

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

July – December 2021

No. 62

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**RSMC Tokyo
Lead Center for Monitoring Quality of Land Surface Observations**

**Japan Meteorological Agency
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Report on the Quality of Land Surface Observations in Region II
(No. 62)
July – December 2021

Summary

In its role as a Lead Center, RSMC Tokyo has issued the 62nd report on the land surface observation quality monitoring for the period from July to December 2021. The report includes a consolidated list of stations suspected of producing low-quality observation data.

(1) SLP

As a result of monitoring, seven stations (40700, 40713, 40741, 40854, 40877, 48802, 38719) were excluded from the consolidated lists of the previous report (January – June 2021), and one station (41315) was newly added to the lists.

(2) MSLP

As a result of monitoring, two stations (35615, 35701) were newly added to the lists.

(3) GZ

As a result of monitoring, one station (48802) was excluded from the consolidated lists of the previous report (January – June 2021), and one station (41315) was newly added to the lists.

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	1908
MSLP	2025
GZ	89

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 184 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 184 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 July to December 2021

WMO IDENT	LAT (N)	LON (E)	H (m)	HM (m)	ELEM	NOBS	PGE (%)	SD	BIAS	RMS
35284	50.6	70.0	384	324	SLP	736	0	0.8	6.5	6.5
					MSLP	735	0	0.9	0.7	1.1
38232	43.0	54.1	78	89	SLP	705	71	0.8	14.4	14.4
					MSLP	705	60	0.8	14.3	14.3
38262	43.0	59.8	93	58	SLP	736	0	0.8	4.1	4.2
					MSLP	735	0	0.8	0.9	1.2
38313	43.7	69.0	405	709	SLP	677	79	0.7	14.1	14.1
					MSLP	677	0	2.3	-1.1	2.5
38318	42.1	68.1	183	221	SLP	496	0	1.8	-4.1	4.5
					MSLP	496	0	1.8	0.3	1.8
38836	38.6	68.7	800	1188	SLP	705	2	3.5	-4.1	5.4
					MSLP	703	5	4.8	-5.3	7.2
38875	39.0	73.6	3930	4306	SLP	349	100	0.0	-3.6	3.6
					-	-	-	-	-	-
38880	38.0	58.4	312	308	SLP	734	0	1.4	11.6	11.7
					MSLP	735	0	1.0	0.0	1.0
38944	37.5	69.4	447	586	SLP	712	0	1.2	-5.8	5.9
					MSLP	712	0	1.6	-6.1	6.3
40587	29.3	47.7	55	79	MSLP	729	26	6.9	4.2	8.1
					-	-	-	-	-	-
40877	28.0	57.7	499	682	SLP	698	0	1.5	-1.8	2.3
					MSLP	698	0	1.1	-4.2	4.3
41265	22.8	58.5	469	592	SLP	712	0	0.5	-5.2	5.2
					MSLP	708	0	0.7	-2.0	2.1
41573	33.9	73.4	2127	1312	SLP	603	0	1.8	9.1	9.3
					GZ850	603	0	10.8	-0.9	10.8
42056	32.7	74.8	323	308	SLP	719	0	0.7	-6.6	6.6
					-	-	-	-	-	-
42083	31.1	77.2	2202	1560	SLP	365	95	0.2	14.8	14.8
					-	-	-	-	-	-
42111	30.3	78.0	683	871	SLP	727	0	0.7	5.8	5.8
					MSLP	727	0	1.5	-1.6	2.2
42114	30.4	78.5	770	1525	SLP	362	100	*****	*****	*****
					-	-	-	-	-	-
42147	29.5	79.7	2311	1571	SLP	363	1	0.5	4.3	4.3
					-	-	-	-	-	-
42295	27.1	88.3	2134	1270	SLP	365	78	0.3	14.8	14.8
					GZ850	365	100	0.0	79.2	79.2

WMO IDENT	LAT (N)	LON (E)	H (m)	HM (m)	ELEM	NOBS	PGE (%)	SD	BIAS	RMS
42299	27.3	88.6	1756	1989	SLP	366	0	0.7	0.4	0.8
					GZ850	366	0	8.6	57.2	57.8
43418	8.6	81.3	79	8	SLP	724	0	0.6	4.5	4.5
					MSLP	723	0	0.5	-0.3	0.6
43479	7.0	81.1	670	862	SLP	494	1	0.5	-9.5	9.5
					-	-	-	-	-	-
44406	29.3	81.0	617	1547	SLP	520	0	1.5	4.4	4.6
					MSLP	519	0	2.5	-2.7	3.7
44424	29.3	82.2	2300	3288	SLP	484	1	1.2	-6.1	6.2
					GZ700	484	0	12.9	-52.3	53.9
44429	28.1	82.5	634	884	SLP	522	0	0.7	-3.7	3.8
					MSLP	522	0	1.3	0.5	1.4
47037	40.0	125.3	99	215	SLP	736	0	1.2	-4.1	4.3
					MSLP	736	0	1.3	-4.0	4.2
47102	38.0	124.7	146	4	SLP	736	0	0.7	11.7	11.7
					MSLP	736	0	0.5	-1.2	1.3
47145	36.8	127.3	26	112	SLP	736	0	0.8	-6.2	6.3
					MSLP	736	0	0.6	0.7	0.9
47152	35.6	129.3	36	121	SLP	736	0	0.6	-5.5	5.5
					MSLP	736	0	0.5	-0.2	0.5
48001	27.3	97.4	434	794	SLP	547	100	*****	*****	*****
					MSLP	547	2	1.9	-1.1	2.2
48018	24.2	96.3	95	197	SLP	534	0	1.0	3.7	3.8
					MSLP	534	0	1.1	-0.5	1.2
48062	20.1	92.9	5	3	SLP	541	0	0.9	6.3	6.4
					MSLP	541	0	0.7	-0.4	0.8
48085	17.6	94.6	3	78	SLP	543	0	0.9	6.7	6.8
					MSLP	543	0	1.0	-0.6	1.2
48107	15.3	97.9	7	89	SLP	546	0	1.0	-3.6	3.7
					MSLP	546	0	1.0	0.0	1.0
48921	21.6	101.9	1360	1072	SLP	535	1	1.1	-4.6	4.7
					GZ850	534	100	0.0	96.5	96.5
48935	19.5	103.1	1094	1196	SLP	534	1	4.4	5.3	6.9
					GZ850	533	6	41.5	-34.8	54.2
48952	15.7	106.4	180	334	SLP	540	0	1.1	3.6	3.8
					MSLP	540	0	1.3	2.3	2.6
54945	35.5	119.6	37	22	SLP	736	0	0.5	-3.3	3.3
					MSLP	736	0	0.5	0.1	0.5
56946	23.6	99.4	1104	1396	SLP	736	0	0.6	-4.1	4.1
					MSLP	736	0	1.7	0.8	1.9
56951	24.0	100.2	1503	1839	SLP	734	0	0.6	-13.0	13.0
					MSLP	734	0	2.0	1.2	2.3
57731	28.0	108.3	418	727	SLP	735	100	0.1	-14.9	14.9
					MSLP	735	0	1.1	0.6	1.3

WMO IDENT	LAT (N)	LON (E)	H (m)	HM (m)	ELEM	NOBS	PGE (%)	SD	BIAS	RMS
58921	26.0	117.4	204	530	SLP	736	0	0.6	-6.4	6.4
					MSLP	736	0	0.8	0.0	0.8
59632	22.0	108.6	6	25	SLP	736	0	0.5	-5.0	5.0
					MSLP	736	0	0.5	0.1	0.5

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)

KAZAKHSTAN

35284 - Positive bias of O-G at the station level (Figures 2 and 3)

38232 - Positive bias of O-G at the station level and at the mean sea level (Figures 4 and 5)

38313 - Positive bias of O-G at the station level (Figures 7 and 8)

38318 - Negative bias of O-G at the station level (Figures 7 and 9)

UZBEKISTAN

38262 - Positive bias of O-G at the station level (Figures 4 and 6)

TAJIKISTAN

38836 - Negative bias of O-G at the station level and at the mean sea level (Figures 7 and 10)

38875 - Positive bias of O-G at the station level (Figures 7 and 11)

38944 - Negative bias of O-G at the station level and at the mean sea level (Figures 7 and 13)

TURKMENISTAN

38880 - Positive bias of O-G at the station level (Figures 4 and 12)

KUWAIT

40587 - Observed values were constant during the period. (Figure 14)

IRAN, ISLAMIC REPUBLIC OF

40877 - Negative bias of O-G at the mean sea level (Figure 15)

OMAN

41265 - Negative bias of O-G at the station level (Figures 16 and 17)

PAKISTAN

41573 - Positive bias of O-G at the station level (Figures 18 and 19)

INDIA

42056 - Negative bias of O-G at the station level (Figures 18 and 20)

42083 - Positive bias of O-G at the station level (Figures 18 and 21)

42111 - Positive bias of O-G at the station level (Figures 18 and 22)

42114 - Negative bias of O-G at the station level (Figures 18 and 23)

42147 - Positive bias of O-G at the station level (Figures 18 and 24)

42295 - Positive bias of O-G at the station level and at 850 hPa (Figures 25 and 26)

42299 - Positive bias of O-G at 850 hPa (Figure 27)

SRI LANKA

43418 - Positive bias of O-G at the station level (Figures 28 and 29)

43479 - Negative bias of O-G at the station level (Figures 28 and 30)

NEPAL

44406 - Positive bias of O-G at the station level (Figures 31 and 32)

44424 - Negative bias of O-G at the station level and at 700 hPa (Figures 31 and 33)

44429 - Negative bias of O-G at the station level (Figures 31 and 34)

KOREA, DEMOCRATIC PEOPLE'S REPUBLIC OF

47037 - Negative bias of O-G at the station level and at the mean sea level (Figures 35 and 36)

KOREA, REPUBLIC OF

47102 - Positive bias of O-G at the station level (Figures 35 and 37)

47145 - Negative bias of O-G at the station level (Figures 35 and 38)

47152 - Negative bias of O-G at the station level (Figures 35 and 39)

REPUBLIC OF THE UNION OF MYANMAR

48001 - Positive bias of O-G at the station level (Figures 40 and 41)

48018 - Positive bias of O-G at the station level (Figures 40 and 42)

48062 - Positive bias of O-G at the station level (Figures 40 and 43)

48085 - Positive bias of O-G at the station level (Figures 44 and 45)

48107 - Negative bias of O-G at the station level (Figures 44 and 46)

LAO PEOPLE'S DEMOCRATIC REPUBLIC

48921 - Negative bias of O-G at the station level and at 850 hPa (Figures 47 and 48)

48935 - Negative bias of O-G at 850 hPa from the middle of October 2021 (Figure 49)

48952 - Positive bias of O-G at the station level (Figures 50 and 51)

CHINA

54945 - Negative bias of O-G at the station level (Figures 35 and 52)

56946 - Negative bias of O-G at the station level (Figures 47 and 53)

56951 - Negative bias of O-G at the station level (Figures 47 and 54)

57731 - Negative bias of O-G at the station level (Figures 55 and 56)

58921 - Negative bias of O-G at the station level (Figures 57 and 58)

59632 - Negative bias of O-G at the station level (Figures 59 and 60)

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
35615	47.6	53.3	-21	-20	SLP	703	0	0.6	0.2	0.6
					MSLP	703	0	0.8	5.2	5.3
35701	47.2	51.0	-27	-21	SLP	469	0	0.5	0.1	0.5
					MSLP	469	0	0.6	6.3	6.3
41315	17.3	54.1	881	597	SLP	333	99	0.4	14.7	14.7
					GZ850	212	94	20.1	-67.5	70.4

KAZAKHSTAN

35615 - Positive bias of O-G at the mean sea level (Figure 61)

35701 - Positive bias of O-G at the mean sea level and the low frequency of observations from the end of October 2021 (Figure 62)

OMAN

41315 - The resumption of observations from October 2021. Positive bias of O-G at the station level and Negative bias of O-G at 850 hPa (Figures 63 and 64)

4.3 Stations improved and excluded from the previous consolidated list

IRAN, ISLAMIC REPUBLIC OF

40700 - Since the station's elevation above sea level was changed from 32 to 78 m in September 2021 in JMA's records based on OSCAR/Surface, the negative bias of O-G at the station level has improved. (Figure 65)

40713 - Since the station's elevation above sea level was changed from 1478 to 1344 m in September 2021 in JMA's records based on OSCAR/Surface, the positive bias of O-G at the station level has improved. (Figure 66)

40741 - Since the station's elevation above sea level was changed from 235 to 278 m in September 2021 in JMA's records based on OSCAR/Surface, the negative bias of O-G at the station level has improved. (Figure 67)

40854 - Since the station's elevation above sea level was changed from 940 to 1067 m in September 2021 in JMA's records based on OSCAR/Surface, the negative bias of O-G at the station level has improved. (Figure 68)

40877 - Since the station's elevation above sea level was changed from 470 to 499 m in September 2021 in JMA's records based on OSCAR/Surface, the negative bias of O-G at the station level has improved. (Figure 69)

VIET NAM

48802 - The negative bias of O-G at the station level and at 850 hPa has improved since April 2021. (Figure 70)

4.4 Stations removed from the previous consolidated list

TAJIKISTAN

38719 - Although station 38719 still displays positive biases of O-G at the station level, it was removed from the consolidated list because the biases did not exceed the threshold. (Figure 71)

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.

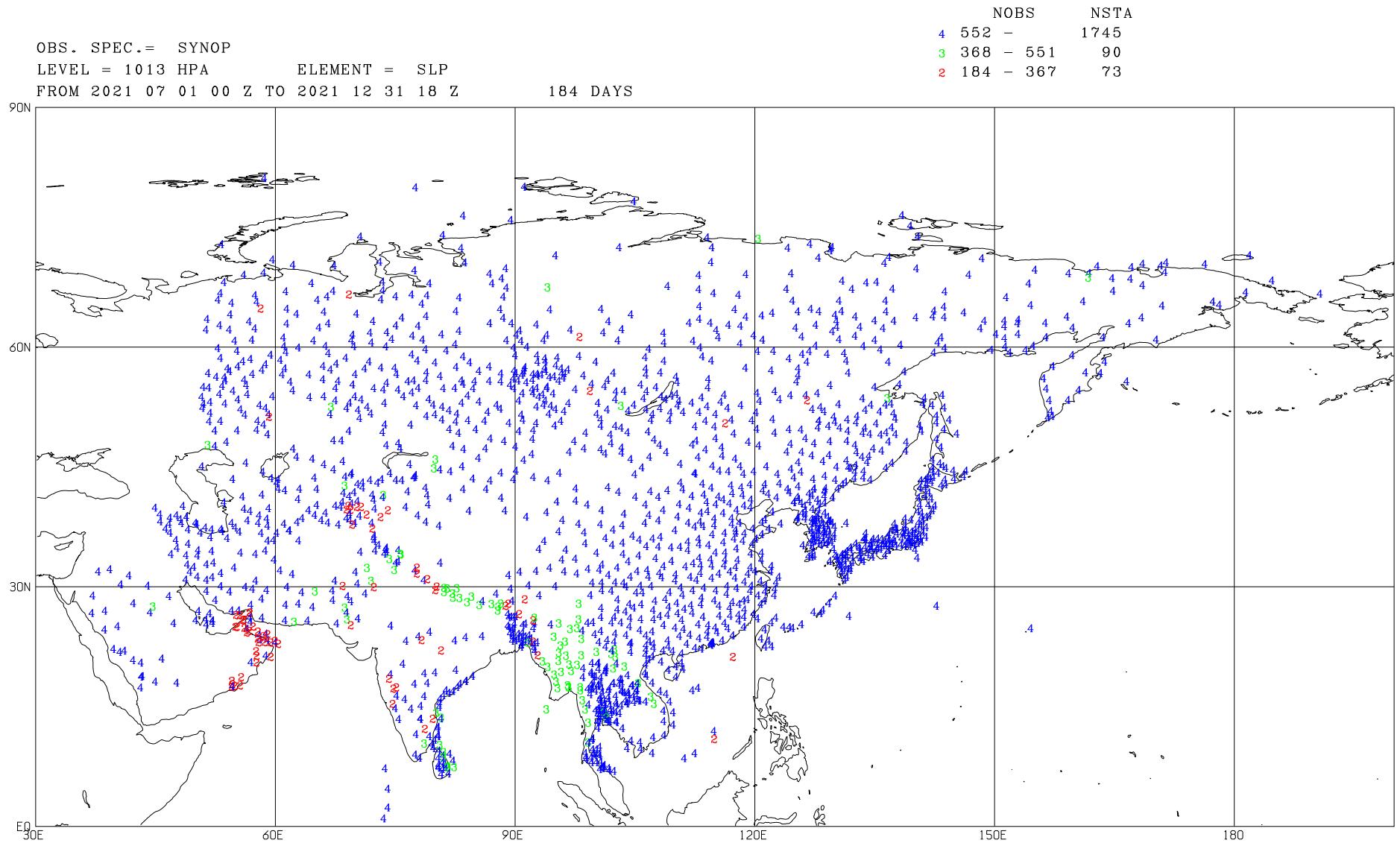


Figure 1(a) Location of all land surface stations reporting station level pressure (SLP) observations in Region II over the six-month period from July to December 2021. Numbers (2, 3, 4) show the total number of observations (NOBS) received at RSMC Tokyo. The total numbers of stations (NSTA) reporting SLP are shown at the top of the figure.

