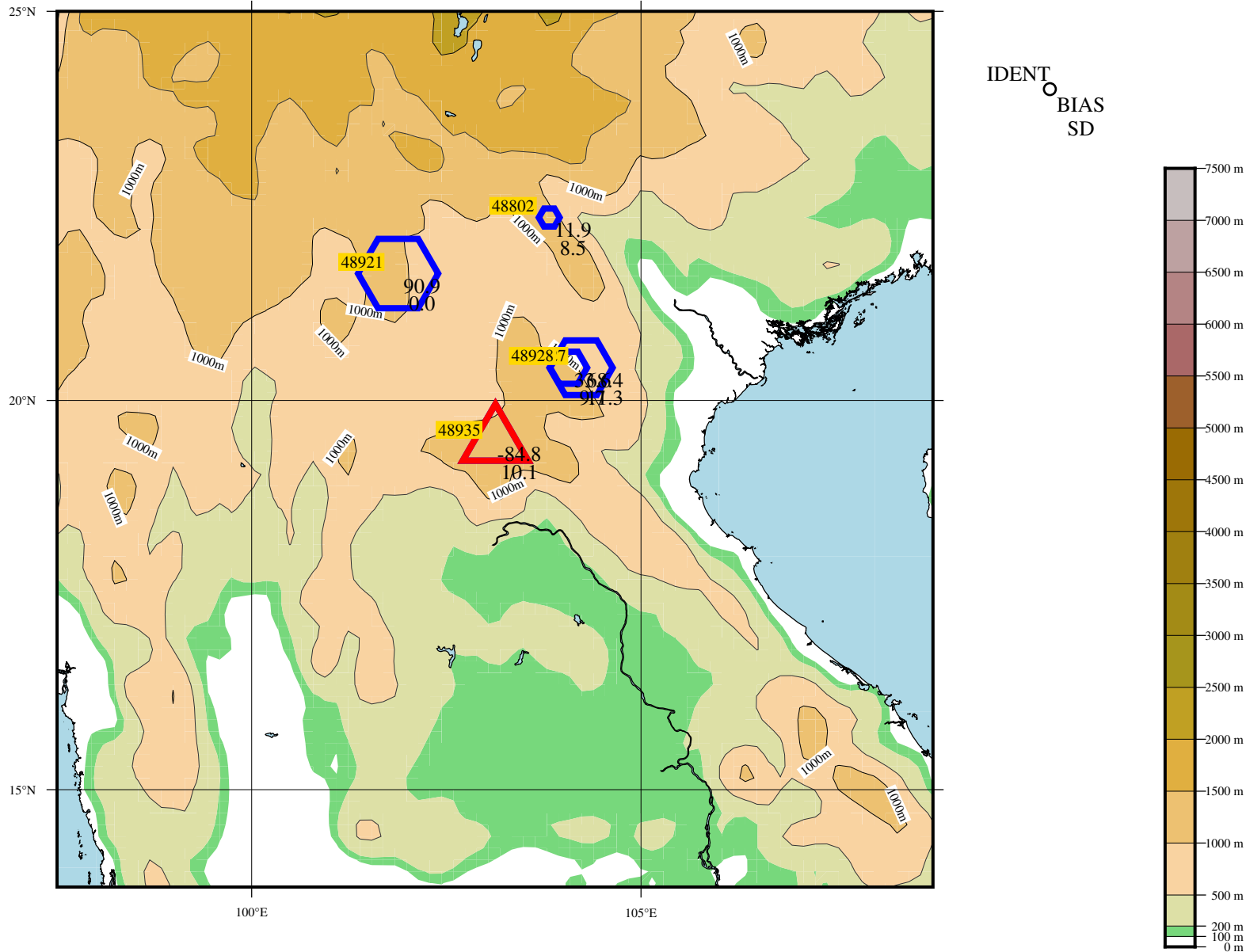
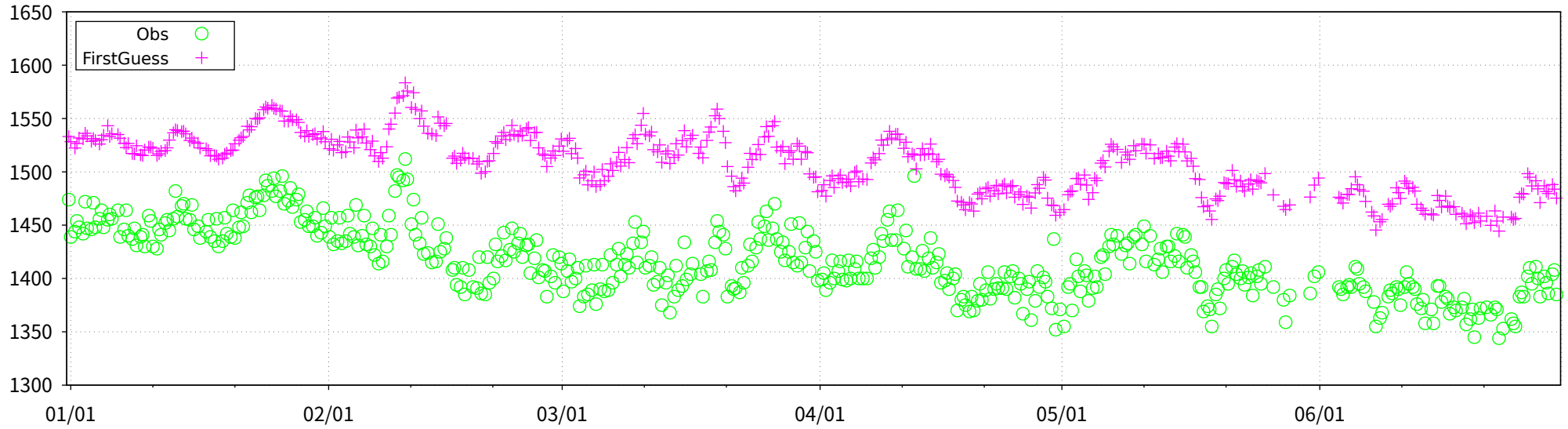


Figure 48 BIAS and SD of GZ for station 48935 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 48935 (lat: 19.5N, lon: 103.1E)

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

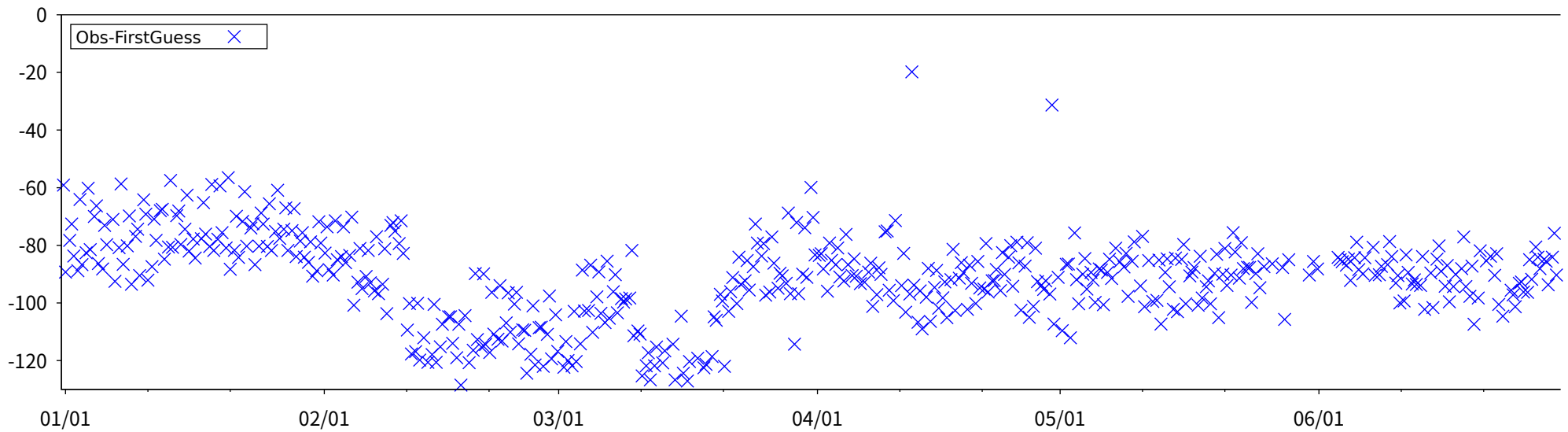


Figure 49 Time-series representation of GZ850 Obs minus FirstGuess for station 48935