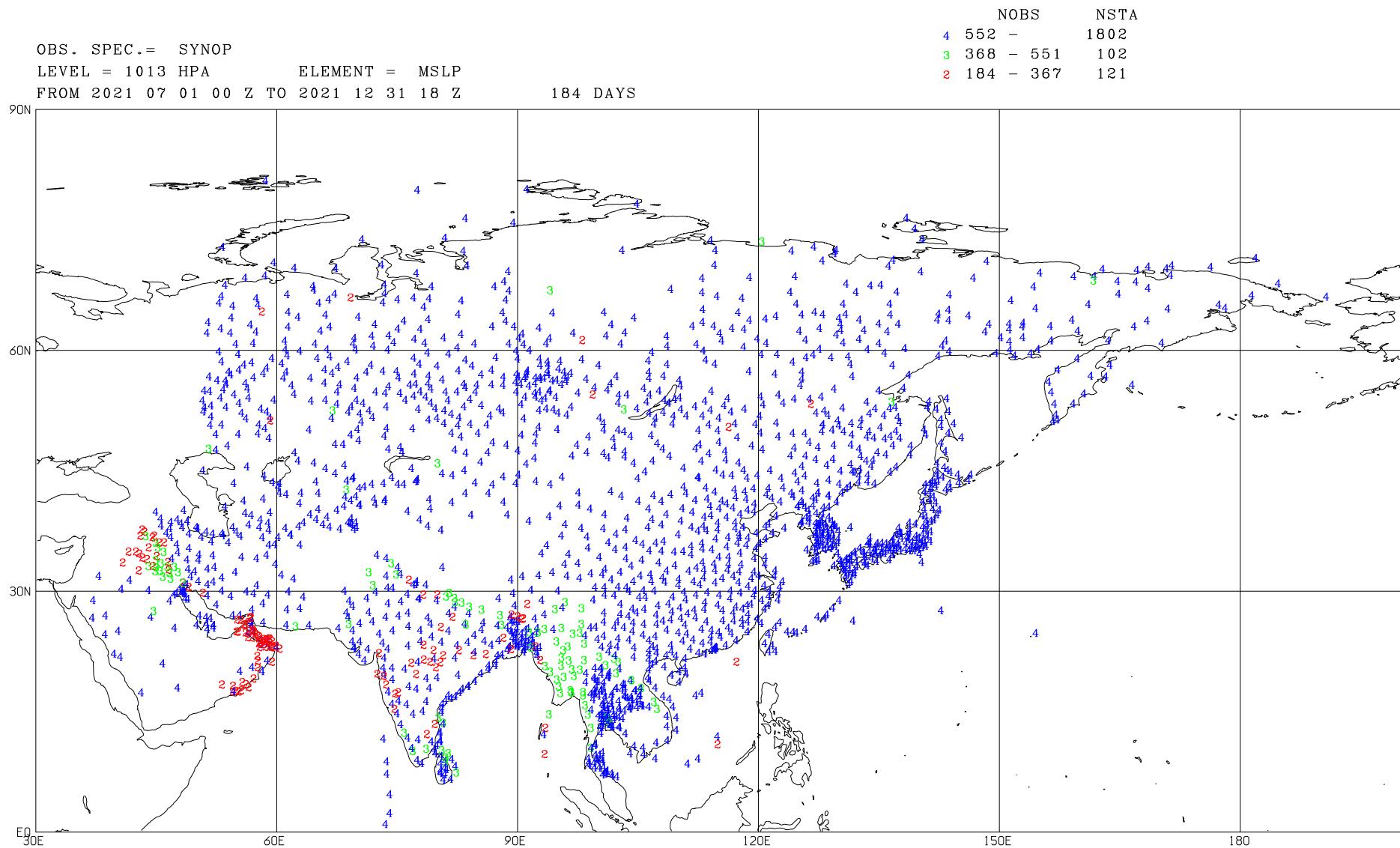


Figure 1(b) Location of all land surface stations reporting mean sea level pressure (MSLP) observations in Region II over the six-month period from July to December 2021. Numbers (2, 3, 4) show the total number of observations (NOBS) received at RSMC Tokyo. The total numbers of stations (NSTA) reporting MSLP are shown at the top of the figure.

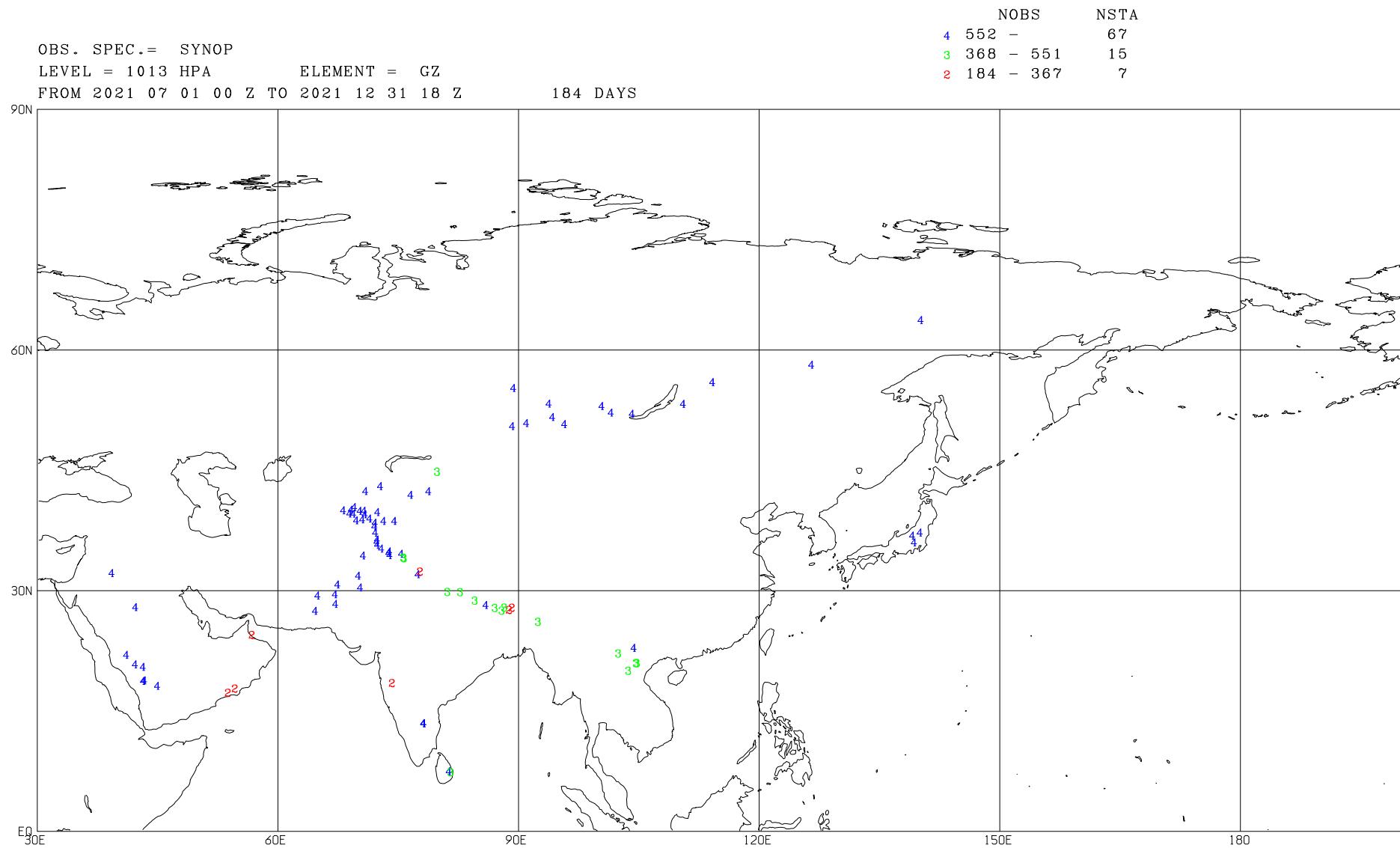
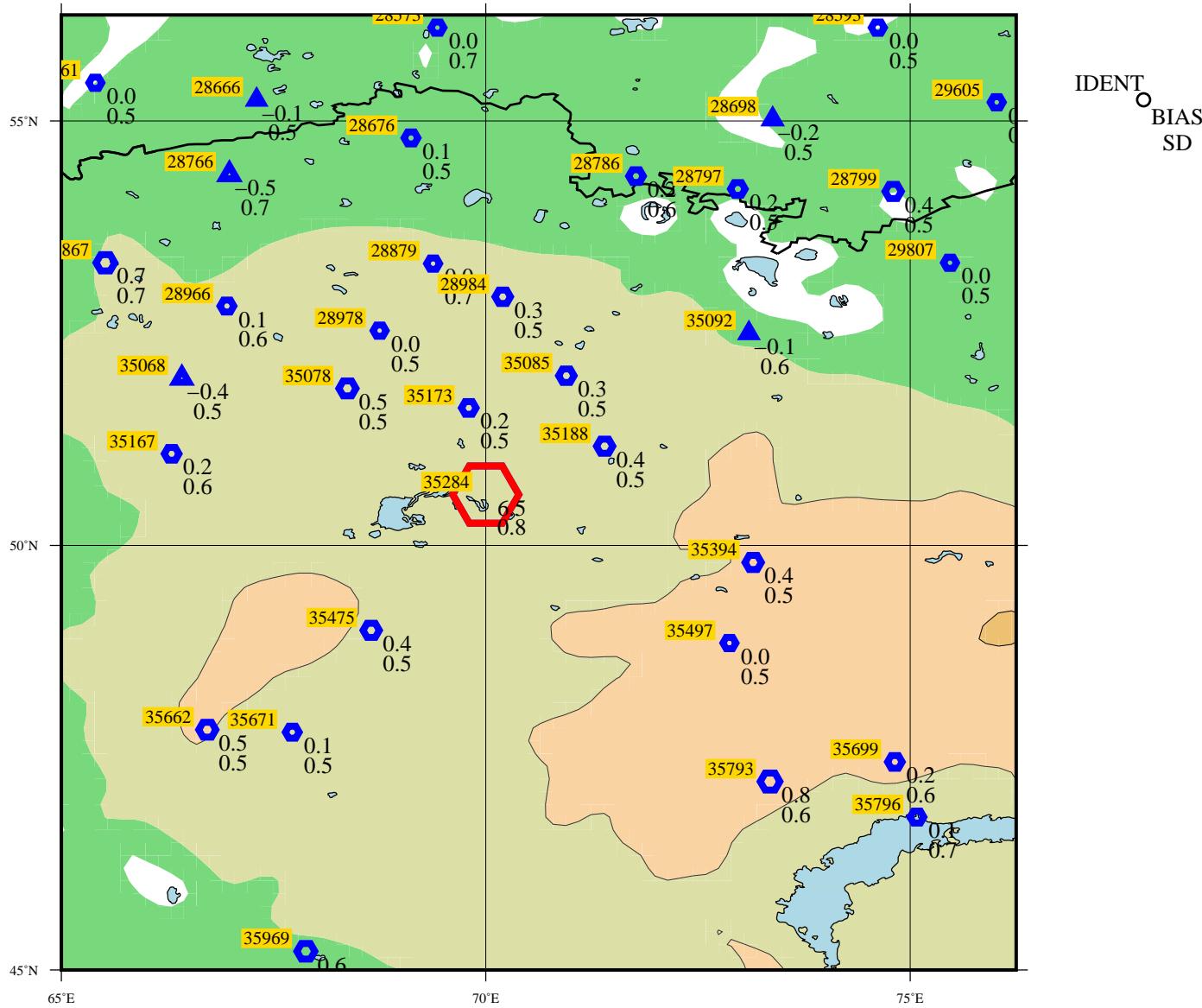


Figure 1(c) Location of all land surface stations reporting geopotential height (GZ) observations in Region II over the six-month period from July to December 2021. Numbers (2, 3, 4) show the total number of observations (NOBS) received at RSMC Tokyo. The total numbers of stations (NSTA) reporting GZ are shown at the top of the figure.

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

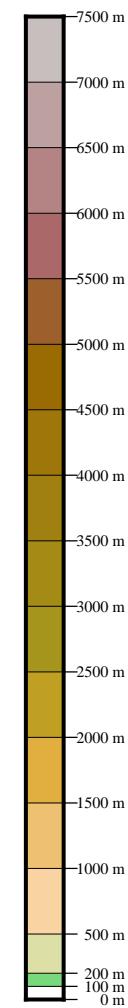


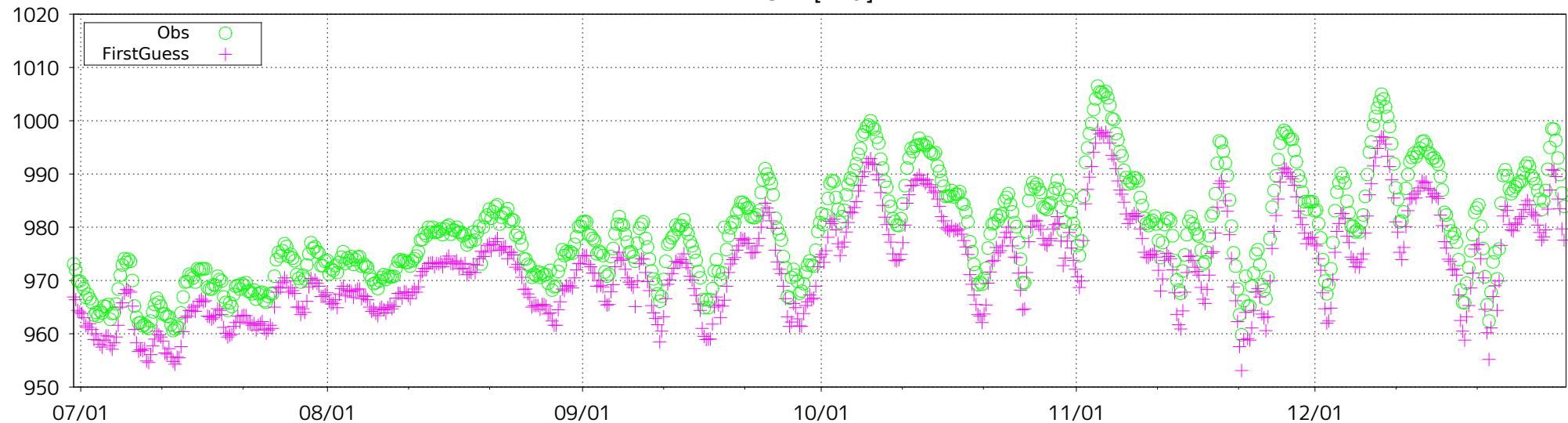
Figure 2 BIAS and SD of SLP for station 35284 (red) and surrounding stations (blue).

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)

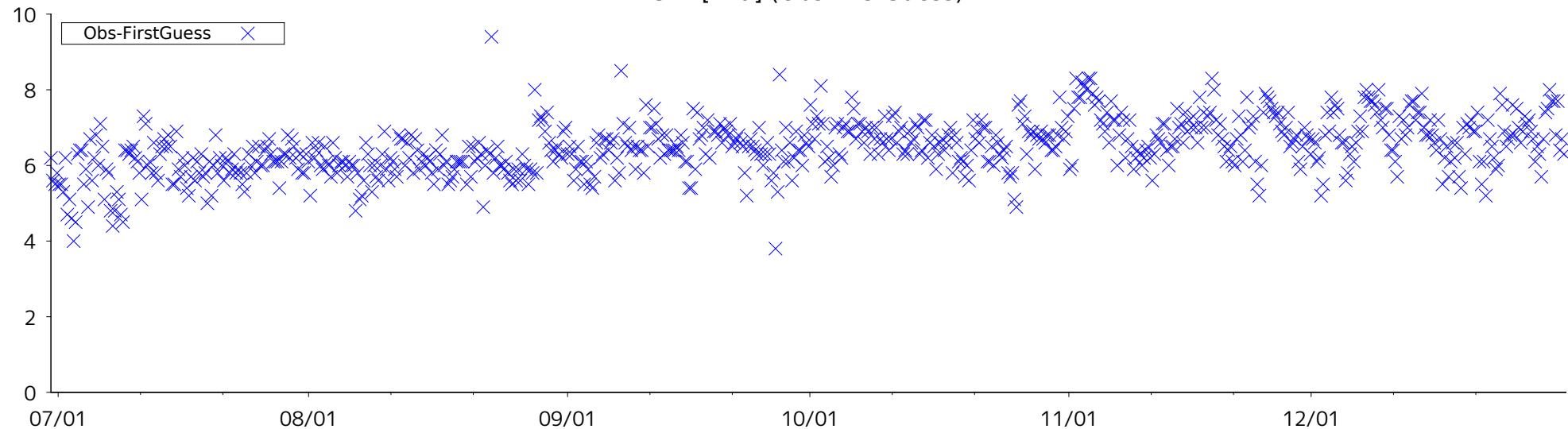
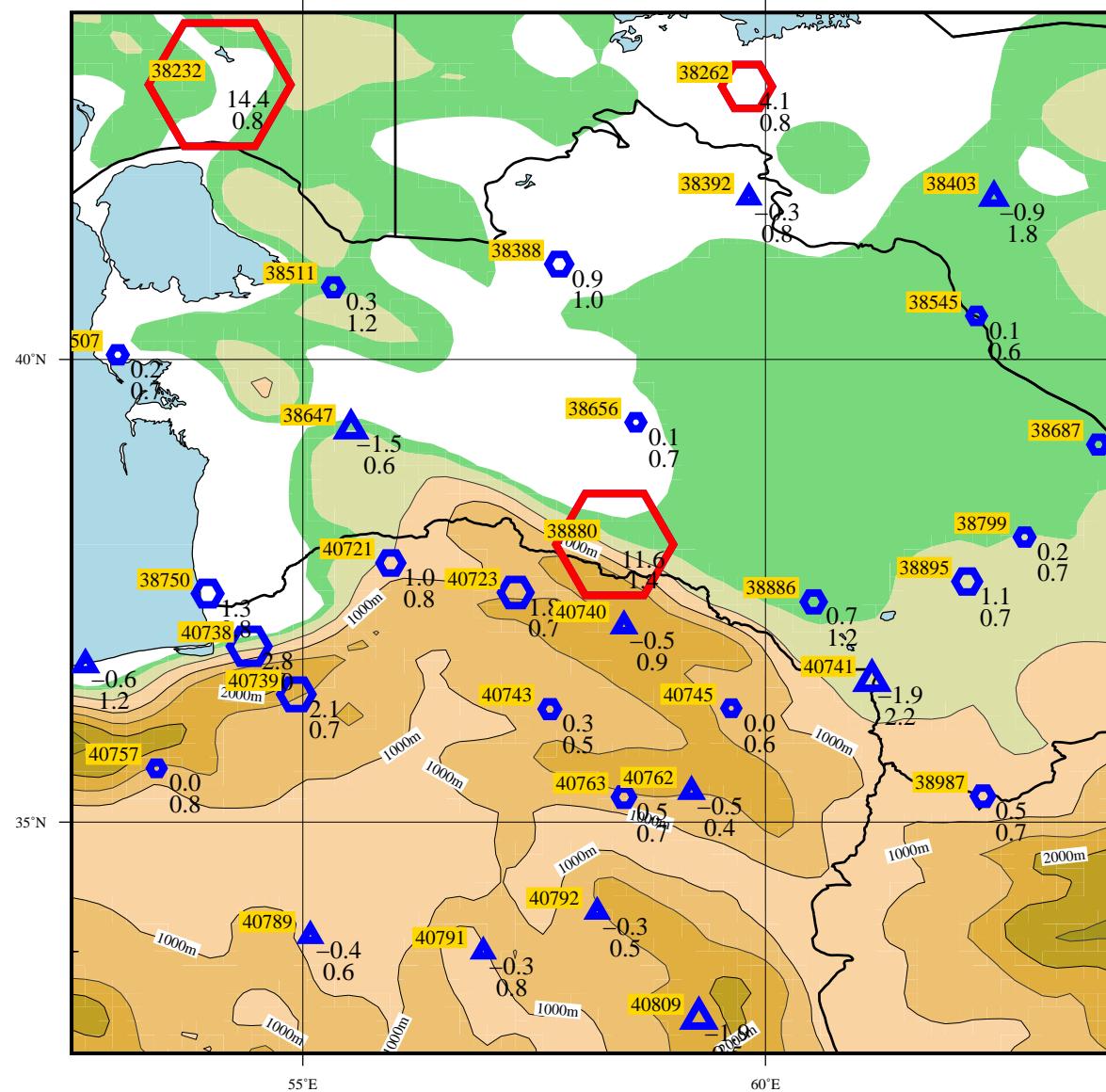