LEVEL = SUR ELEMENT = MSLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

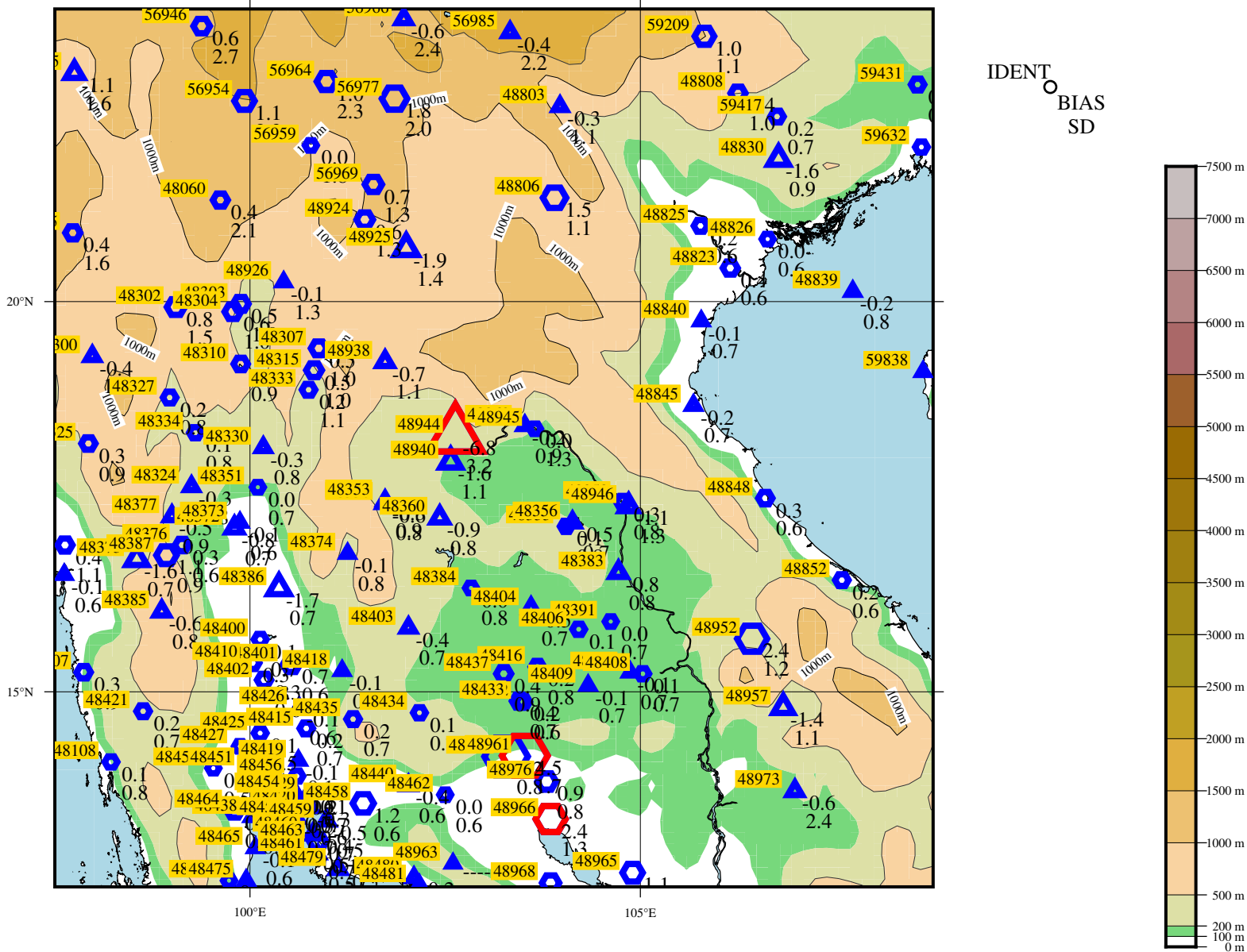
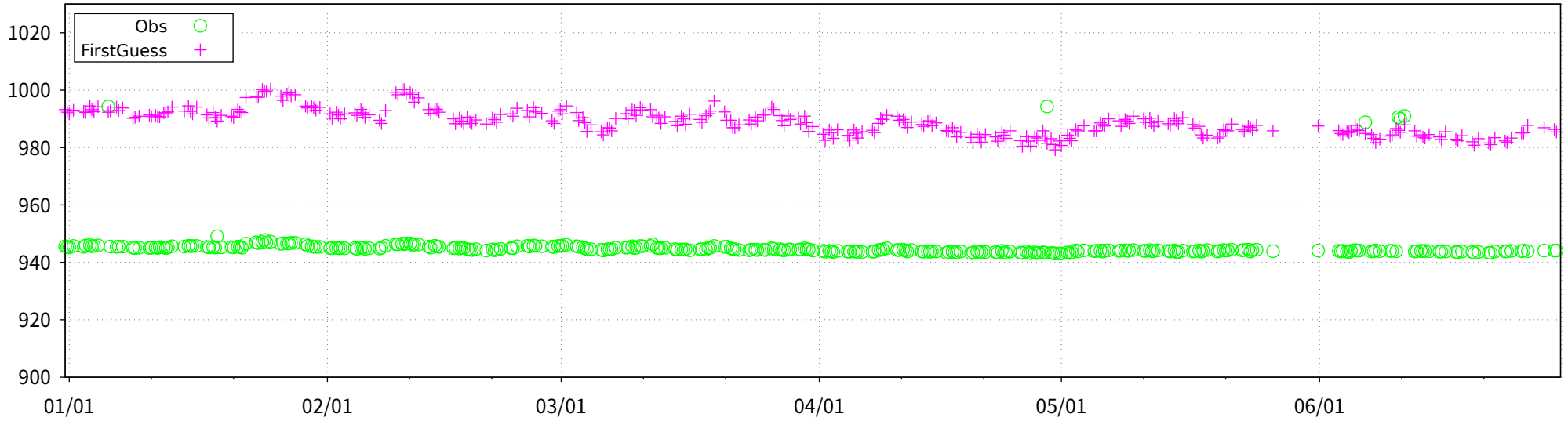


Figure 50 BIAS and SD of MSLP for station 48944, 48961, 48966 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 48944 (lat: 18.3N, lon: 102.6E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

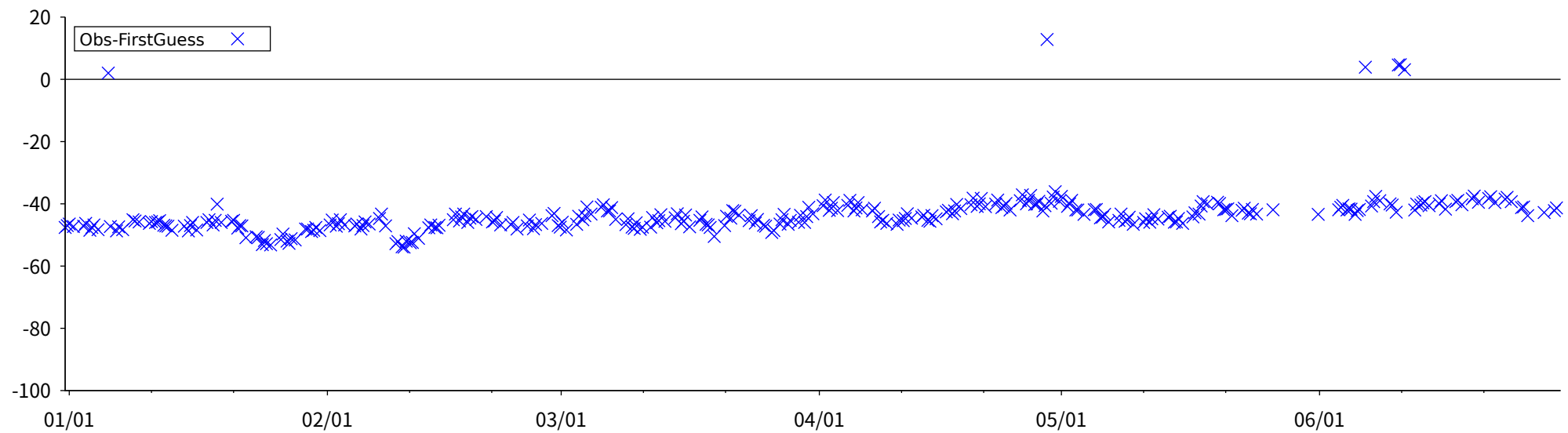
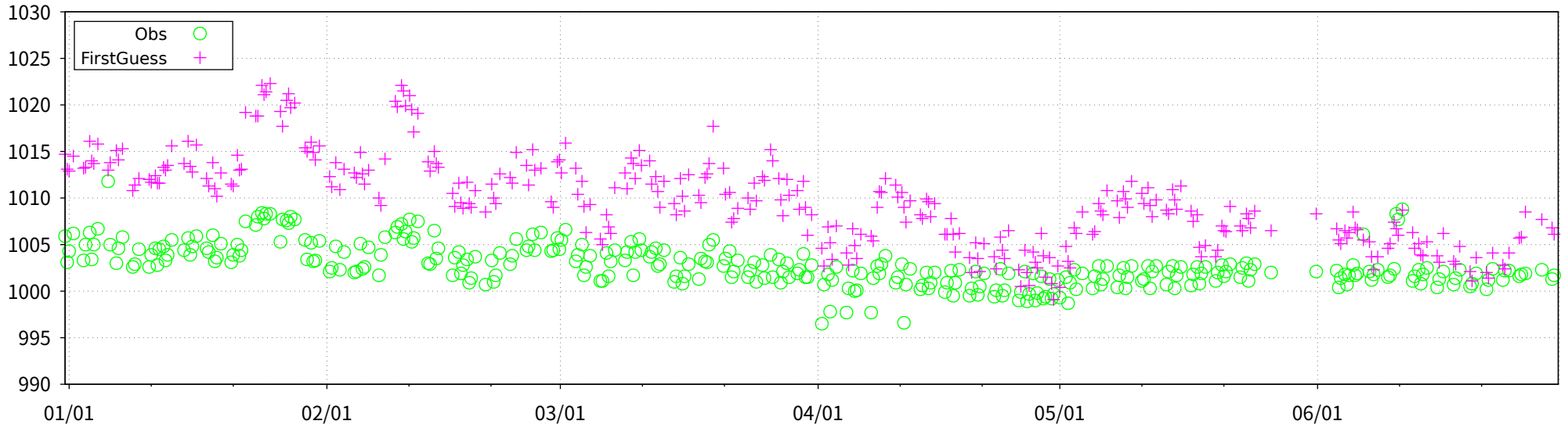


Figure 51(a) Time-series representation of SLP Obs minus FirstGuess for station 48944

ID: 48944 (lat: 18.3N, lon: 102.6E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

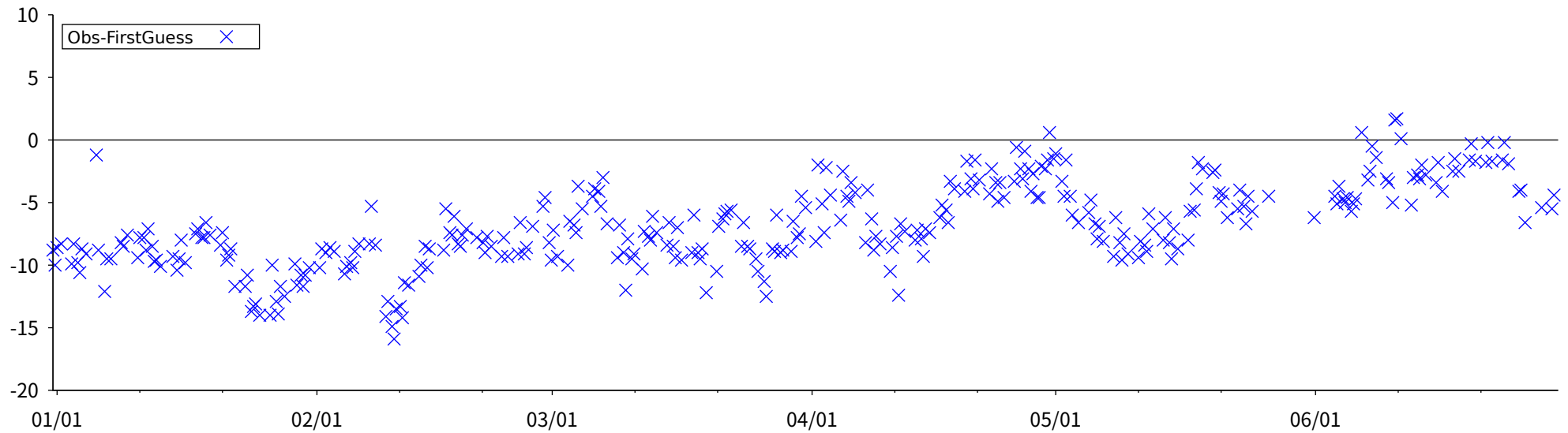
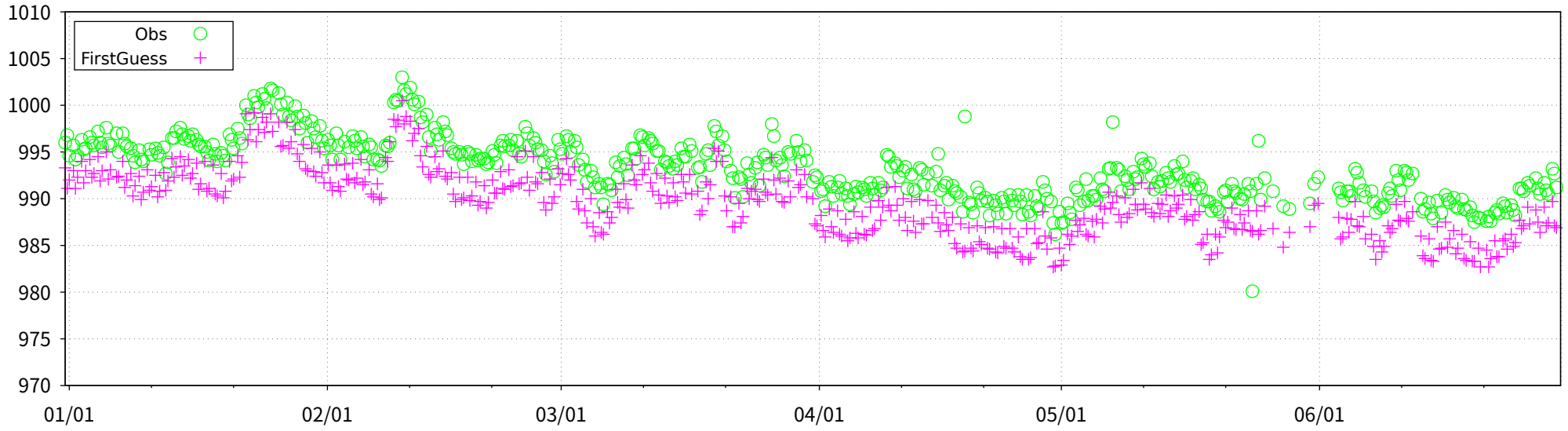


Figure 51(b) Time-series representation of MSLP Obs minus FirstGuess for station 48944

ID: 48952 (lat: 15.7N, lon: 106.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

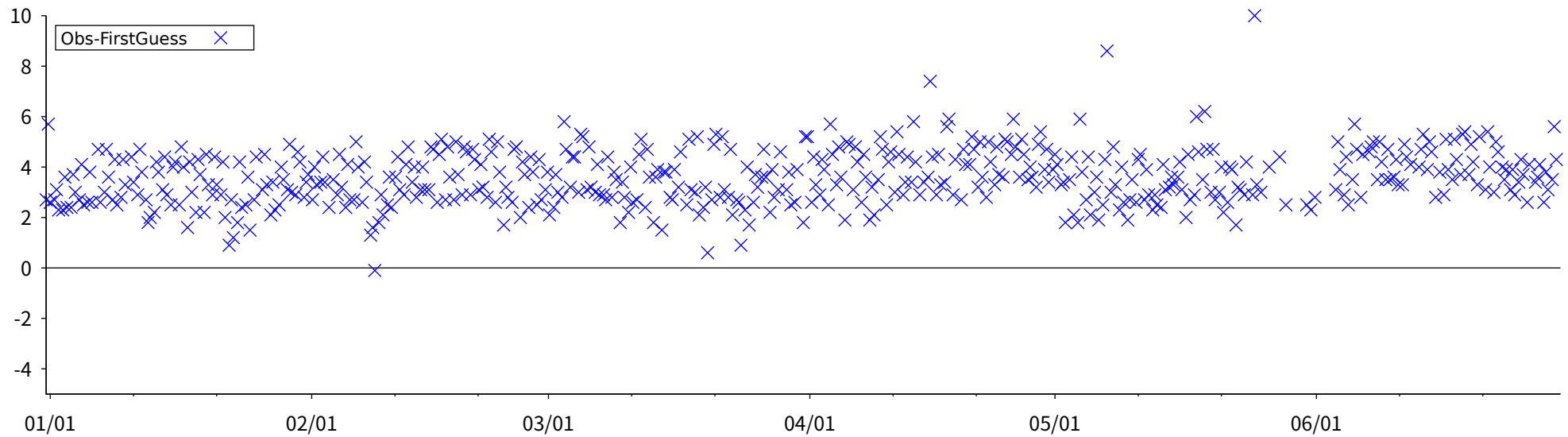
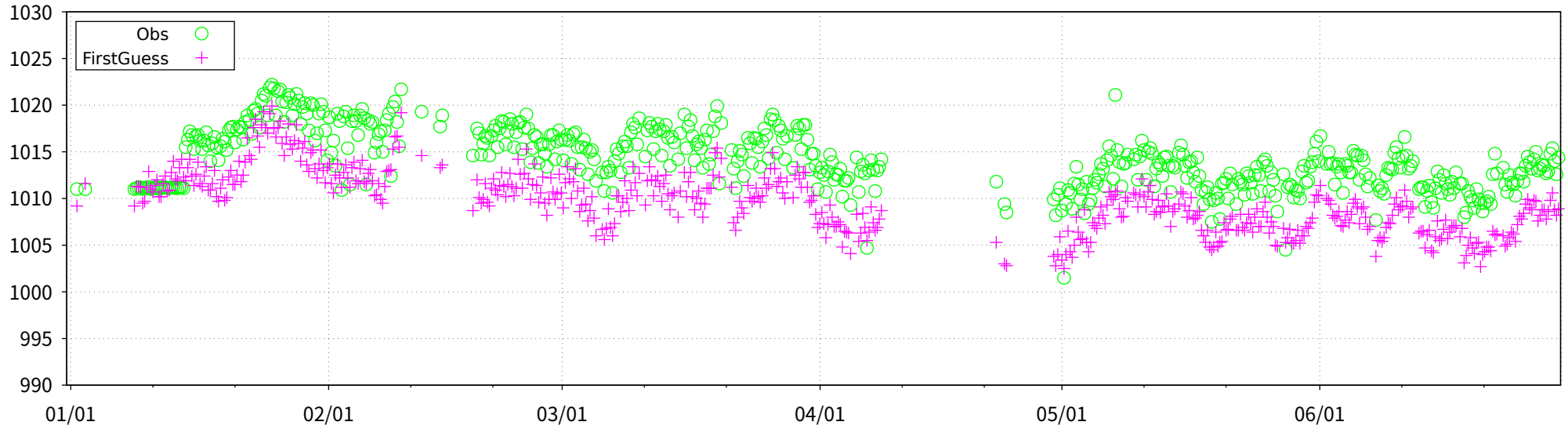


Figure 52 Time-series representation of SLP Obs minus FirstGuess for station 48952

ID: 48961 (lat: 14.2N, lon: 103.5E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

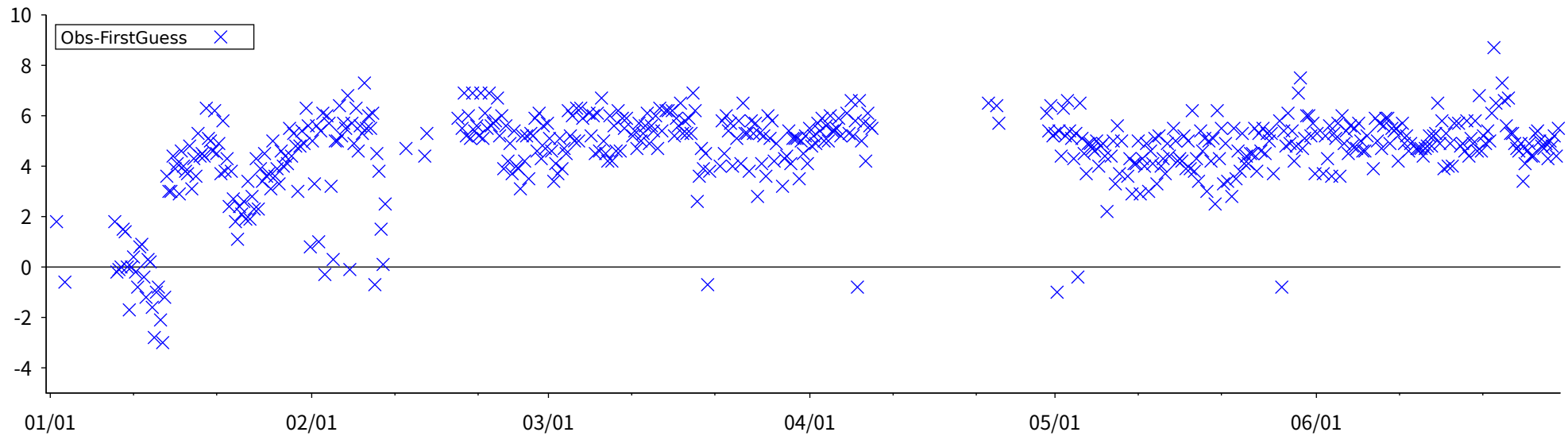


Figure 53 Time-series representation of MSLP Obs minus FirstGuess for station 48961