Figure 3 Time-series representation of SLP Obs minus FirstGuess for station 35284

LEVEL = SUR

ELEMENT = SLP

2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

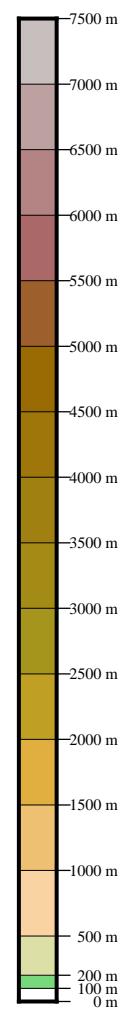


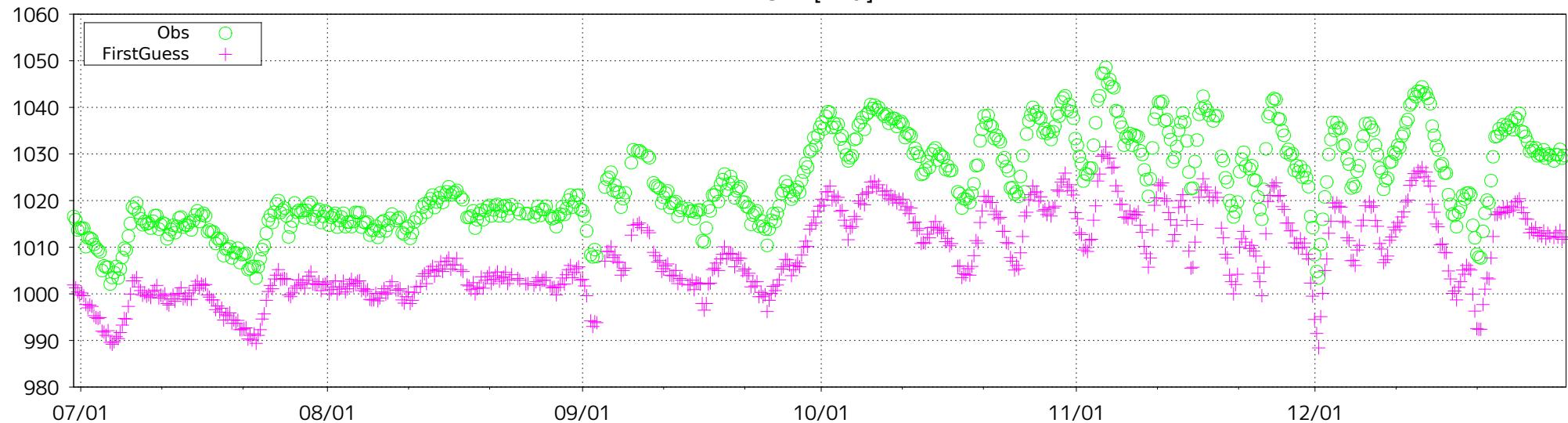
Figure 4 BIAS and SD of SLP for station 38232, 38262, 38880 (red) and surrounding stations (blue).

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: 38232 (lat: 43.0N, lon: 54.1E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

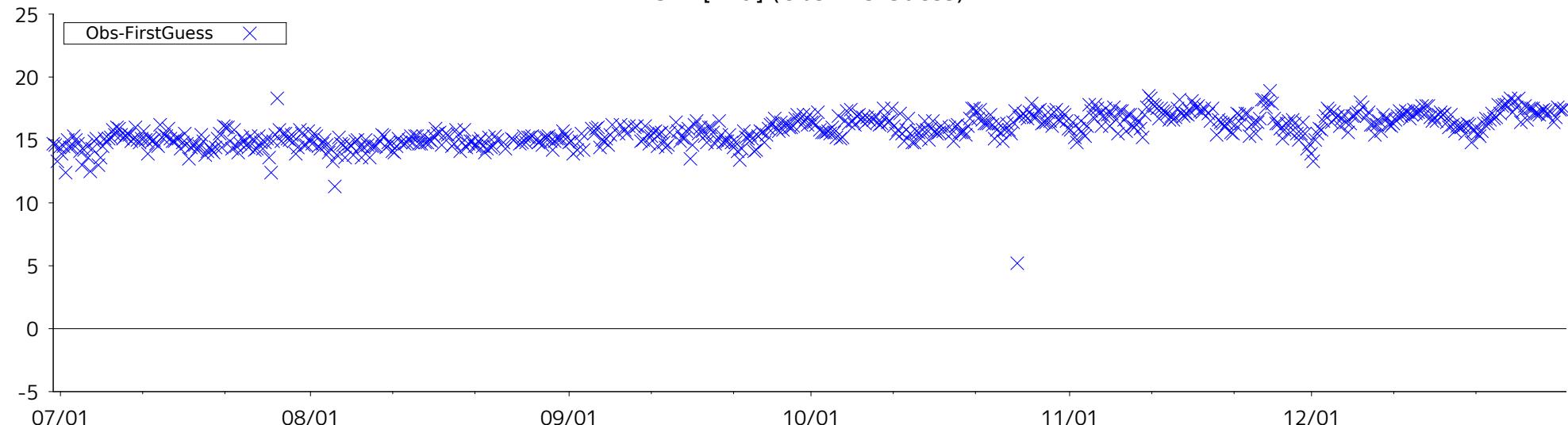
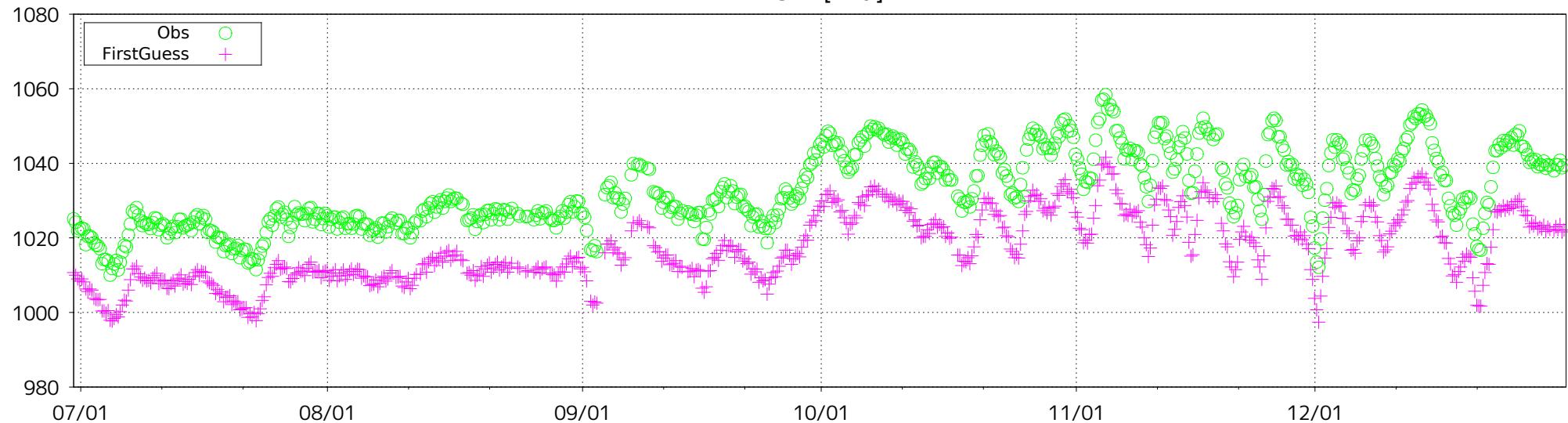


Figure 5(a) Time-series representation of SLP Obs minus FirstGuess for station 38232

ID: 38232 (lat: 43.0N, lon: 54.1E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

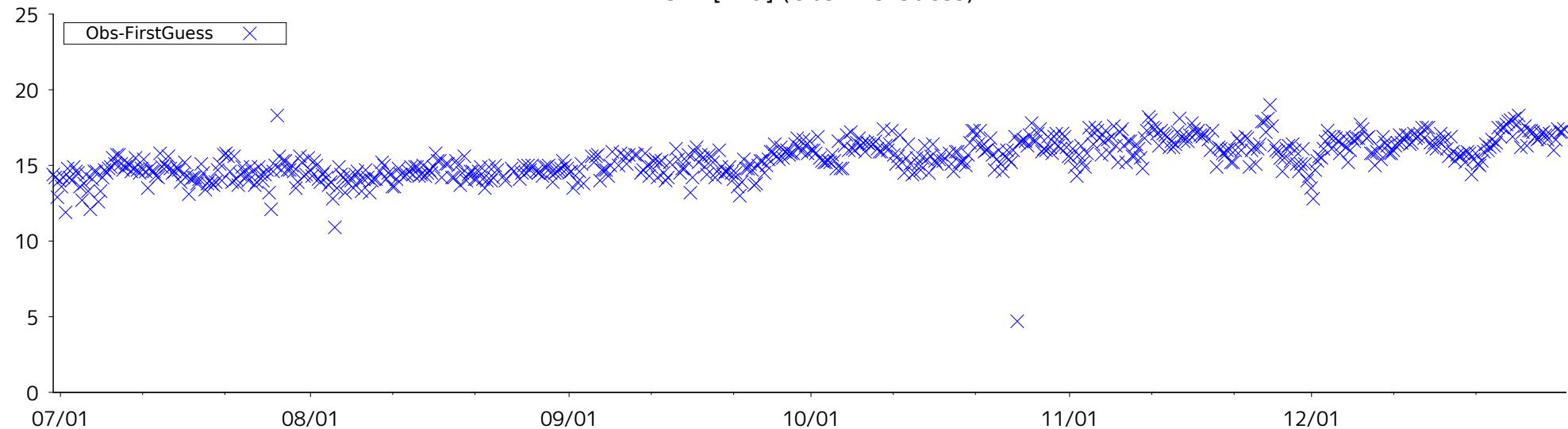
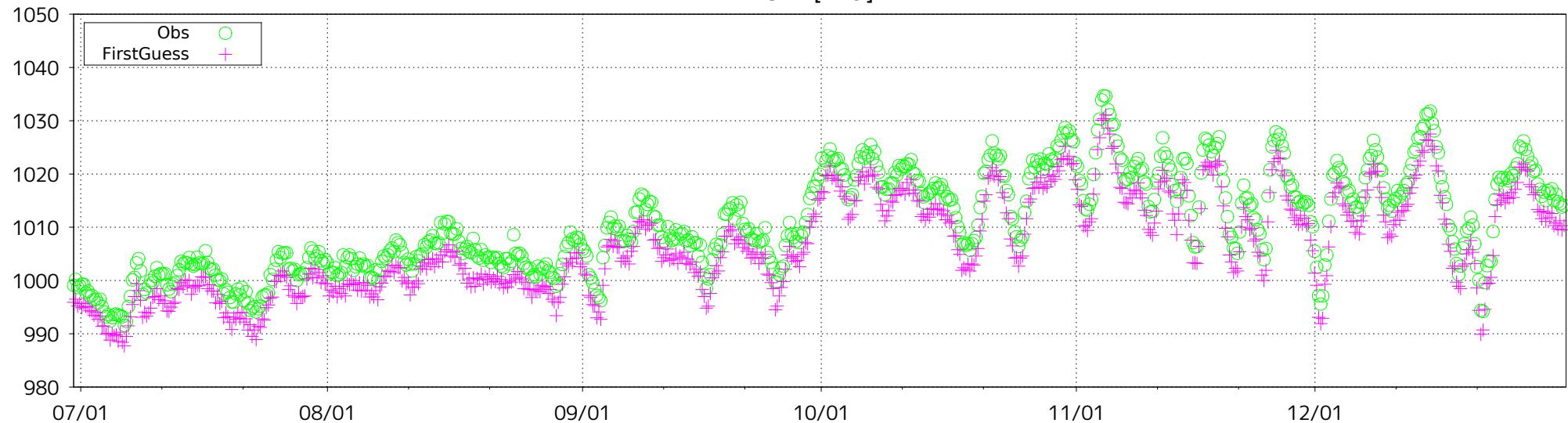


Figure 5(b) Time-series representation of MSLP Obs minus FirstGuess for station 38232

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

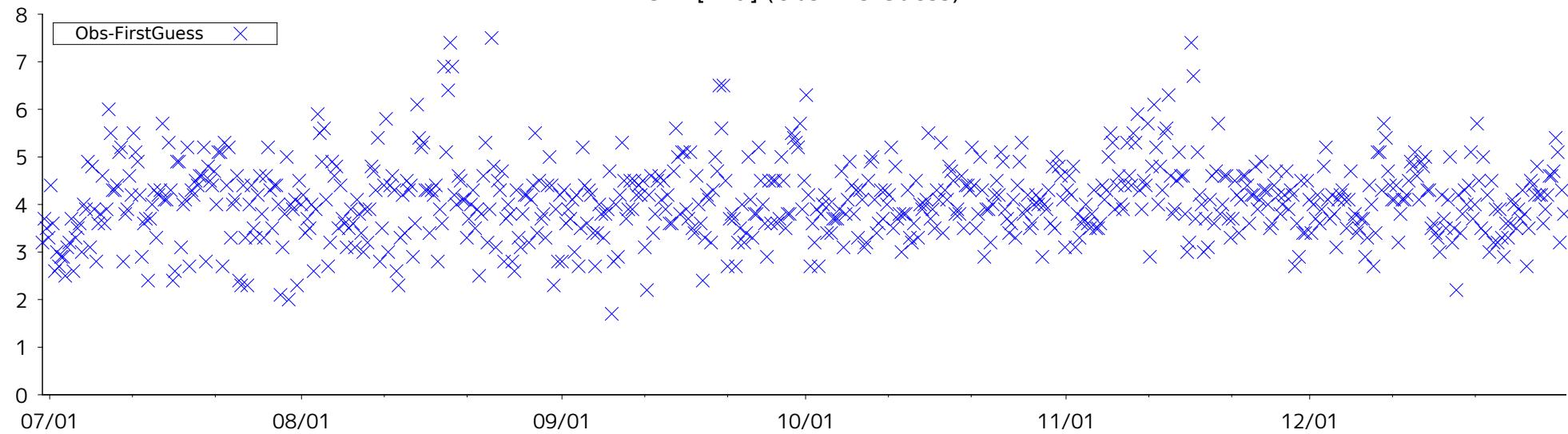


Figure 6 Time-series representation of SLP Obs minus FirstGuess for station 38262

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)