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

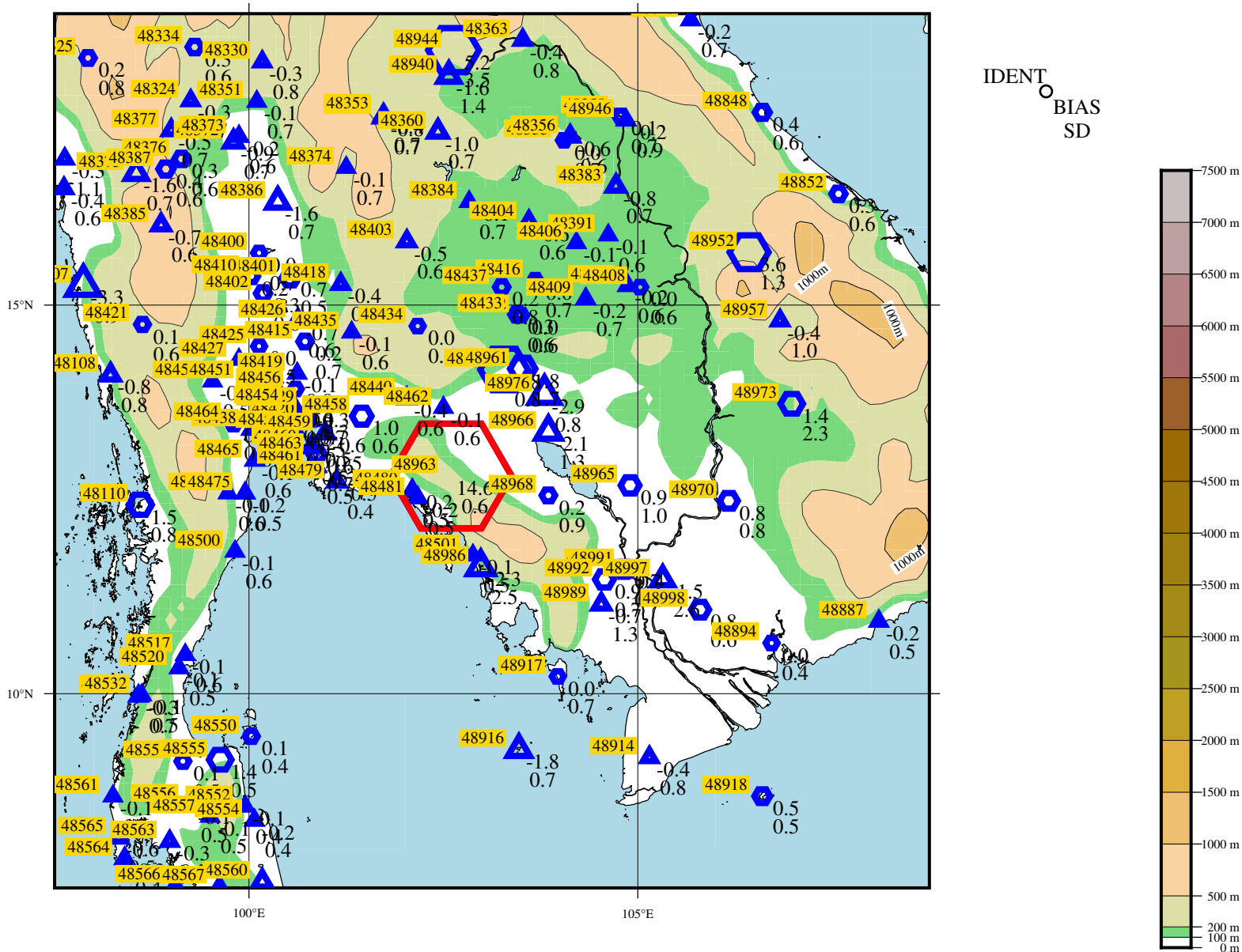


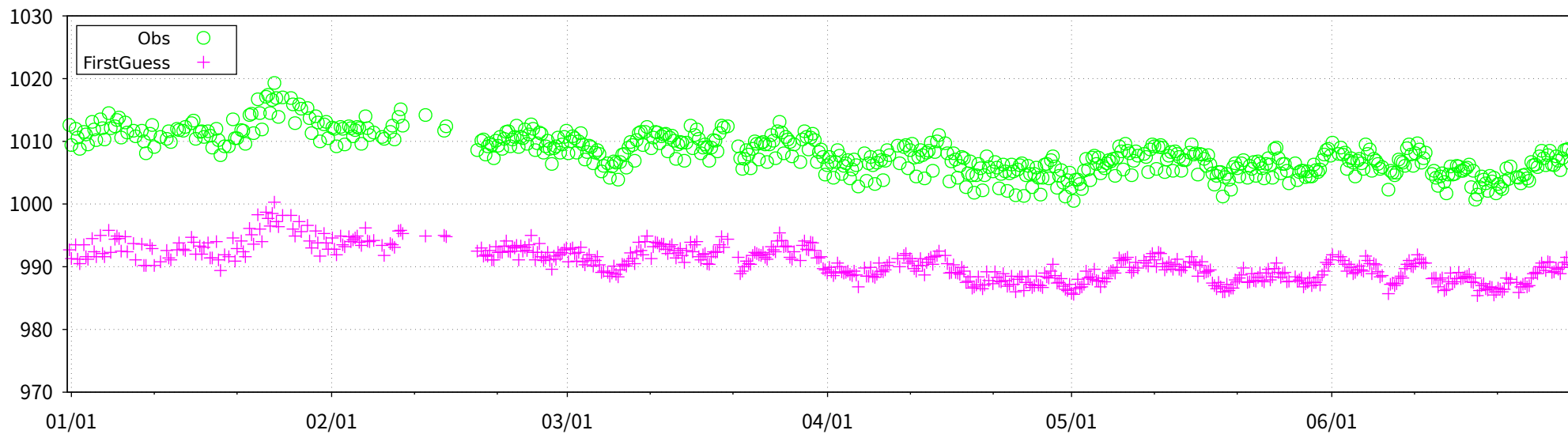
Figure 54 BIAS and SD of SLP for station 48963 (red) and surrounding stations (blue).

The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.

The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 48963 (lat: 12.8N, lon: 102.6E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

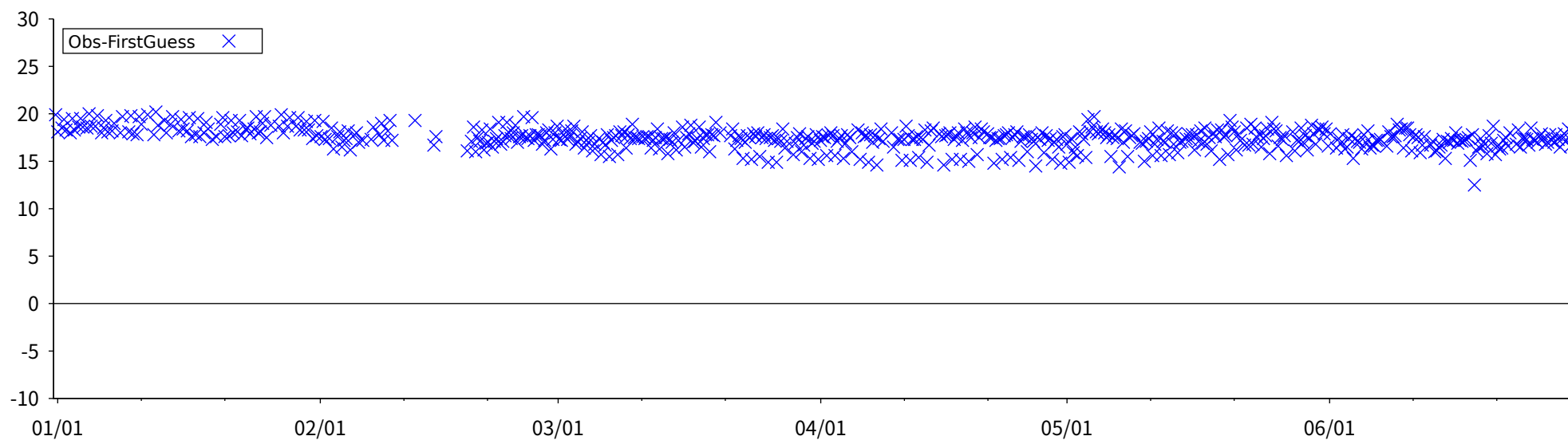
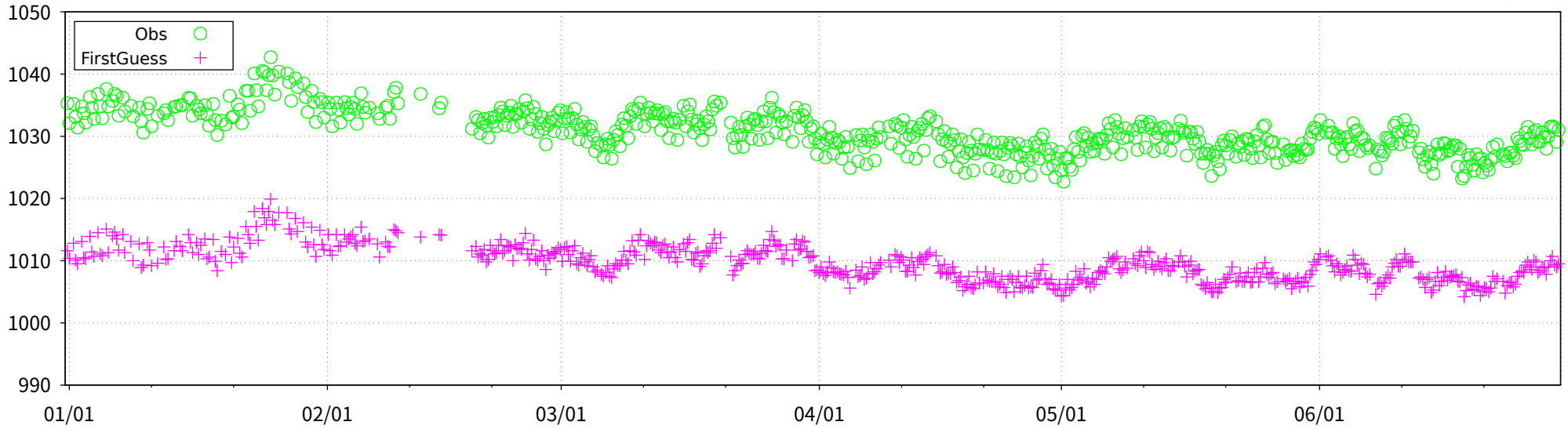


Figure 55(a) Time-series representation of SLP Obs minus FirstGuess for station 48963

ID: 48963 (lat: 12.8N, lon: 102.6E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

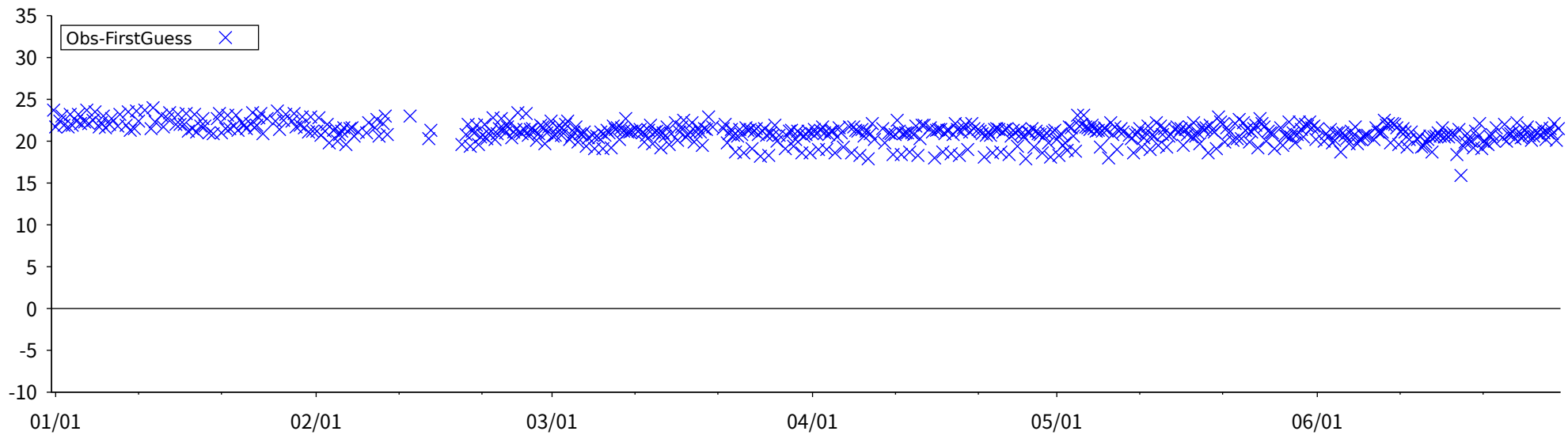
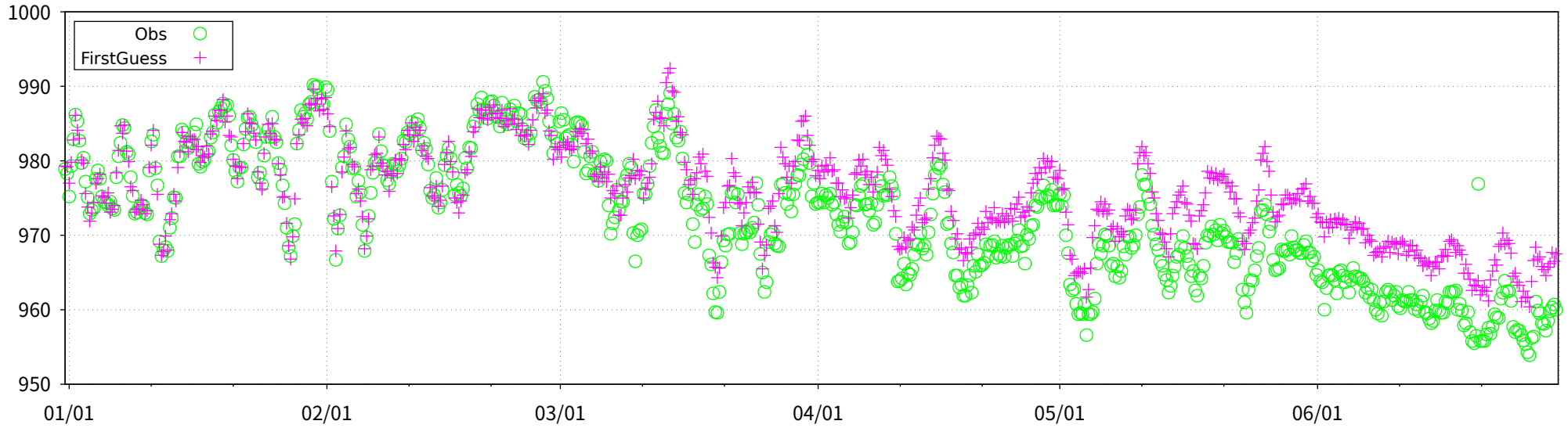


Figure 55(b) Time-series representation of MSLP Obs minus FirstGuess for station 48963

ID: 38567 (lat: 40.1N, lon: 65.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

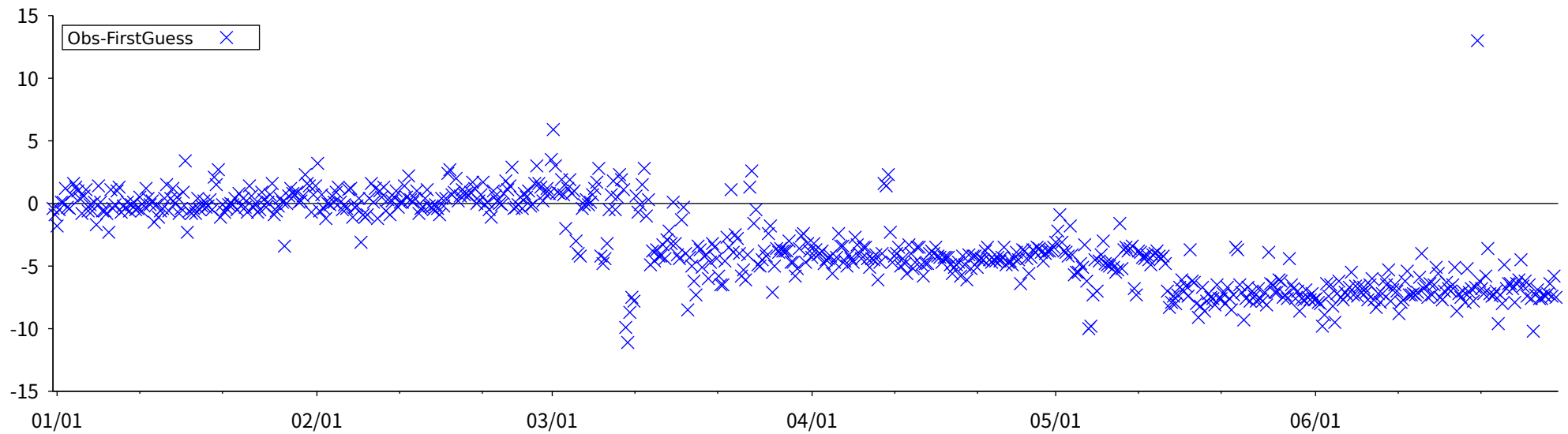
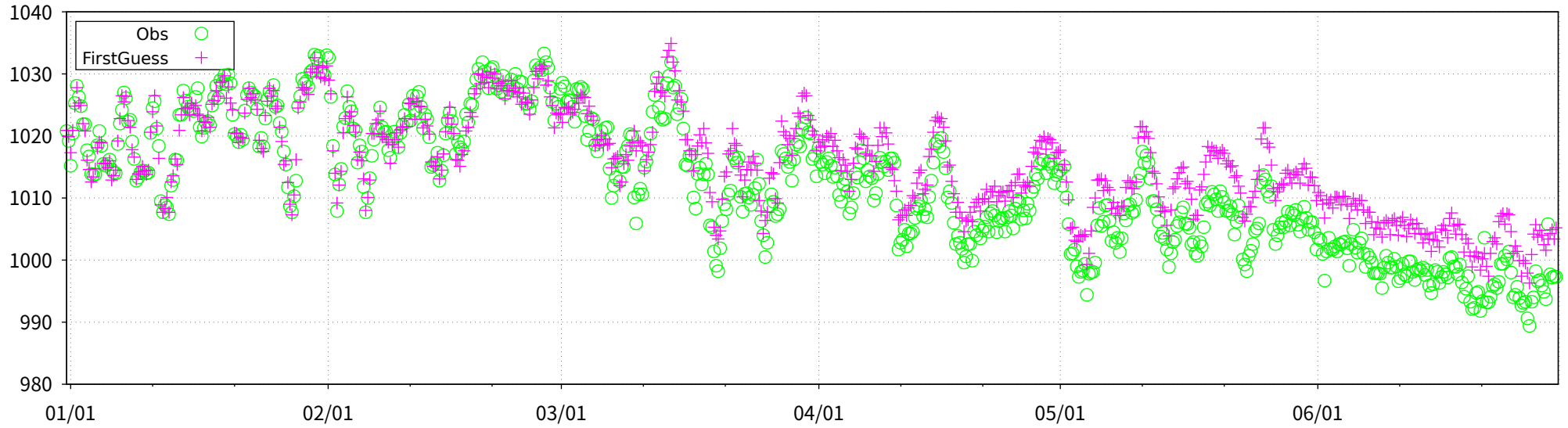


Figure 56(a) Time-series representation of SLP Obs minus FirstGuess for station 38567

ID: 38567 (lat: 40.1N, lon: 65.4E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

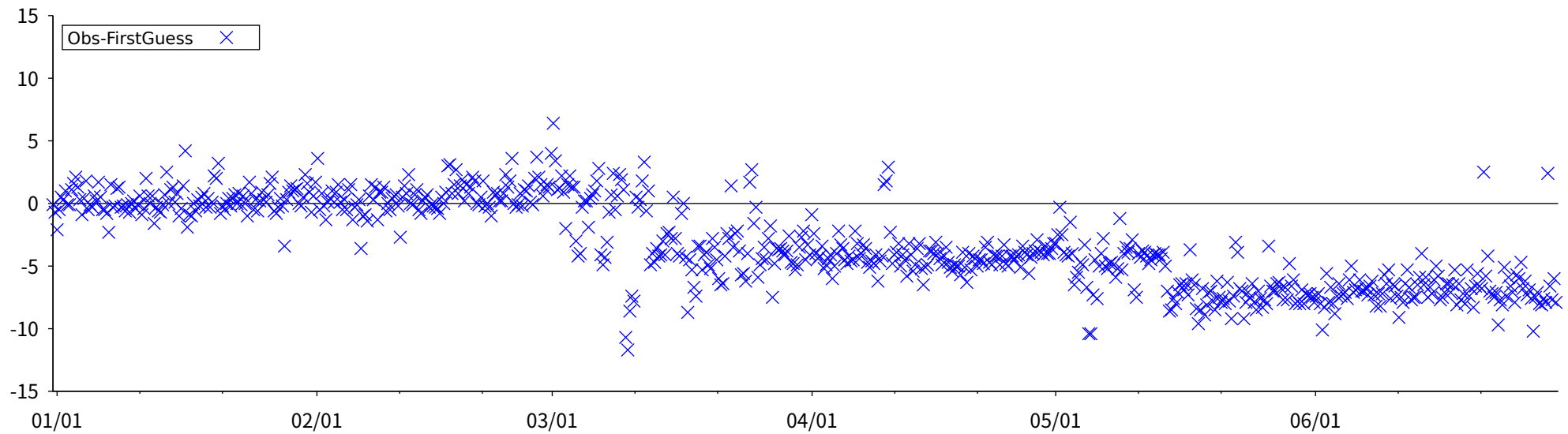
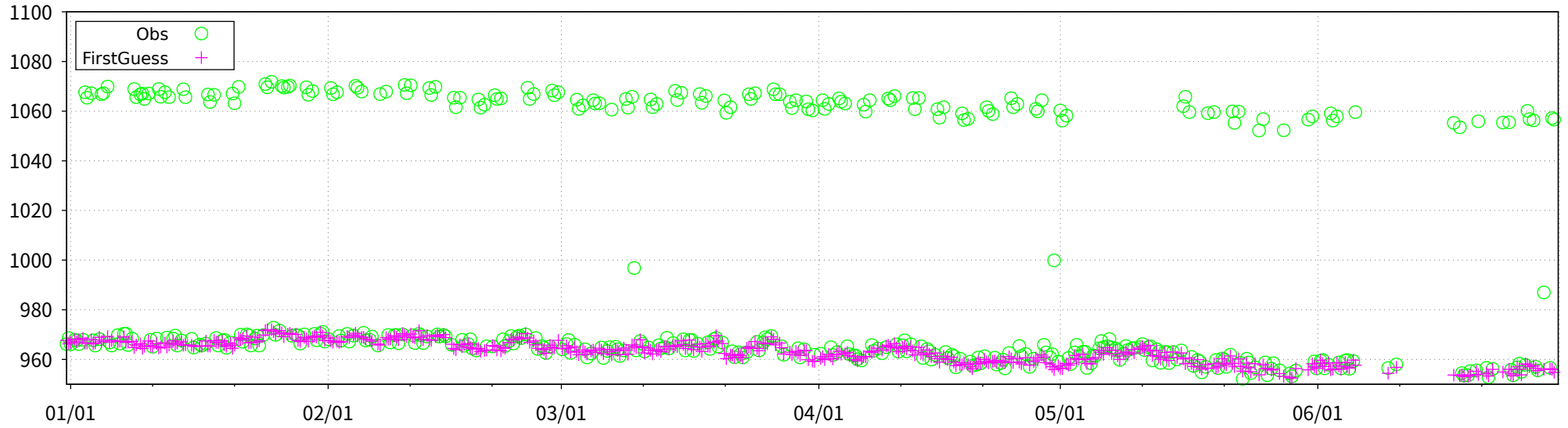


Figure 56(b) Time-series representation of MSLP Obs minus FirstGuess for station 38567

ID: 48001 (lat: 27.3N, lon: 97.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