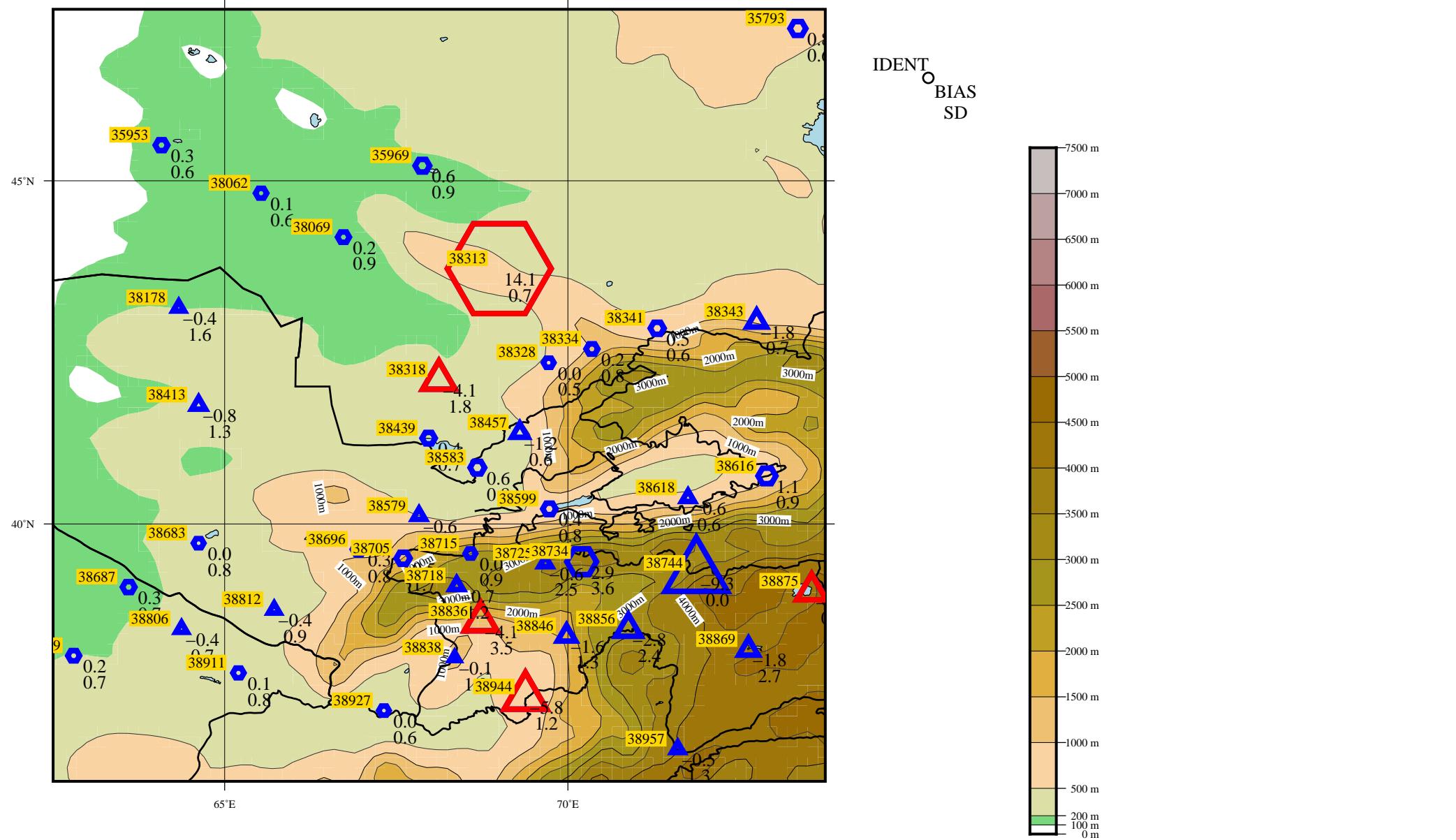


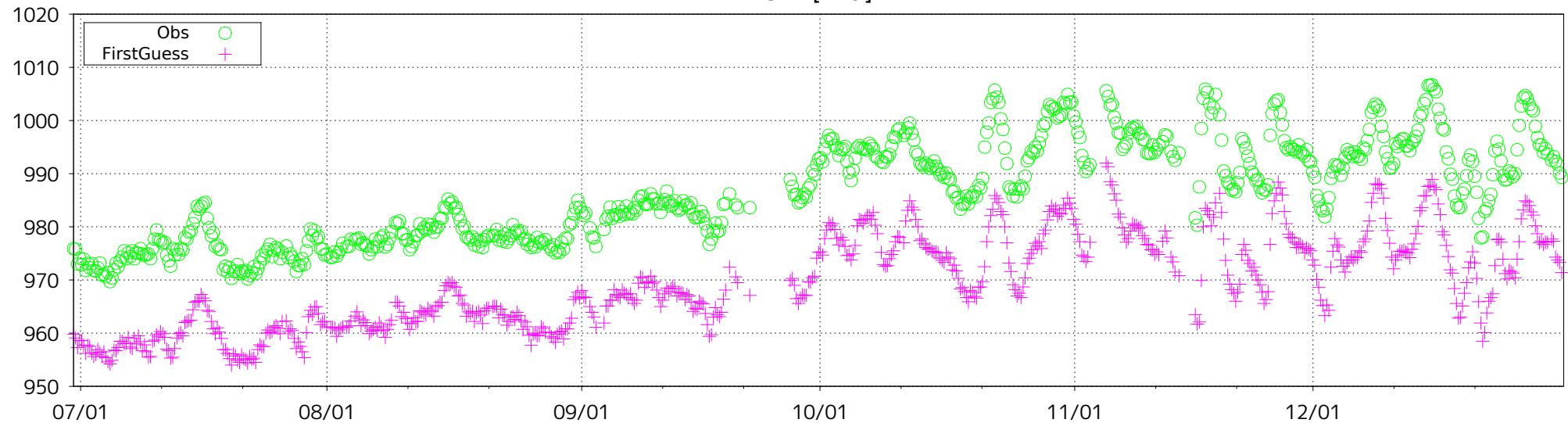
Figure 7 BIAS and SD of SLP for station 38313, 38318, 38836, 38875, 38944 (red) and surrounding stations (blue).

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)

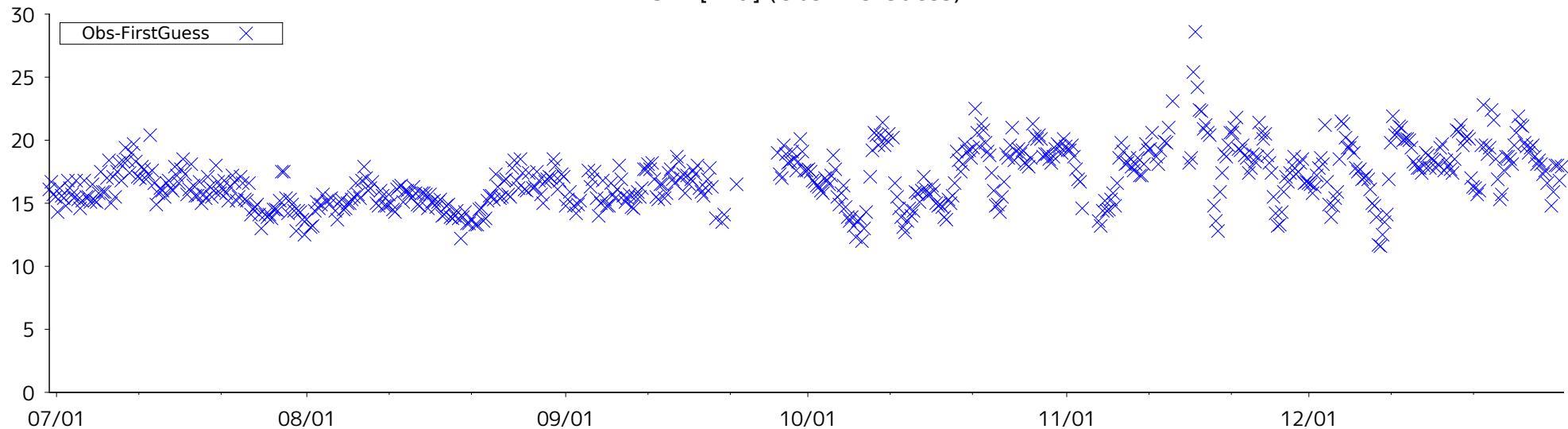
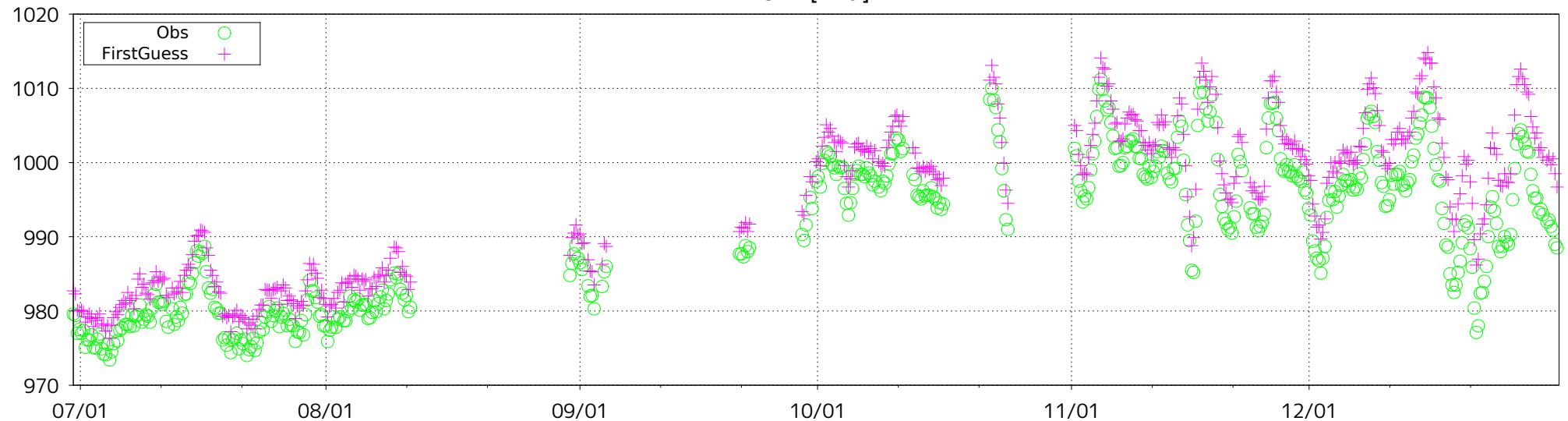


Figure 8 Time-series representation of SLP Obs minus FirstGuess for station 38313

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

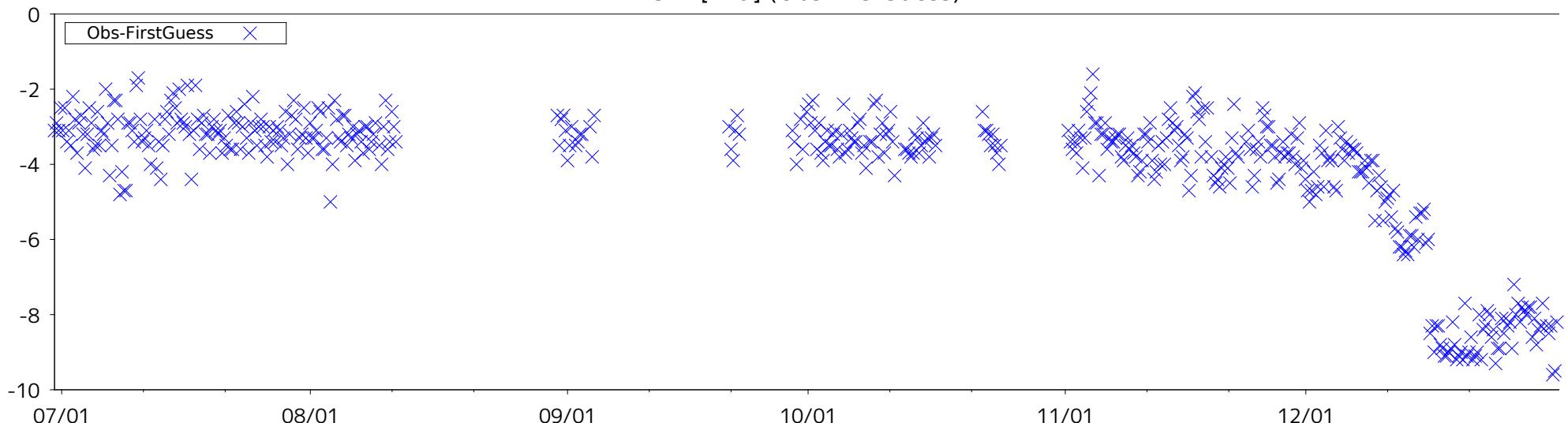
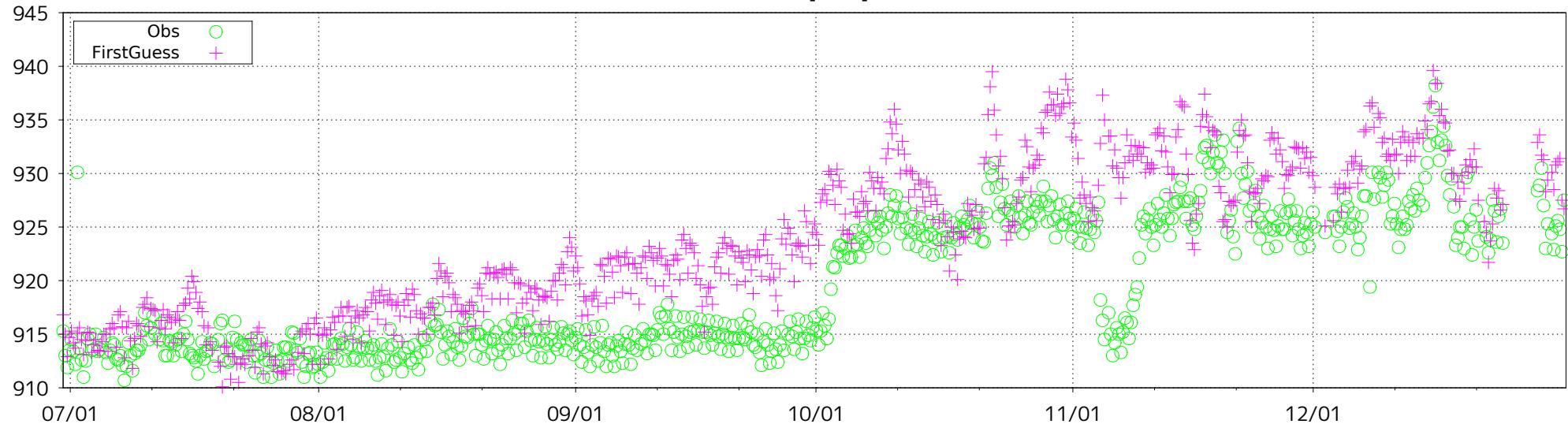


Figure 9 Time-series representation of SLP Obs minus FirstGuess for station 38318

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

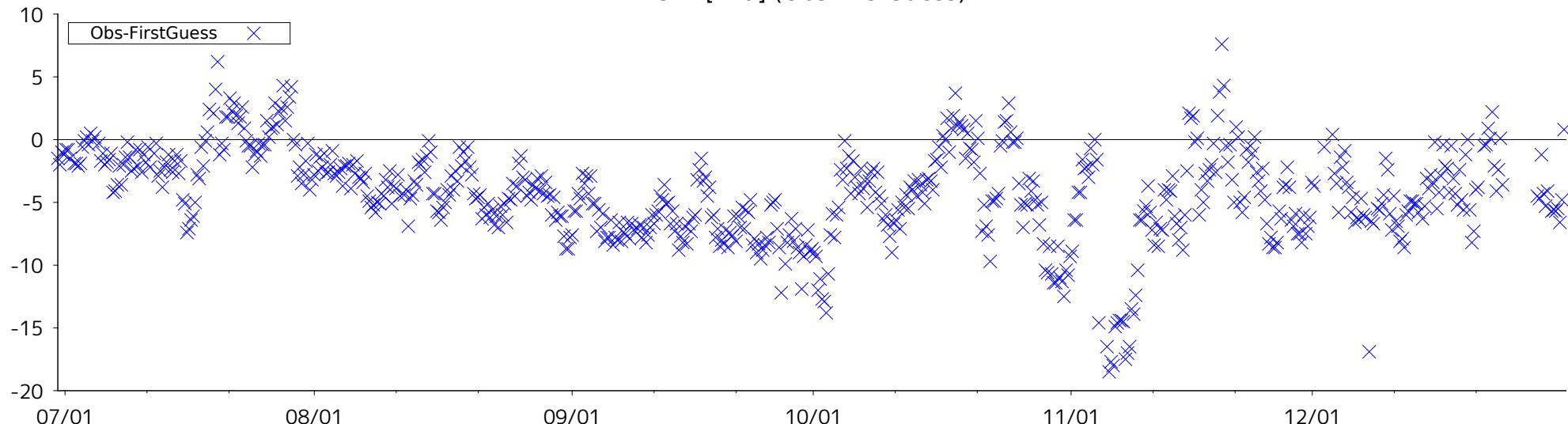
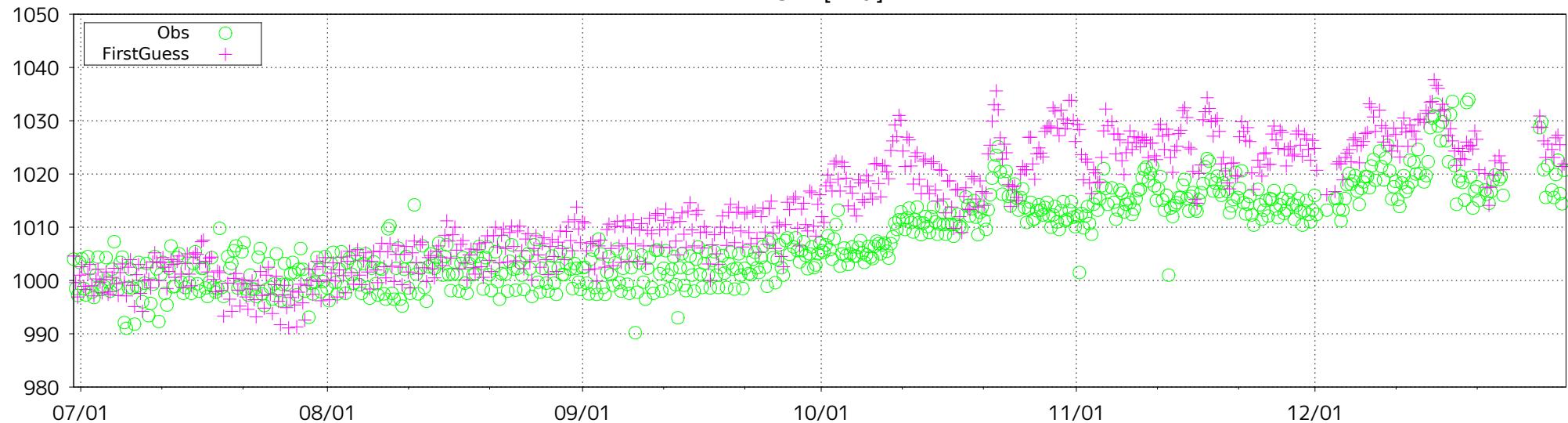


Figure 10(a) Time-series representation of SLP Obs minus FirstGuess for station 38836

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

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

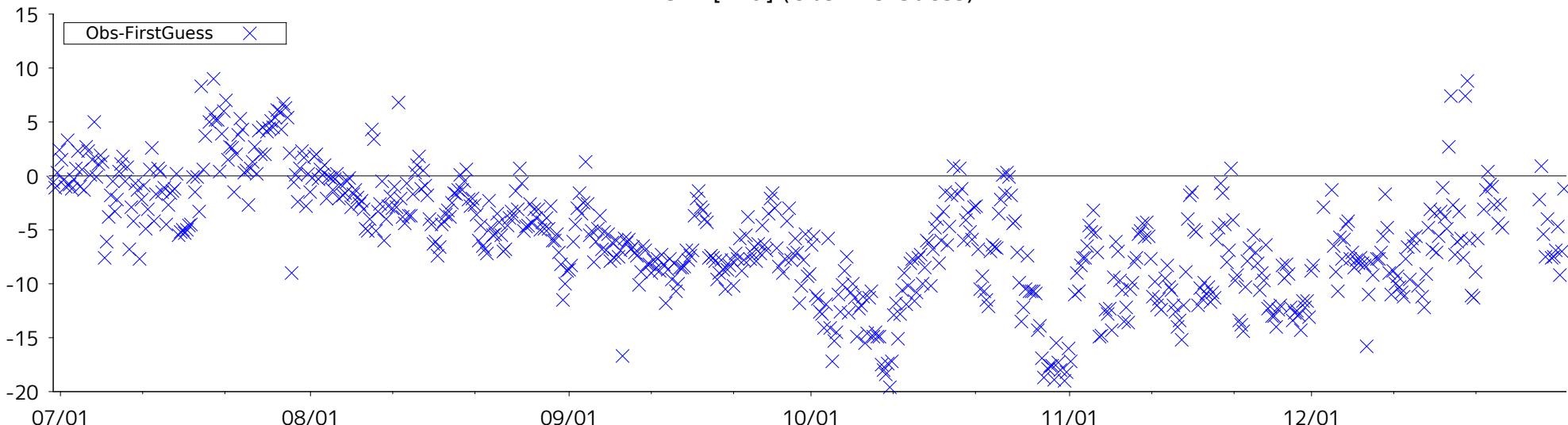
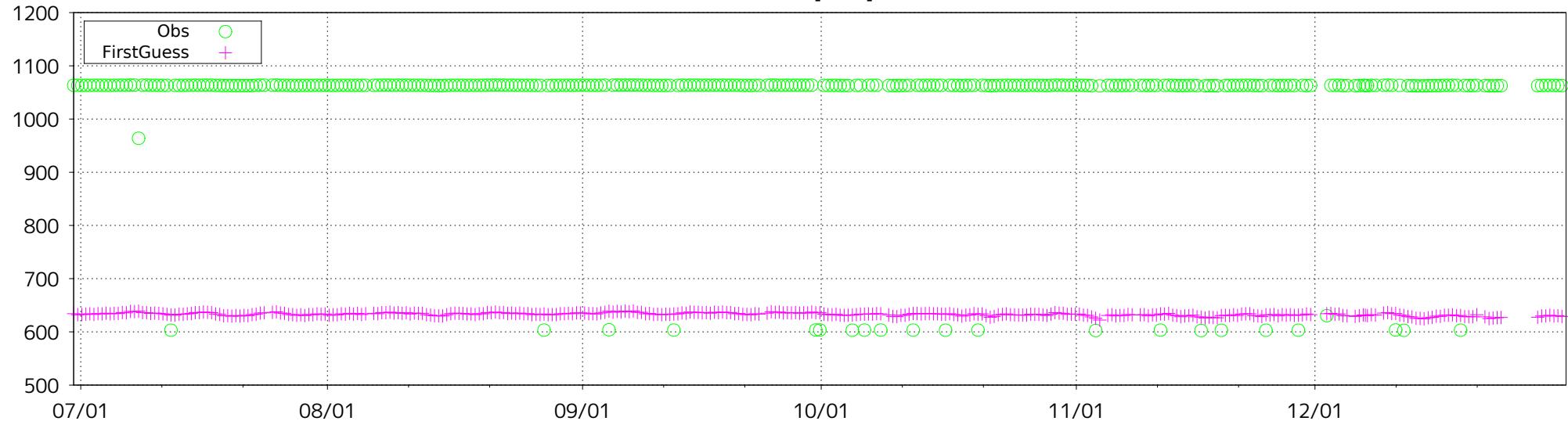


Figure 10(b) Time-series representation of MSLP Obs minus FirstGuess for station 38836

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

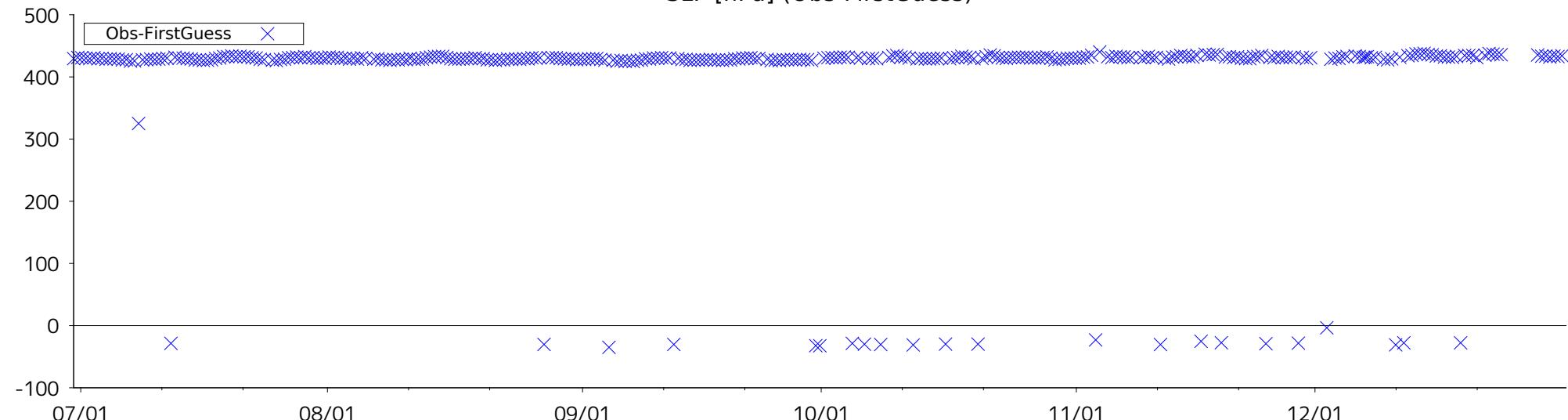
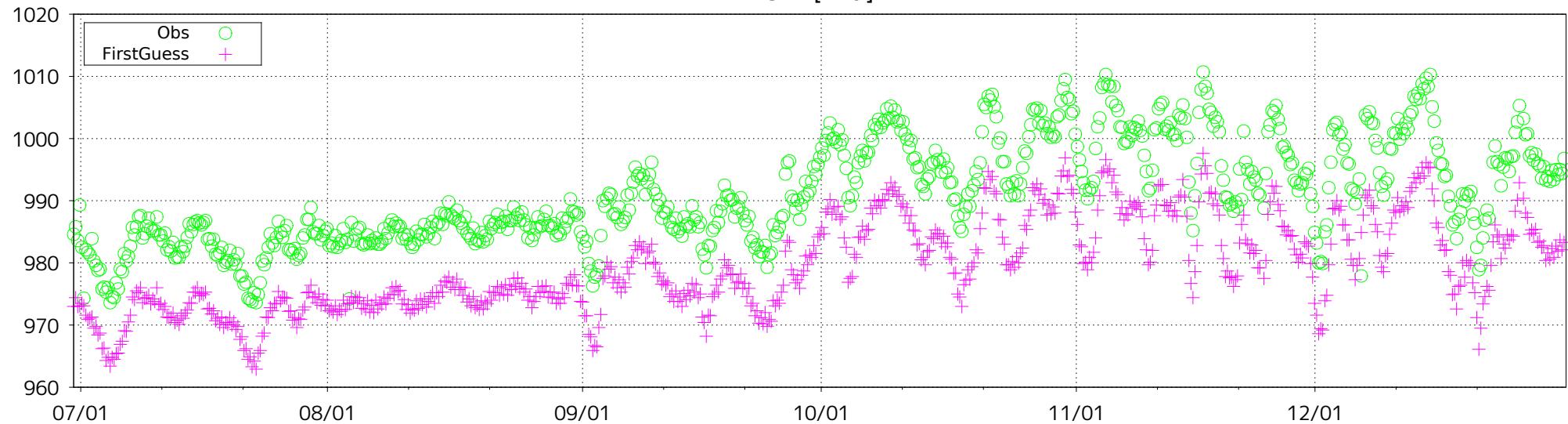


Figure 11 Time-series representation of SLP Obs minus FirstGuess for station 38875

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

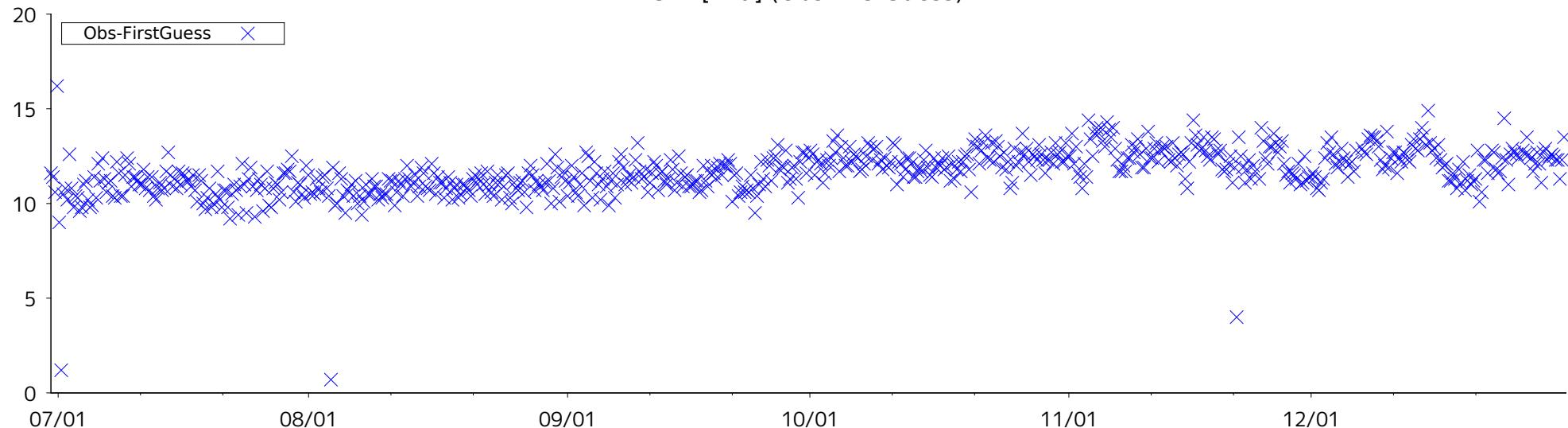
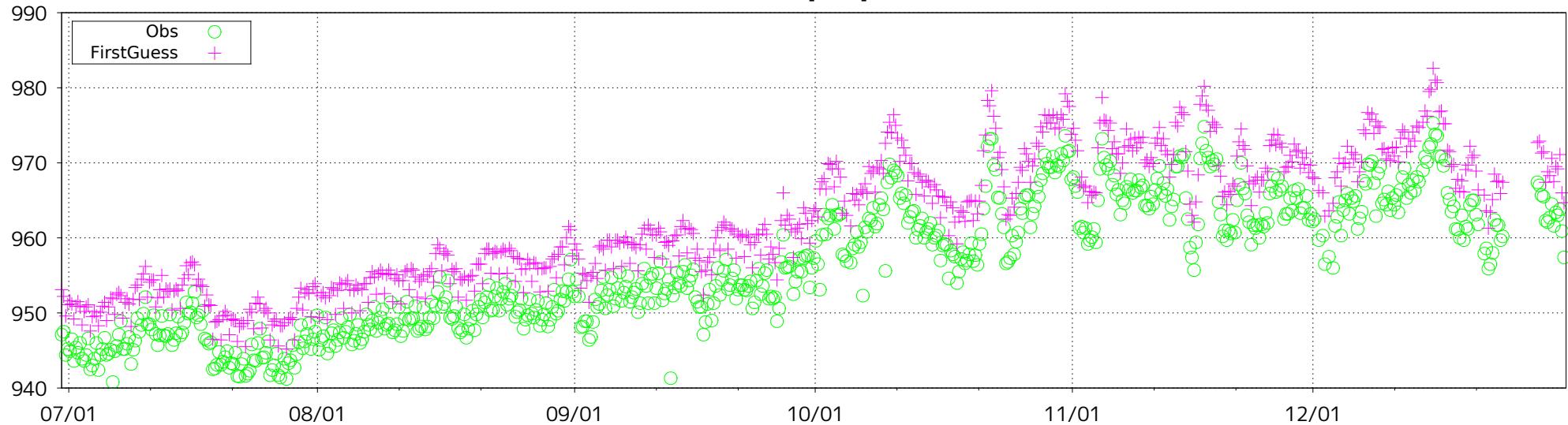


Figure 12 Time-series representation of SLP Obs minus FirstGuess for station 38880

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

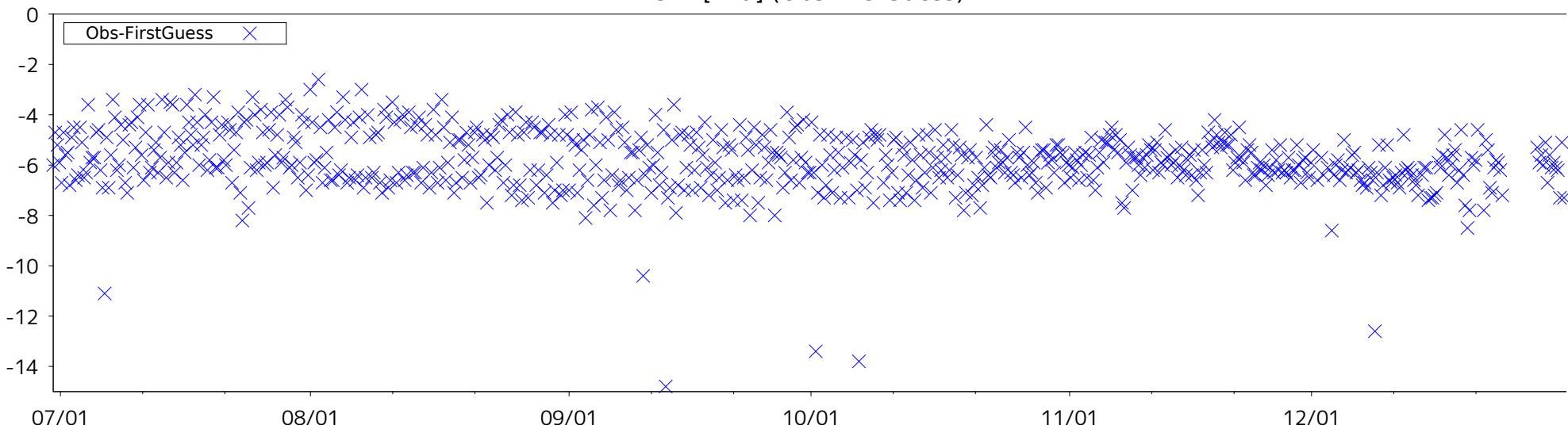
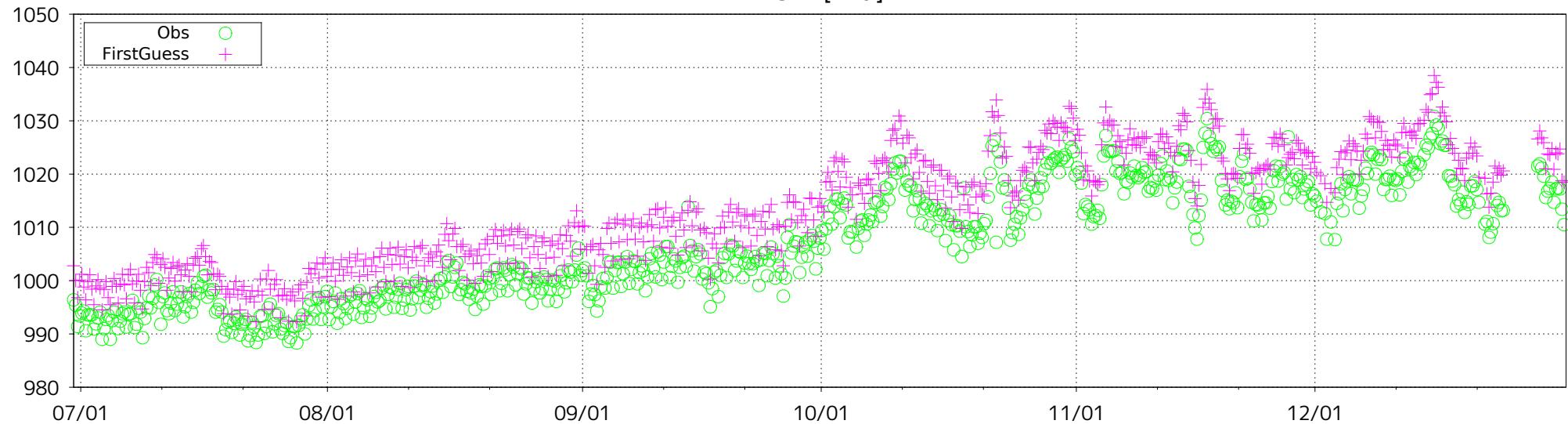


Figure 13(a) Time-series representation of SLP Obs minus FirstGuess for station 38944

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

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

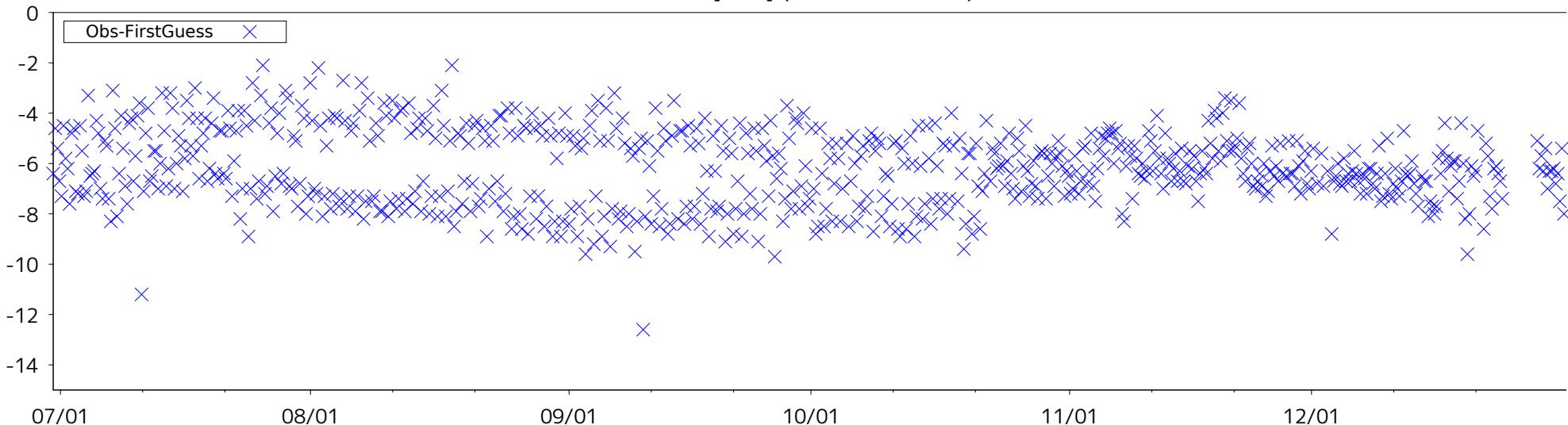
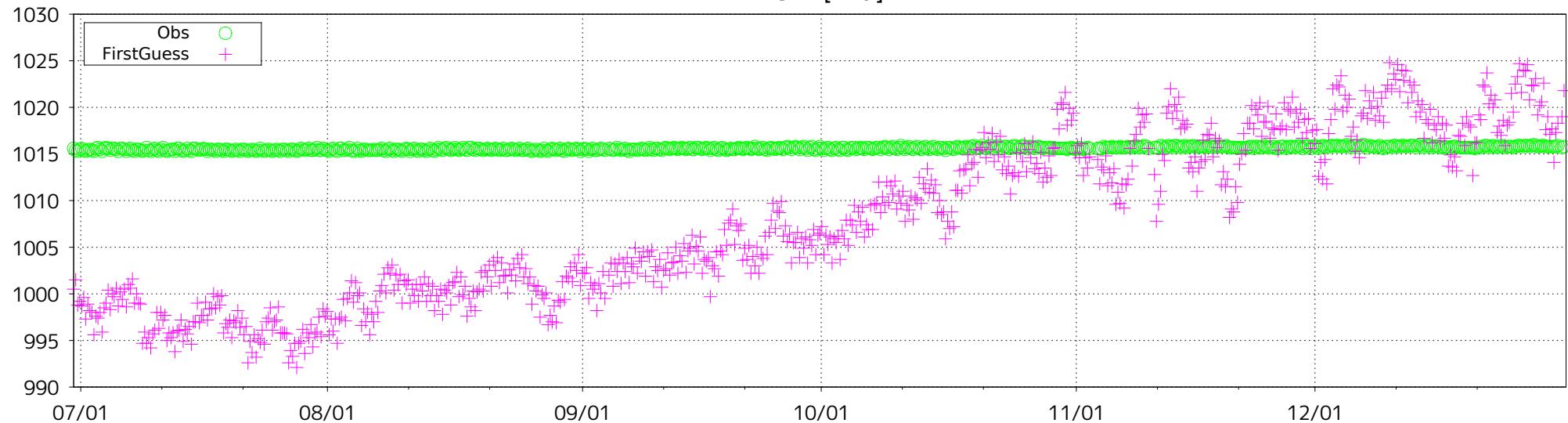