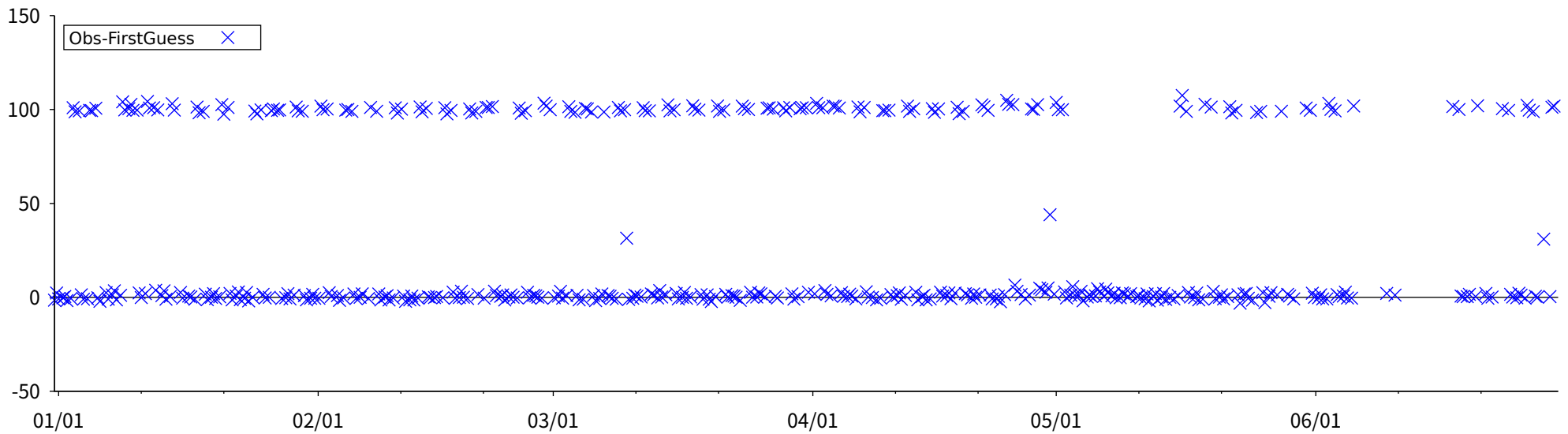
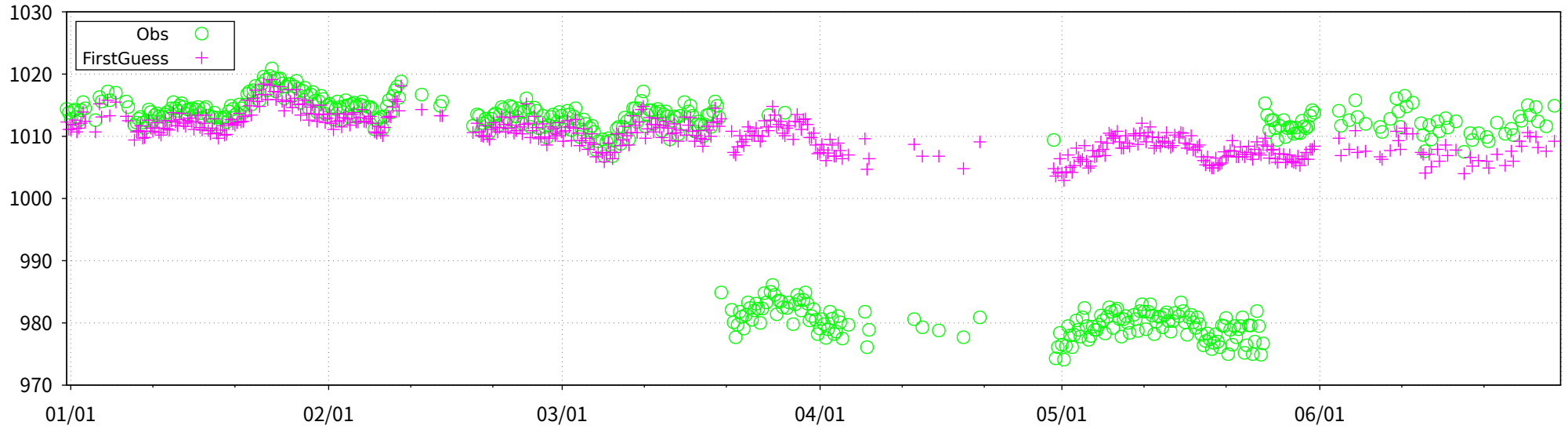


Figure 57 Time-series representation of SLP Obs minus FirstGuess for station 48001

ID: 48966 (lat: 13.4N, lon: 103.9E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

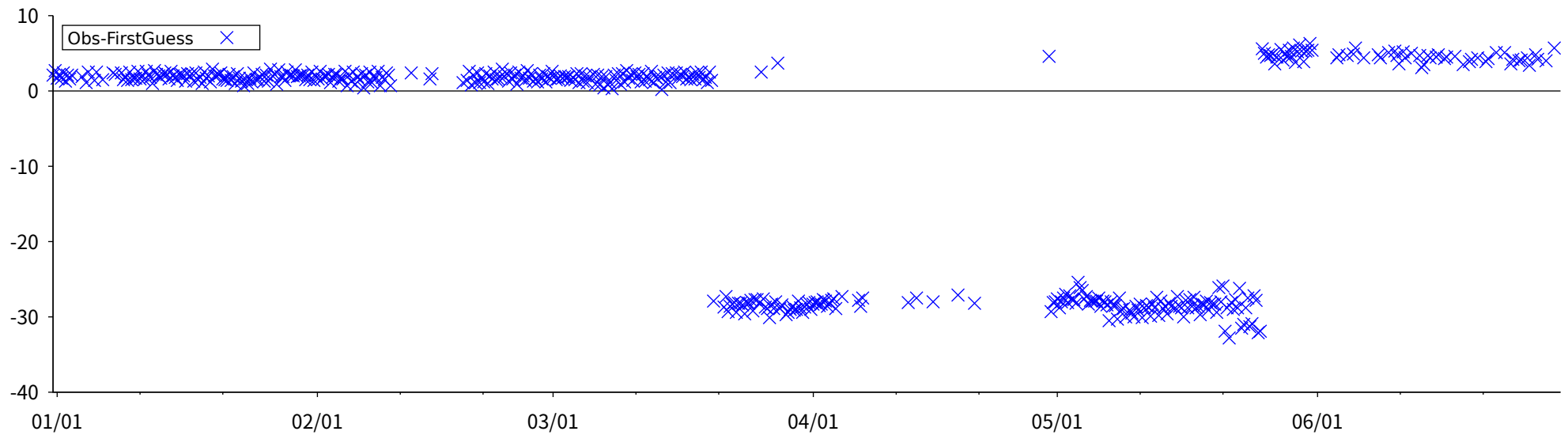


Figure 58 Time-series representation of MSLP Obs minus FirstGuess for station 48966

LEVEL = SUR ELEMENT = MSLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

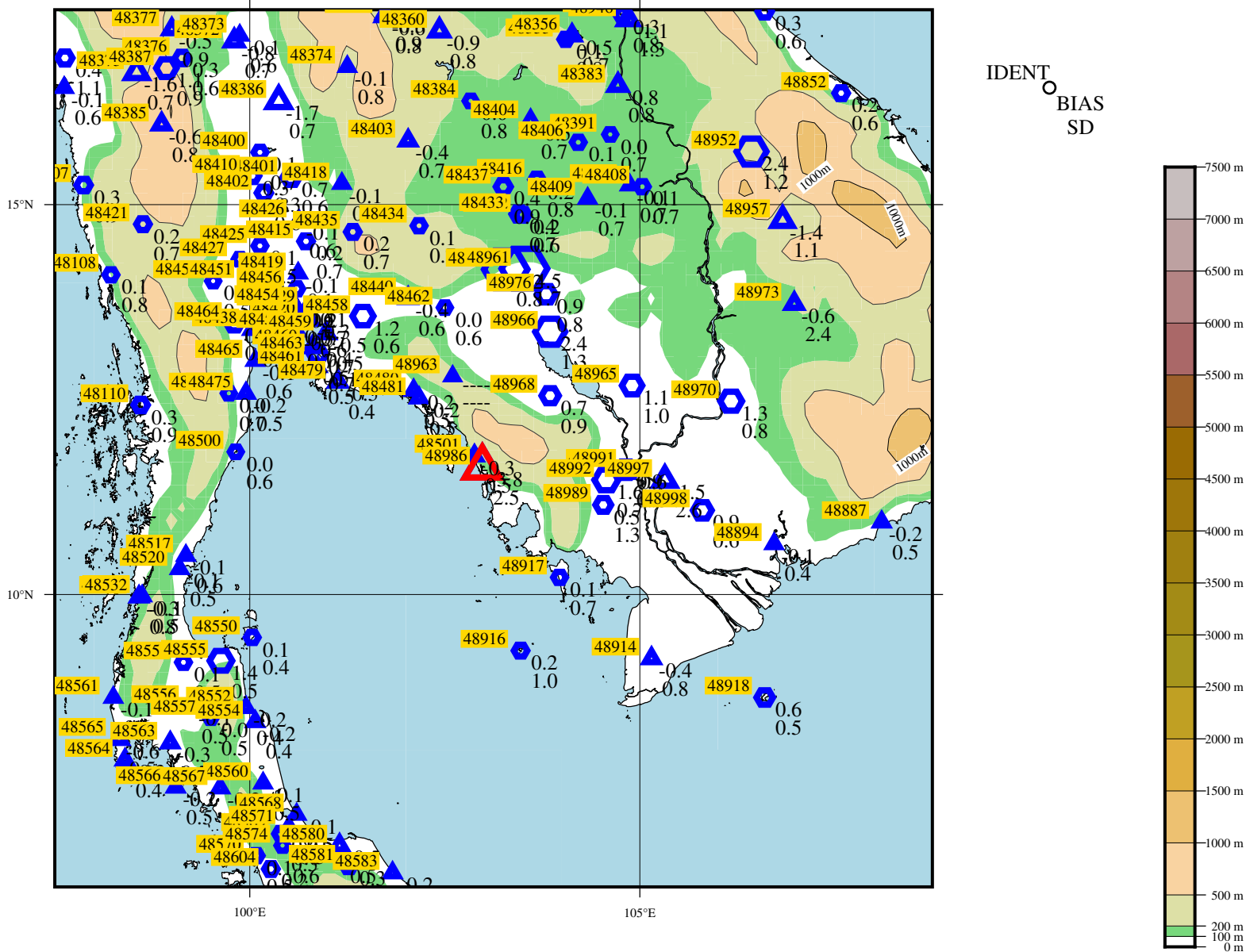
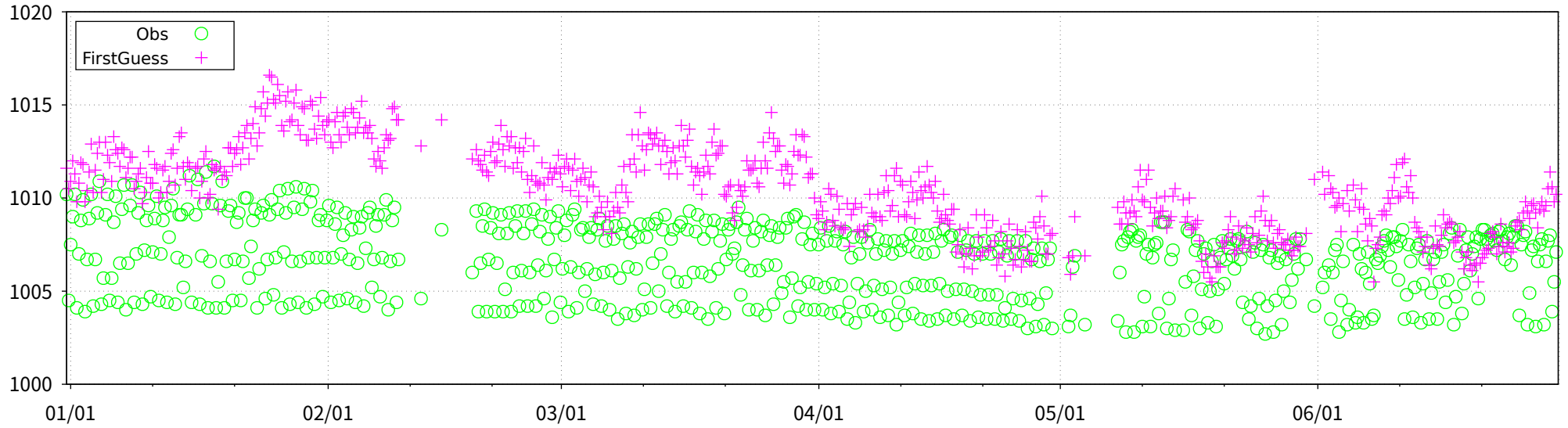