Figure 13(b) Time-series representation of MSLP Obs minus FirstGuess for station 38944

ID: 40587 (lat: 29.3N, lon: 47.7E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

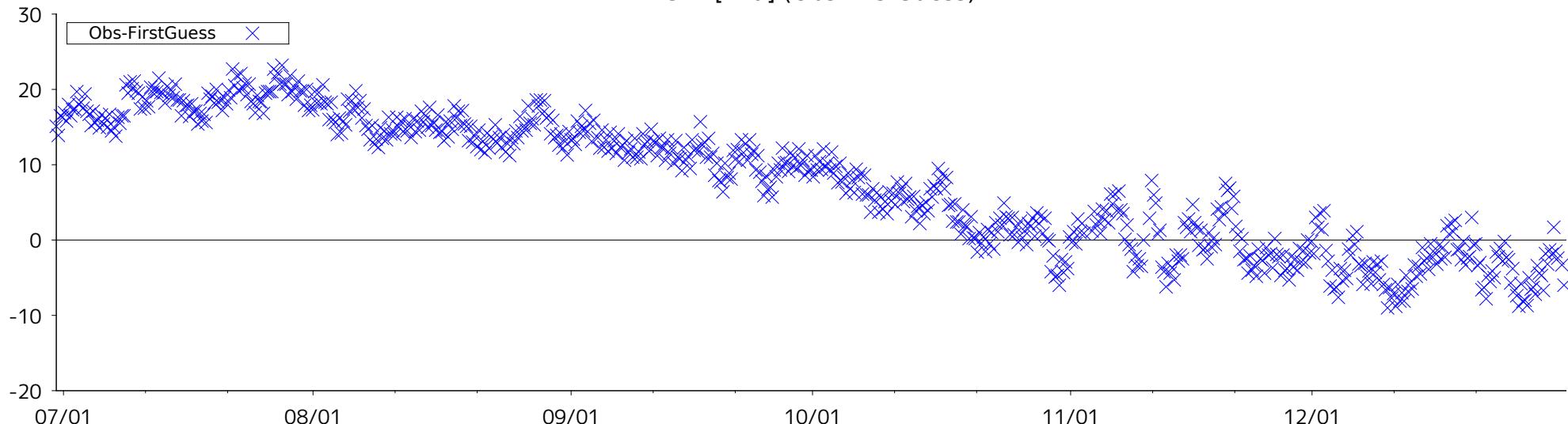
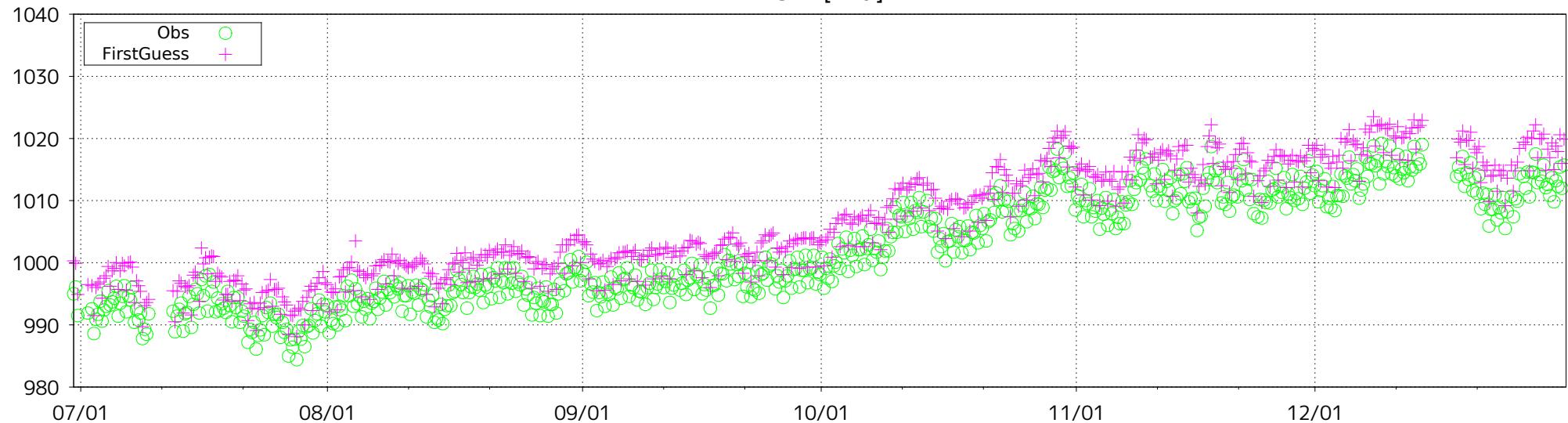


Figure 14 Time-series representation of MSLP Obs minus FirstGuess for station 40587

ID: 40877 (lat: 28.0N, lon: 57.7E)

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

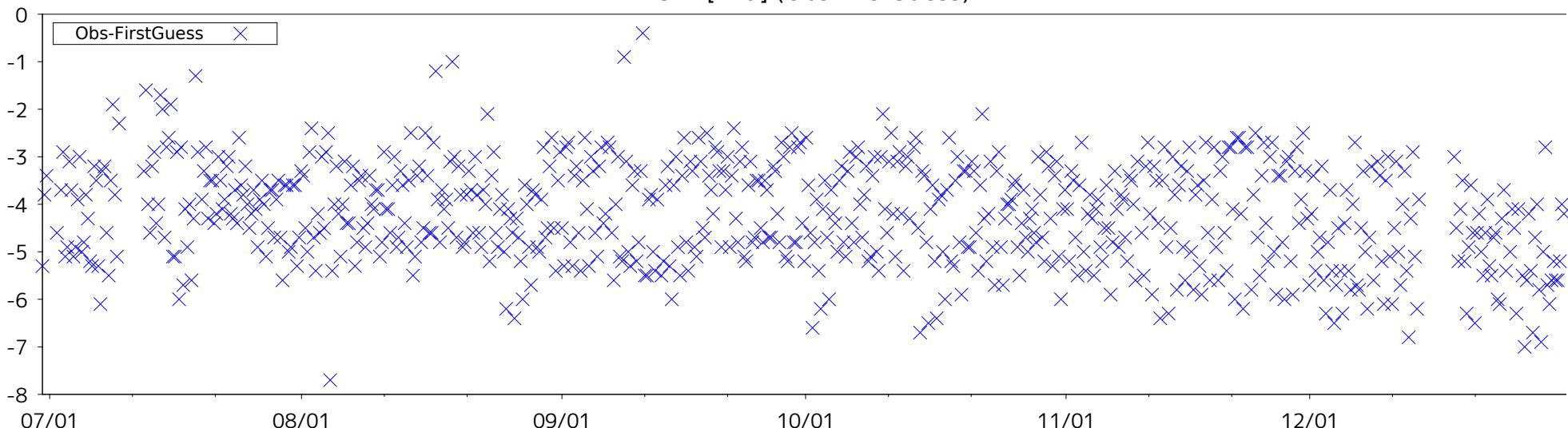
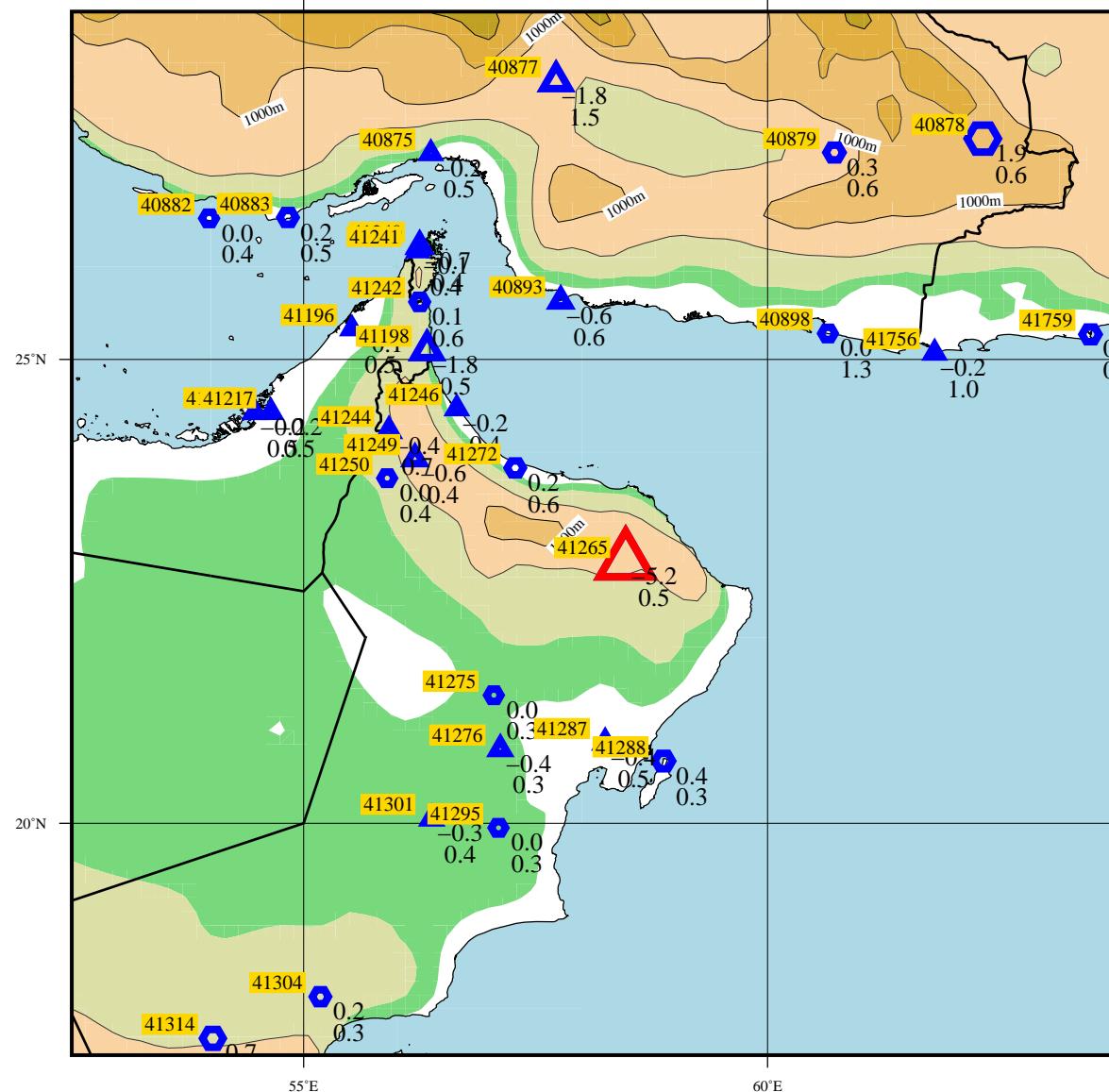


Figure 15 Time-series representation of MSLP Obs minus FirstGuess for station 40877

LEVEL = SUR

ELEMENT = SLP

2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

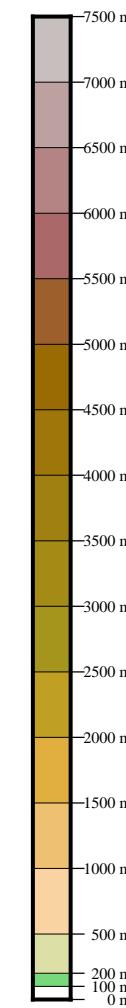


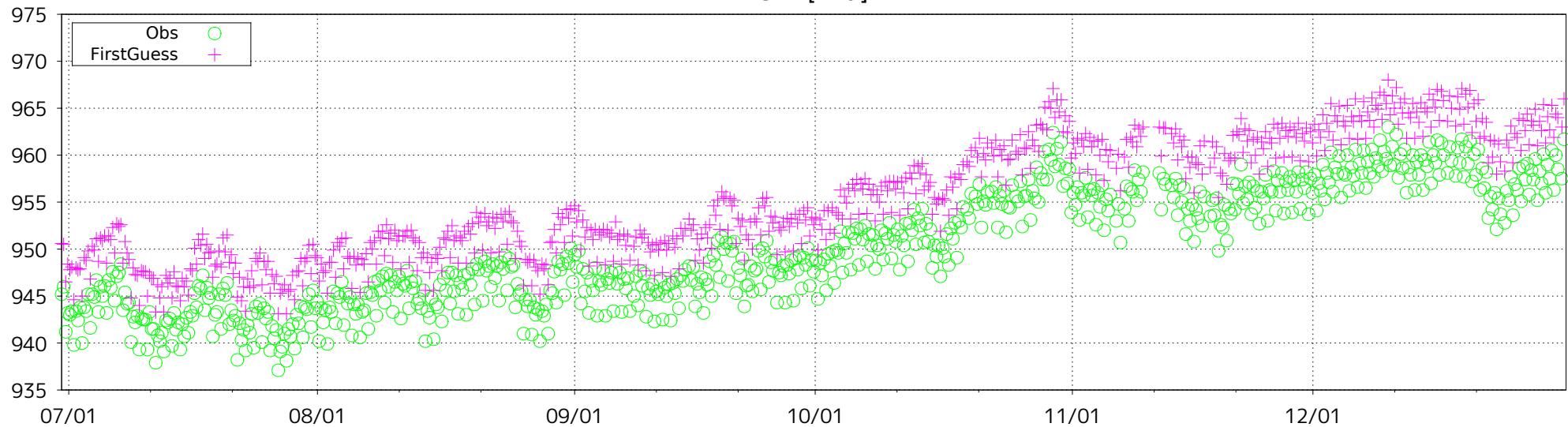
Figure 16 BIAS and SD of SLP for station 41265 (red) and surrounding stations (blue).

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)

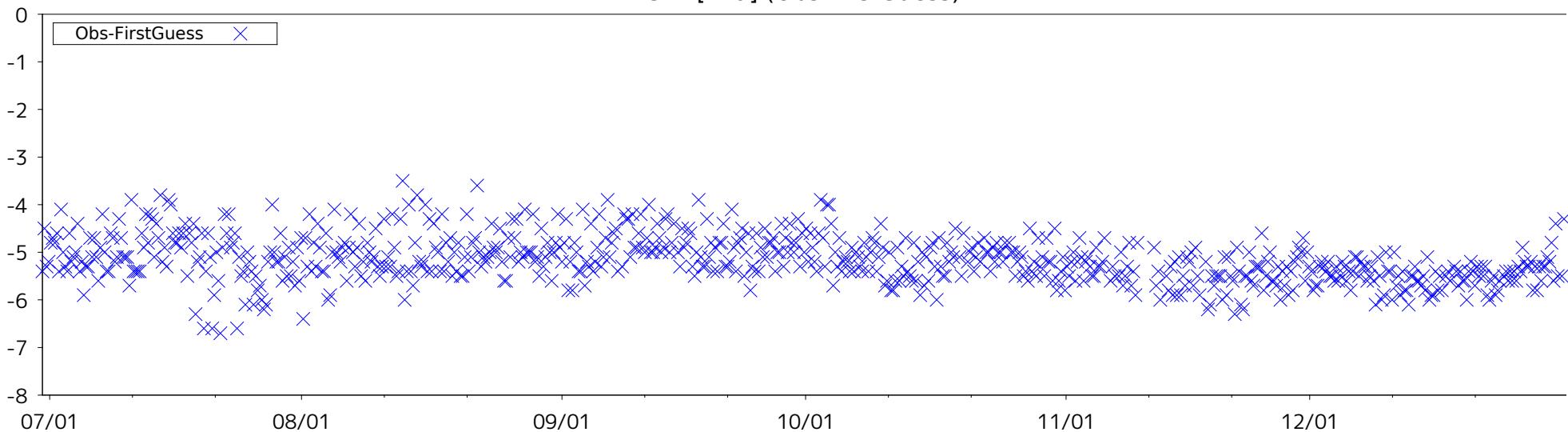
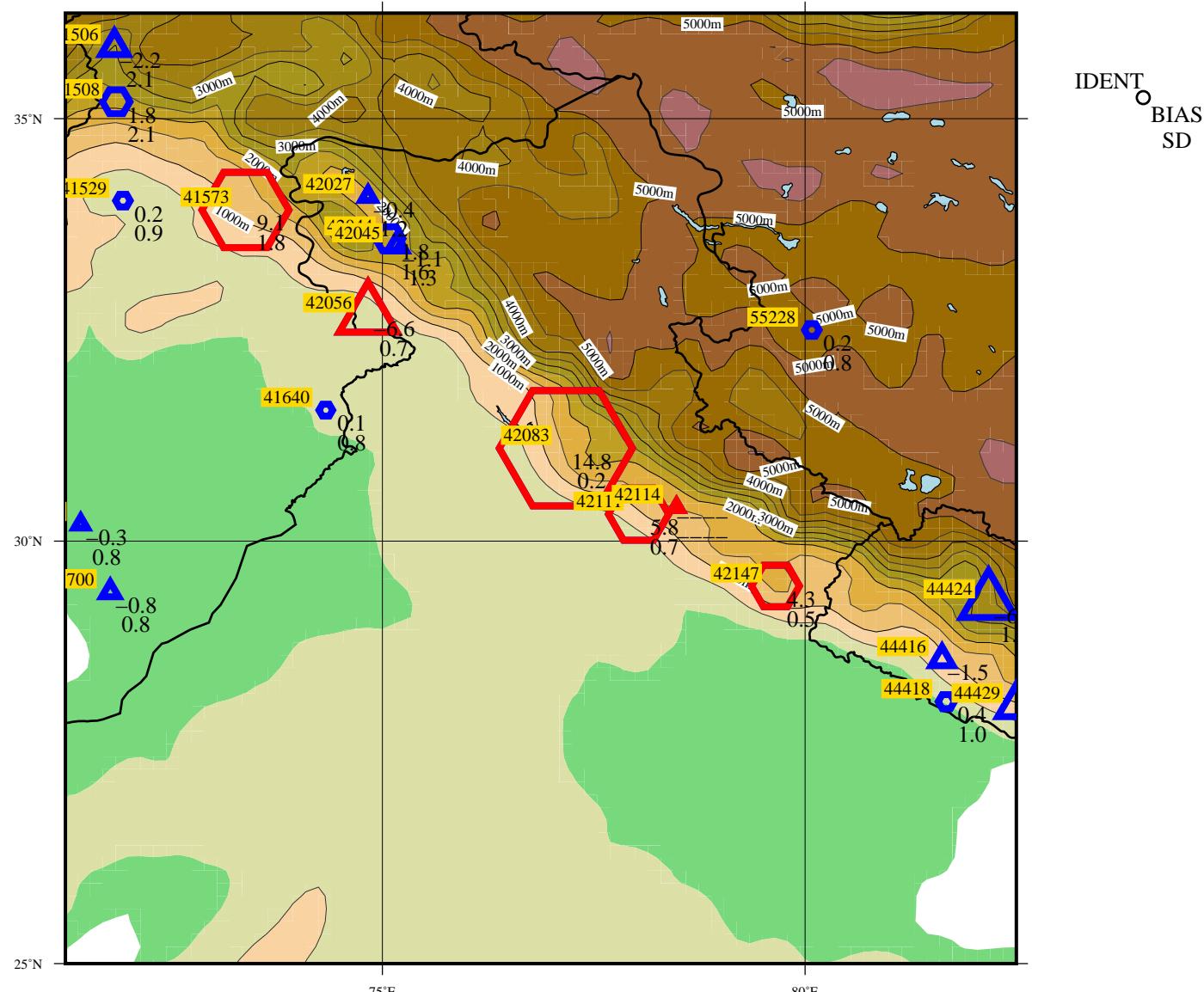


Figure 17 Time-series representation of SLP Obs minus FirstGuess for station 41265

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
O BIAS
SD

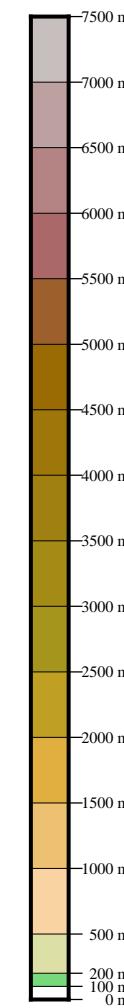


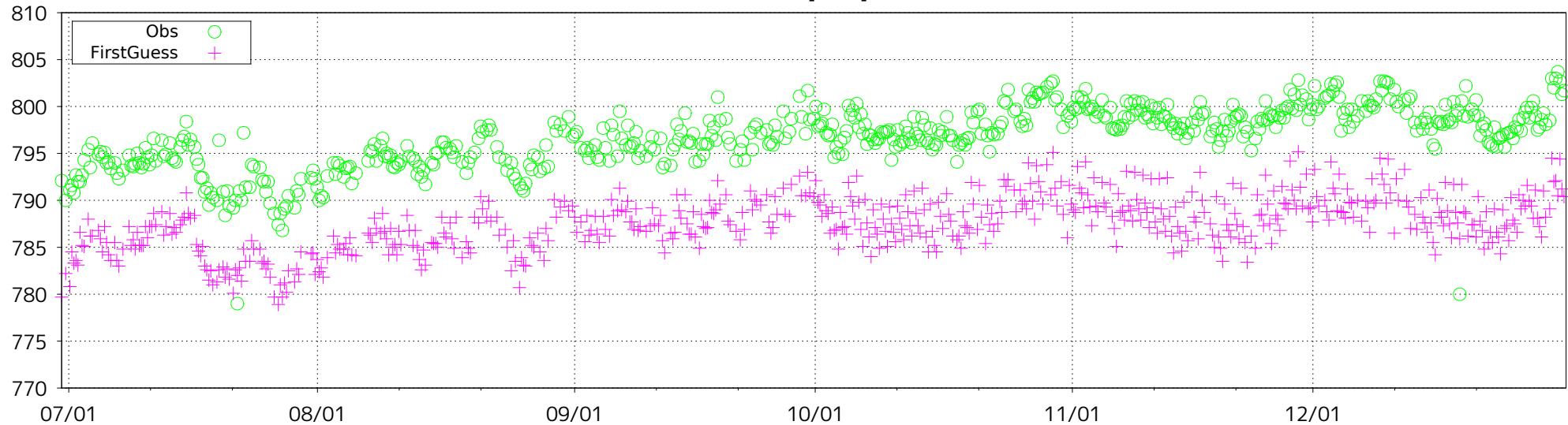
Figure 18 BIAS and SD of SLP for station 41573, 42056, 42083, 42111, 42114, 42147 (red) and surrounding stations (blue).

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)

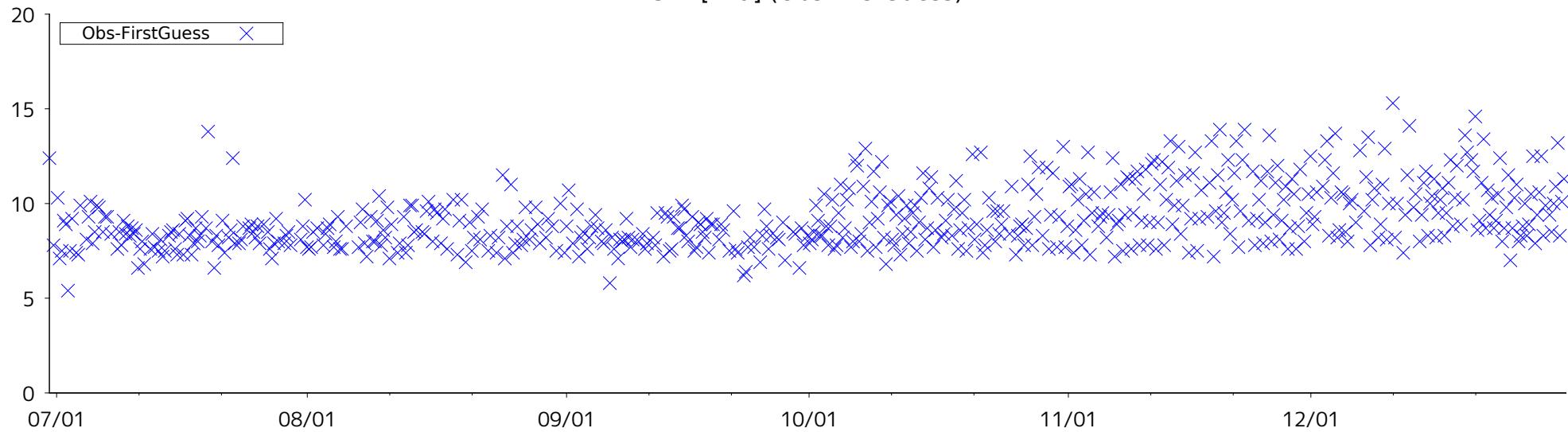
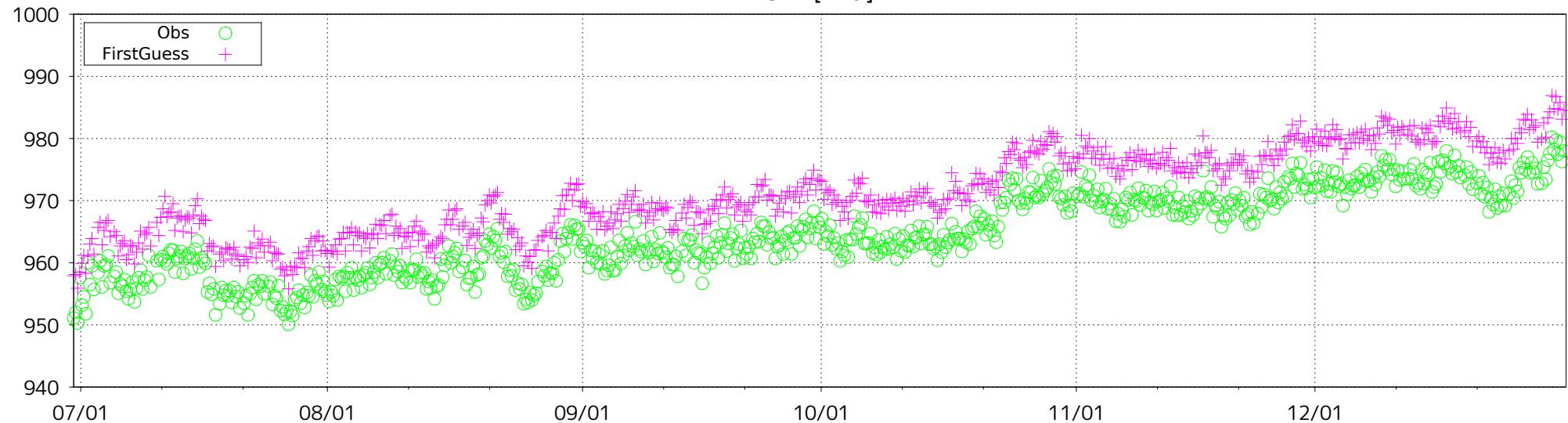


Figure 19 Time-series representation of SLP Obs minus FirstGuess for station 41573

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

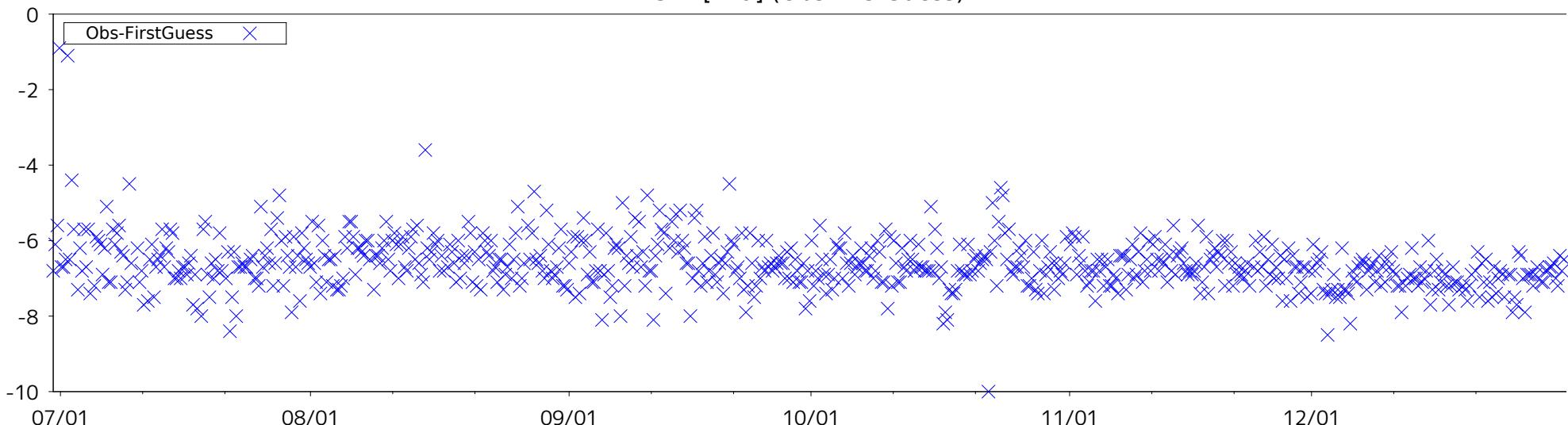
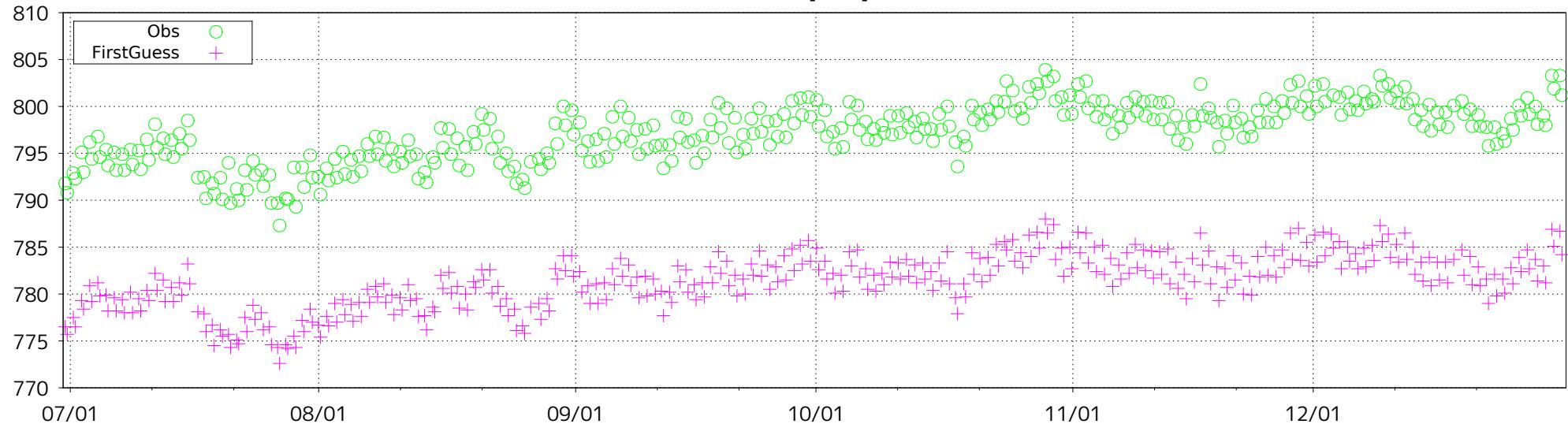


Figure 20 Time-series representation of SLP Obs minus FirstGuess for station 42056

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

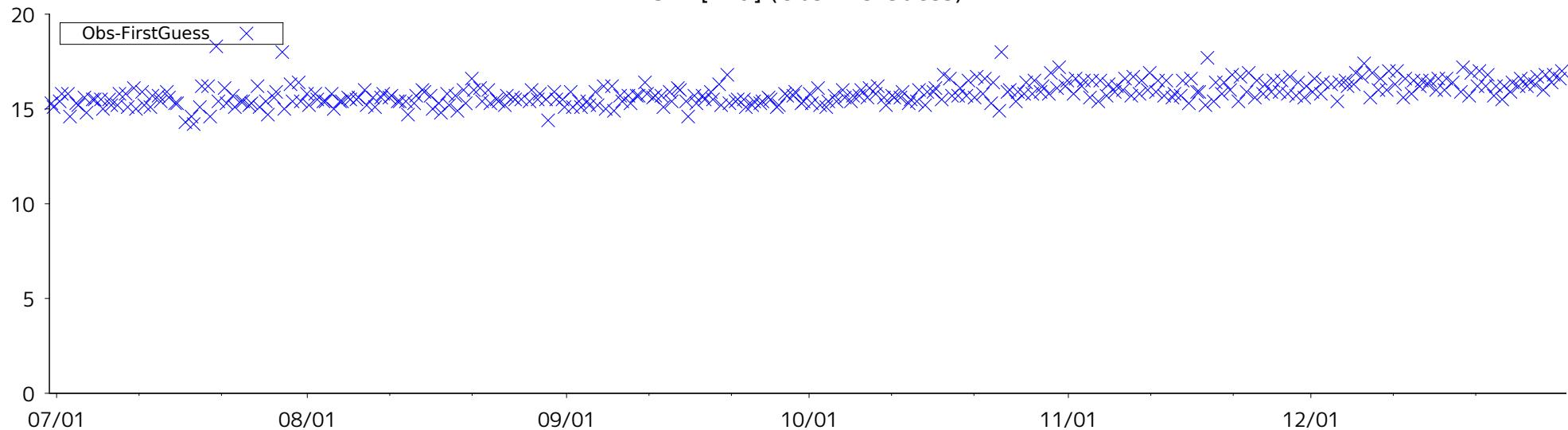
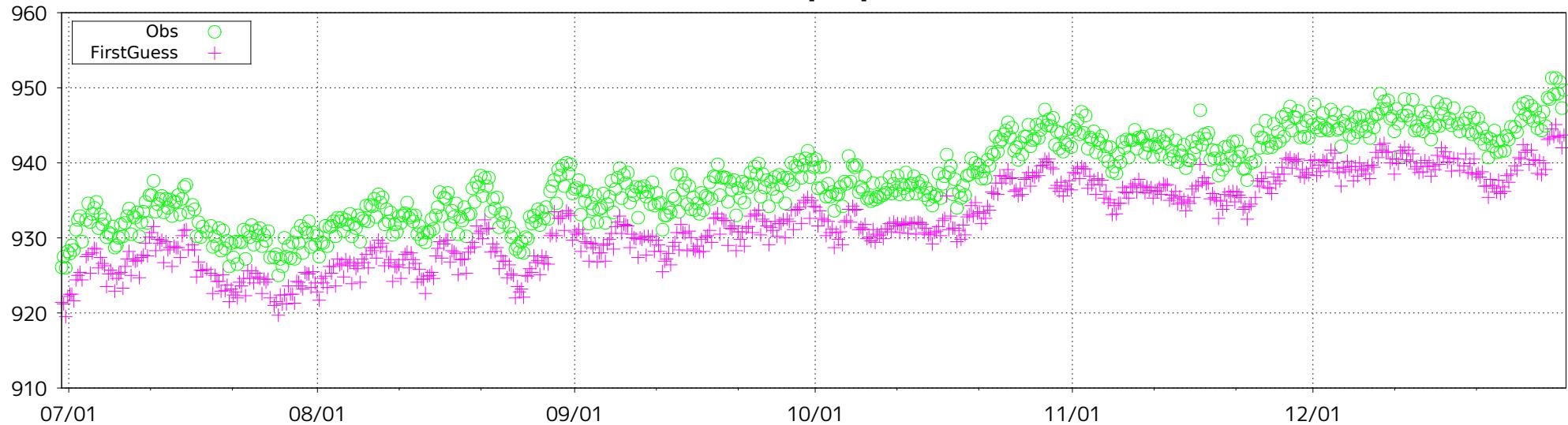