Figure 59 BIAS and SD of MSLP for station 48986 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 48986 (lat: 11.6N, lon: 103.0E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

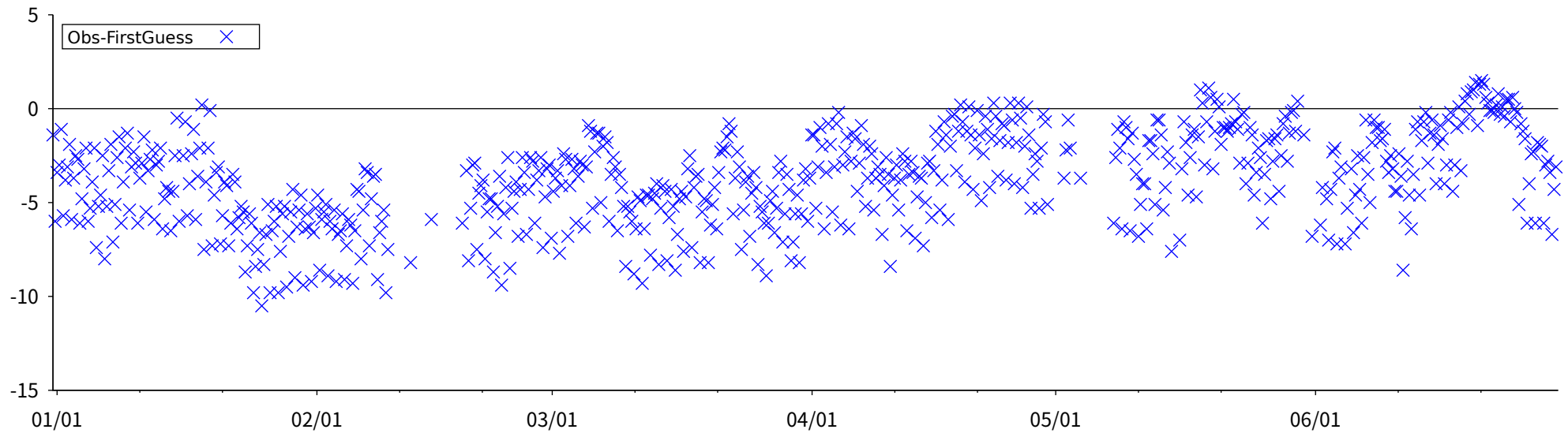


Figure 60 Time-series representation of MSLP Obs minus FirstGuess for station 48986

LEVEL = SUR ELEMENT = SLP
 2024 01 01 00 UTC -> 2024 06 30 18 UTC (182 DAYS)

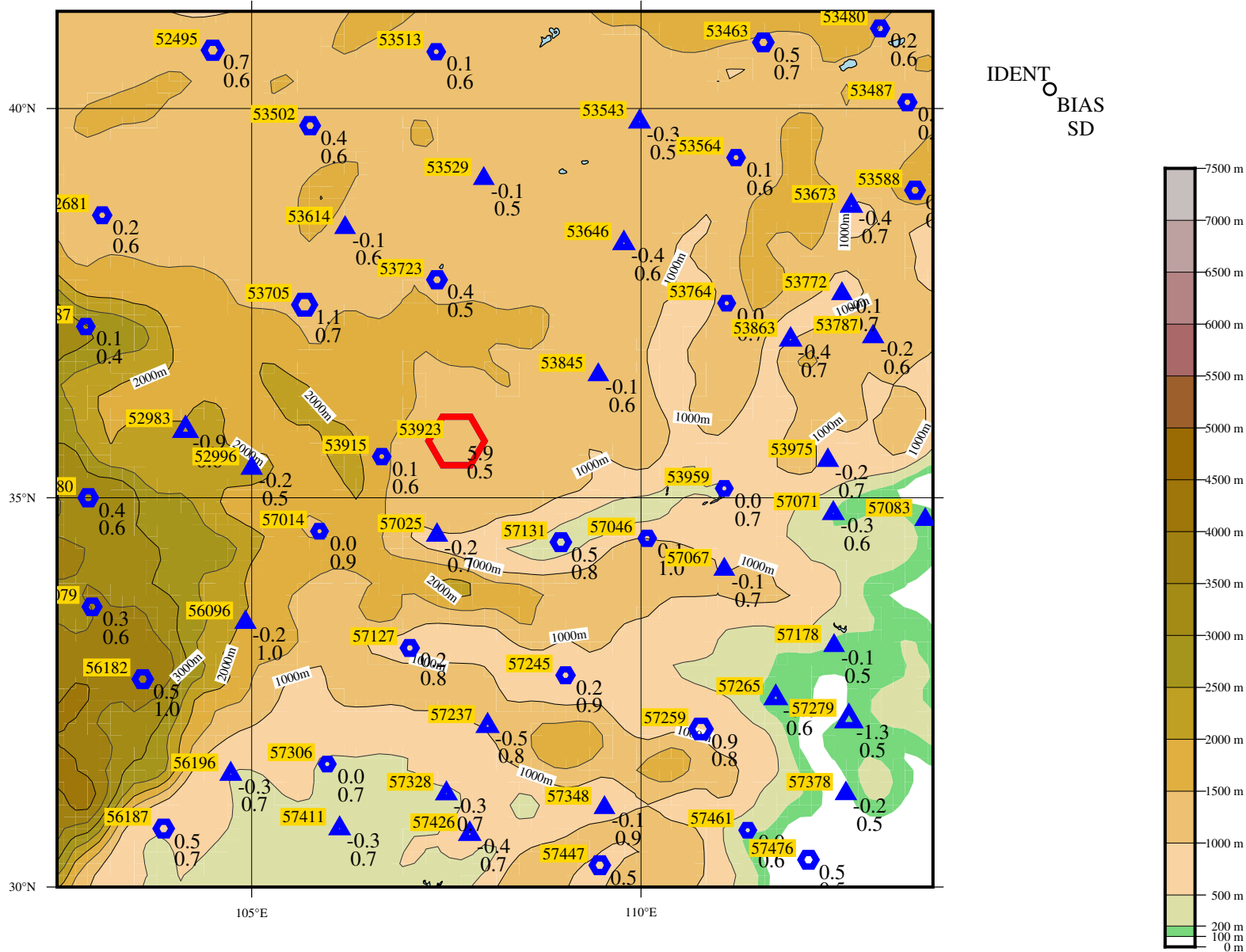
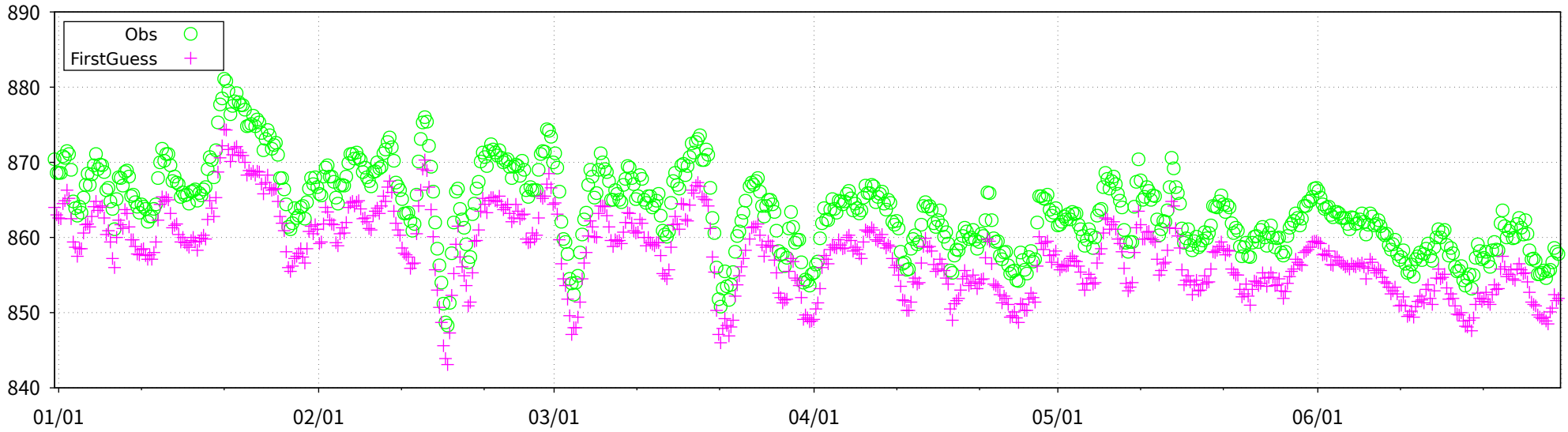


Figure 61 BIAS and SD of SLP for station 53923 (red) and surrounding stations (blue).
 The number to the upper left of each symbol is the WMO IDENT, and those to the lower right are the values of BIAS and SD.
 The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

ID: 53923 (lat: 35.7N, lon: 107.6E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

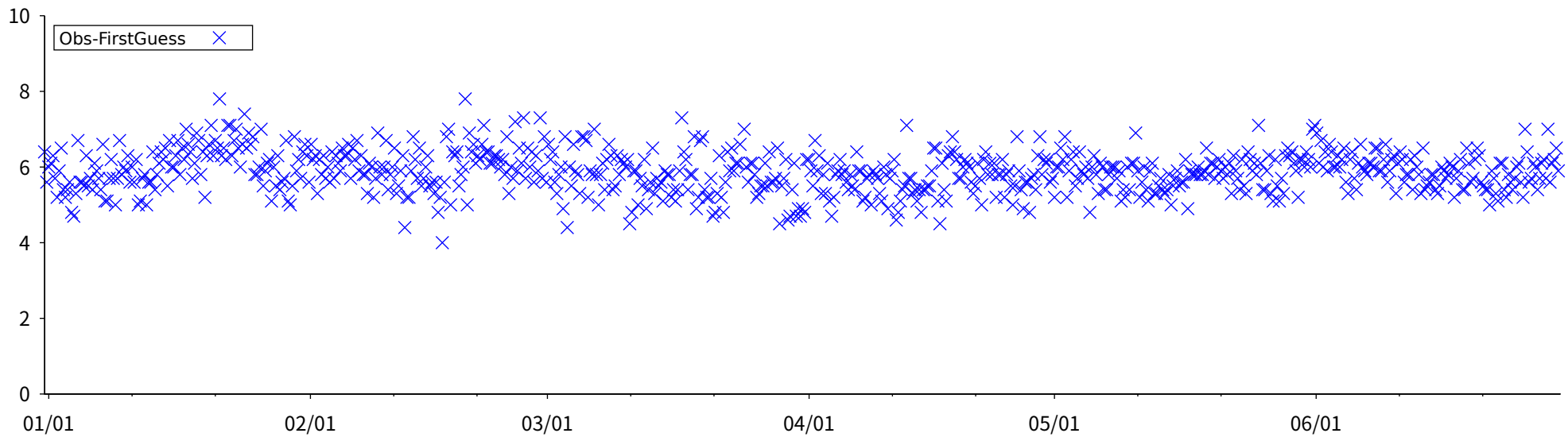
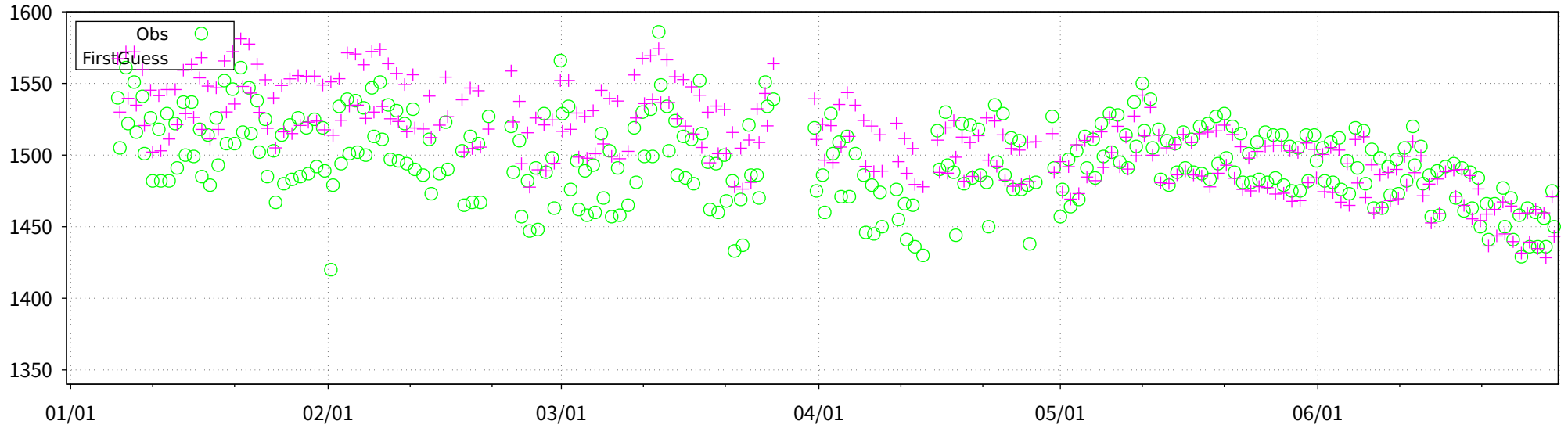


Figure 62 Time-series representation of SLP Obs minus FirstGuess for station 53923

ID: 41437 (lat: 14.5N, lon: 46.9E)

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

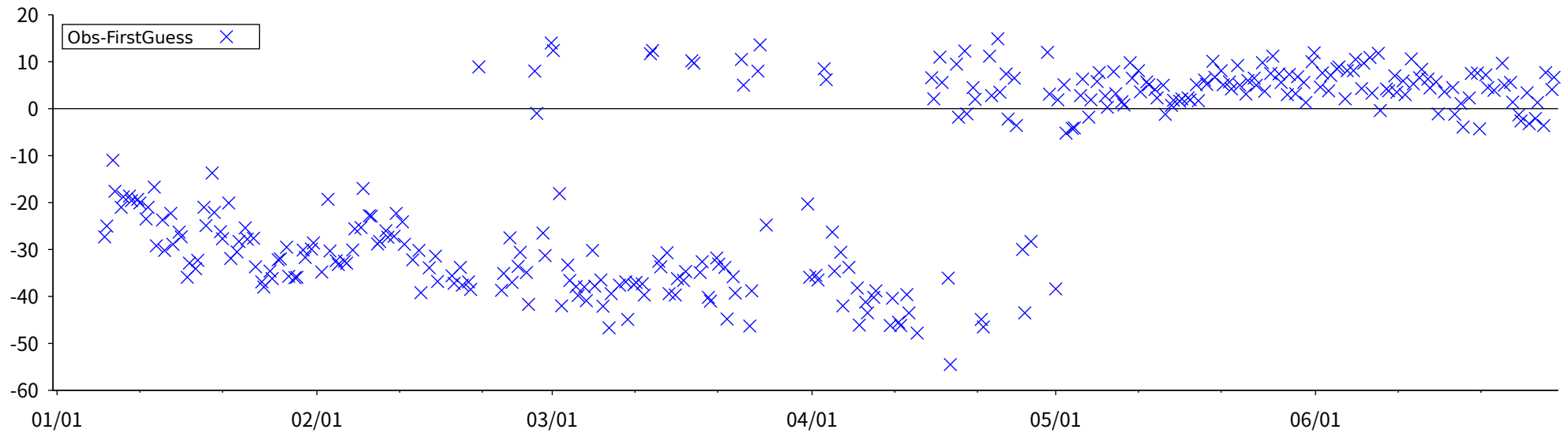
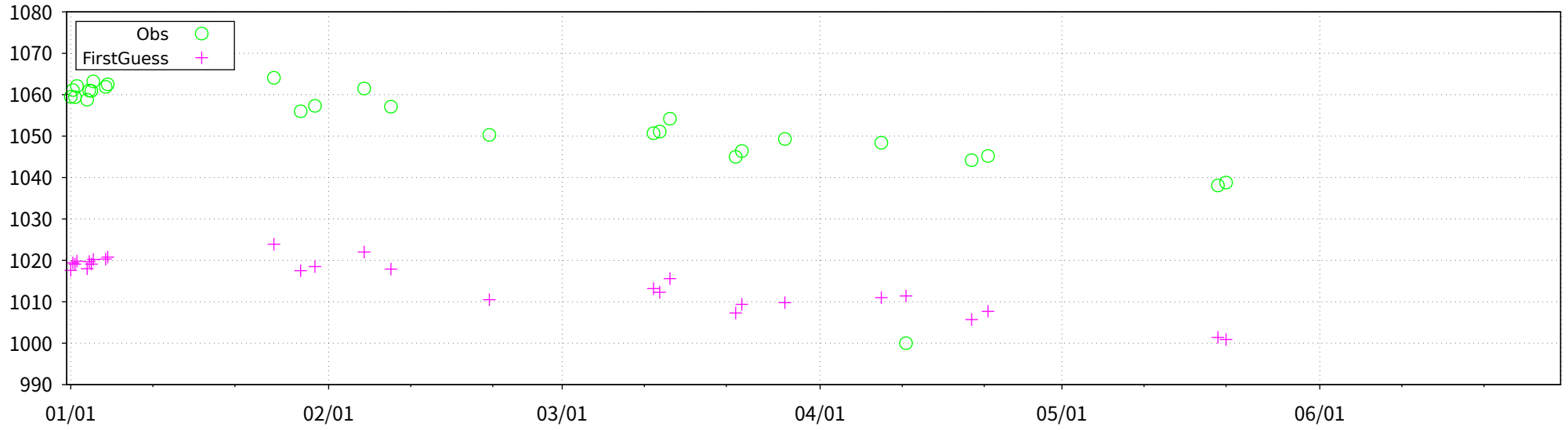


Figure 63 Time-series representation of GZ850 Obs minus FirstGuess for station 41437

ID: 42056 (lat: 32.7N, lon: 74.8E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

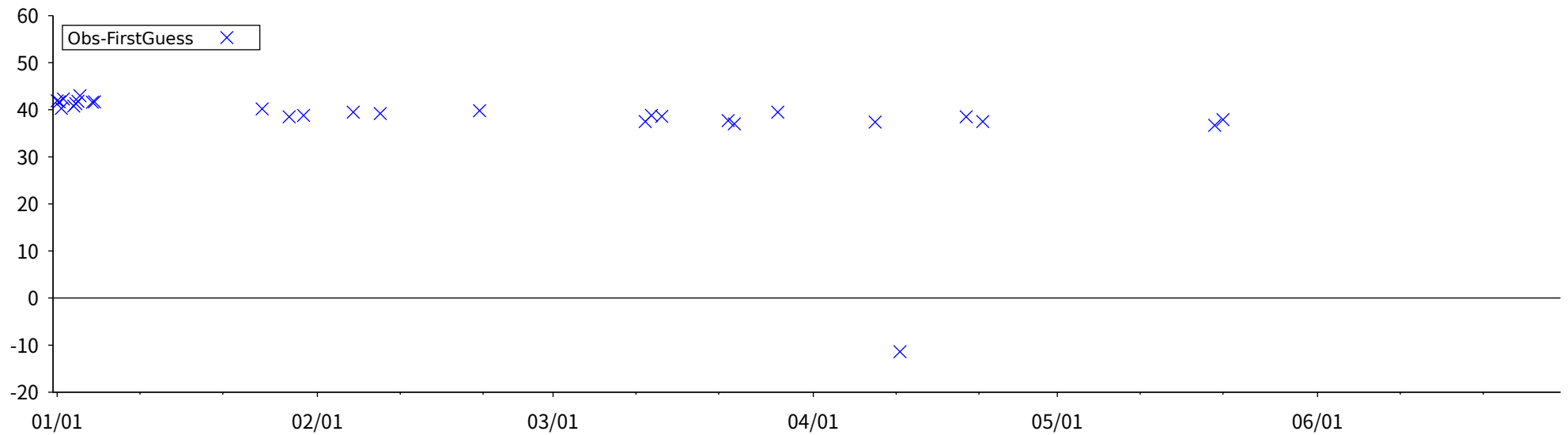


Figure 64 Time-series representation of MSLP Obs minus FirstGuess for station 42056