Figure 21 Time-series representation of SLP Obs minus FirstGuess for station 42083

ID: 42111 (lat: 30.3N, lon: 78.0E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

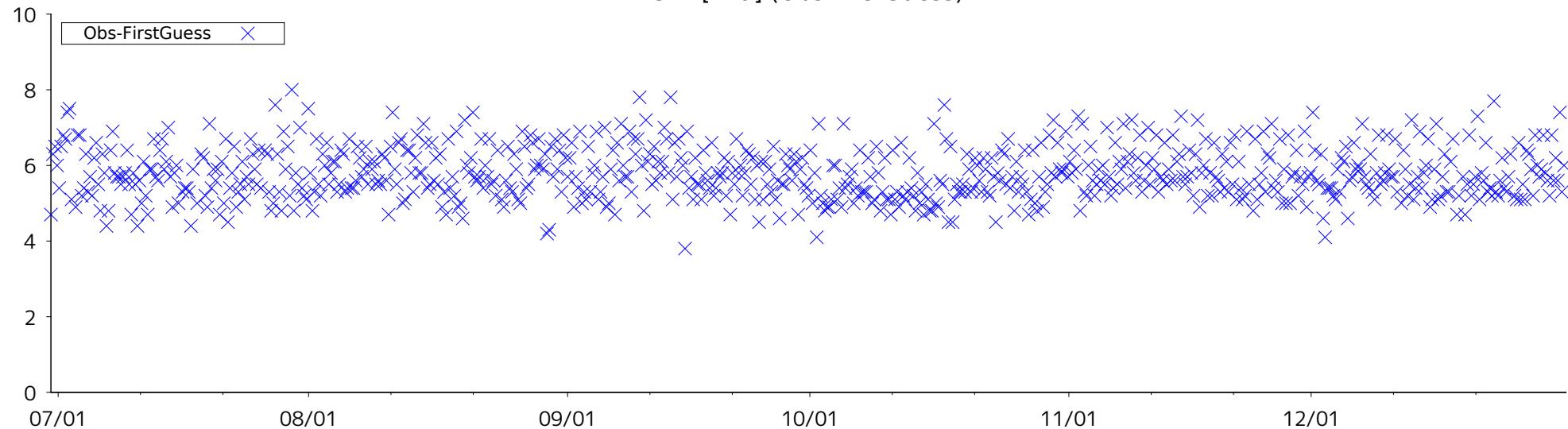
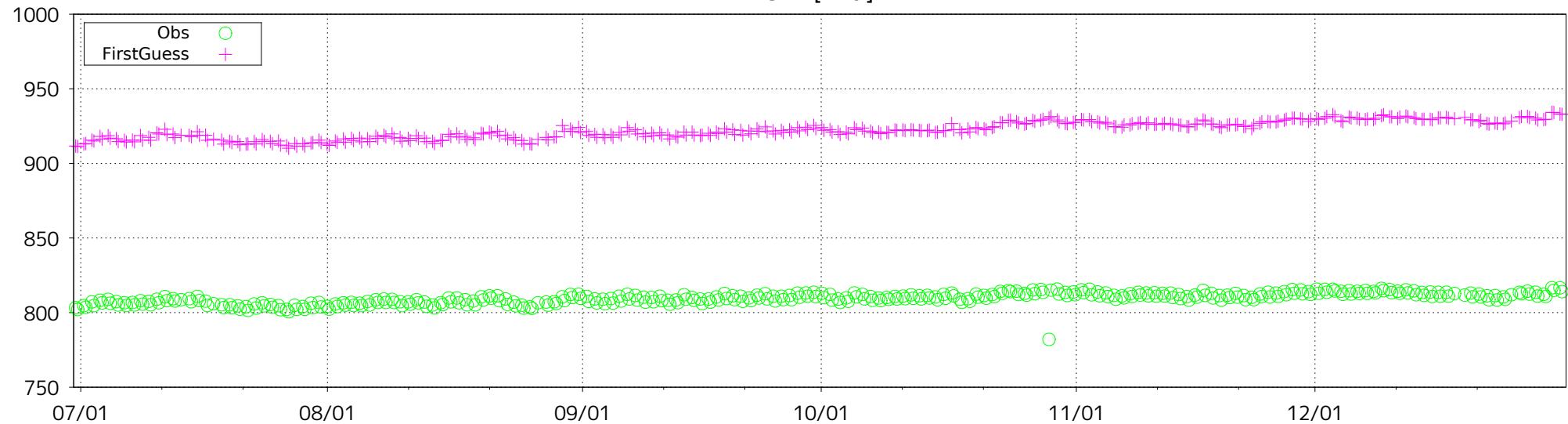


Figure 22 Time-series representation of SLP Obs minus FirstGuess for station 42111

ID: 42114 (lat: 30.4N, lon: 78.5E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

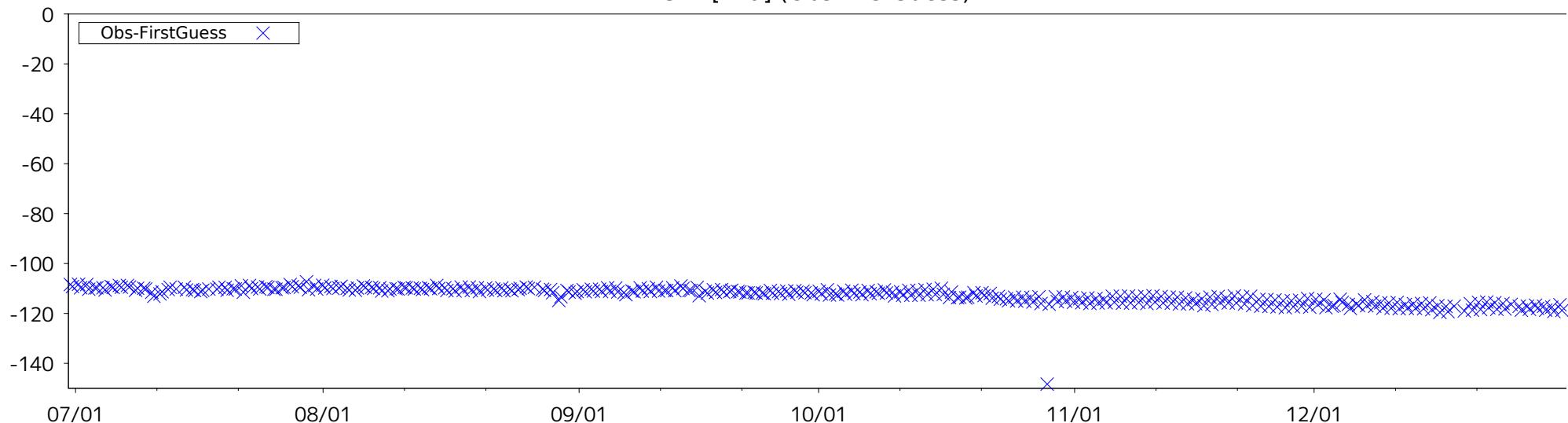
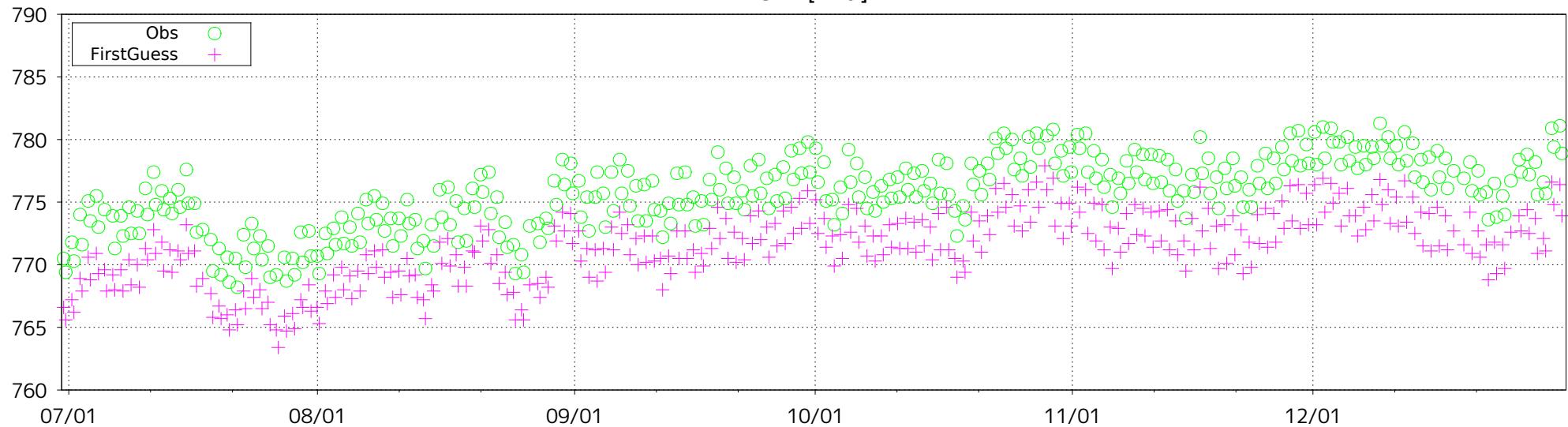


Figure 23 Time-series representation of SLP Obs minus FirstGuess for station 42114

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

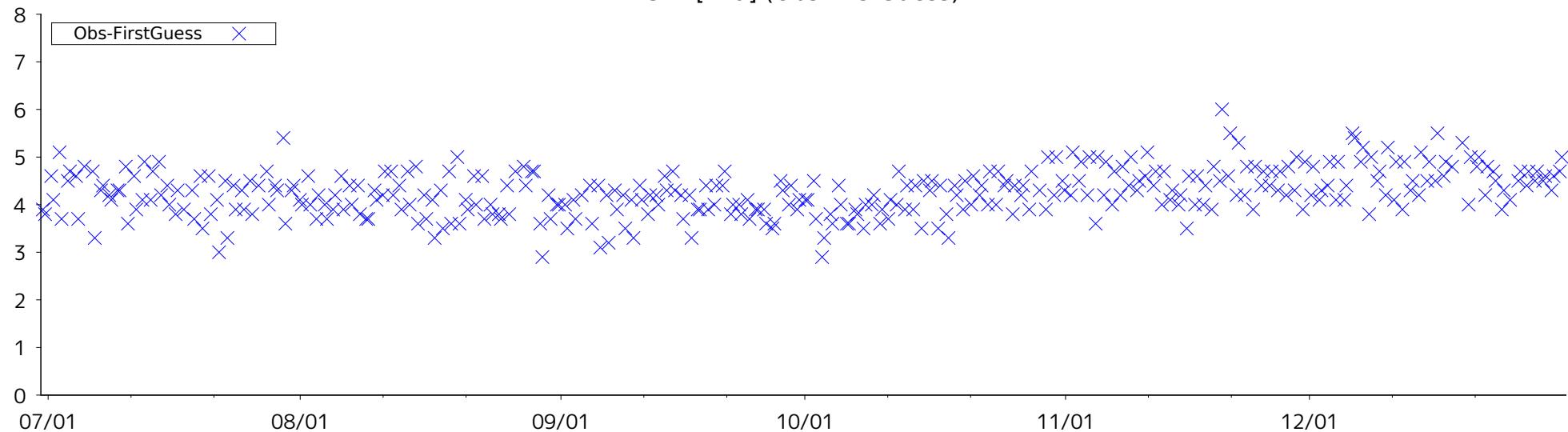
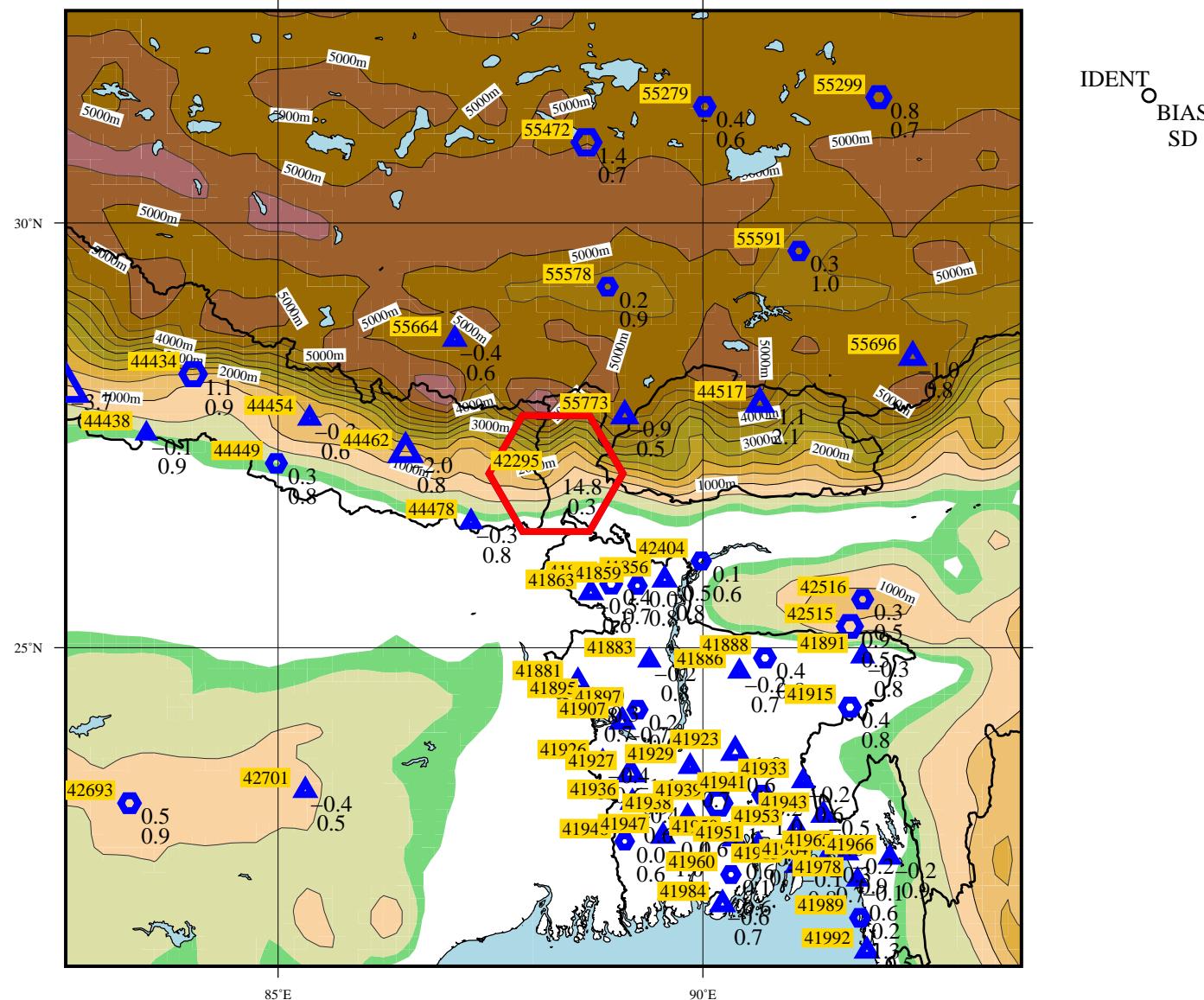


Figure 24 Time-series representation of SLP Obs minus FirstGuess for station 42147

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

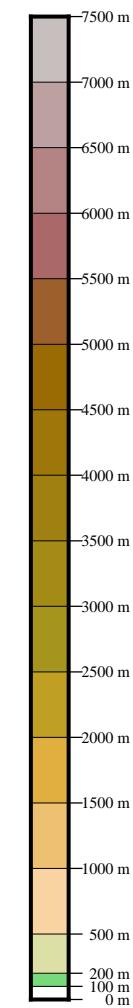


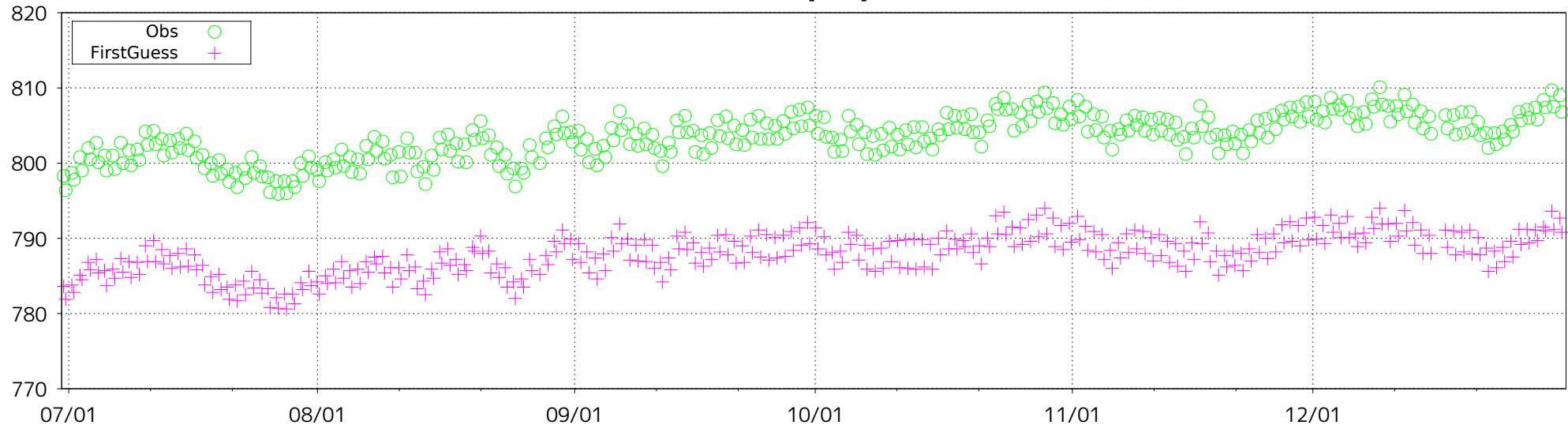
Figure 25 BIAS and SD of SLP for station 42295 (red) and surrounding stations (blue).

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: 42295 (lat: 27.1N, lon: 88.3E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

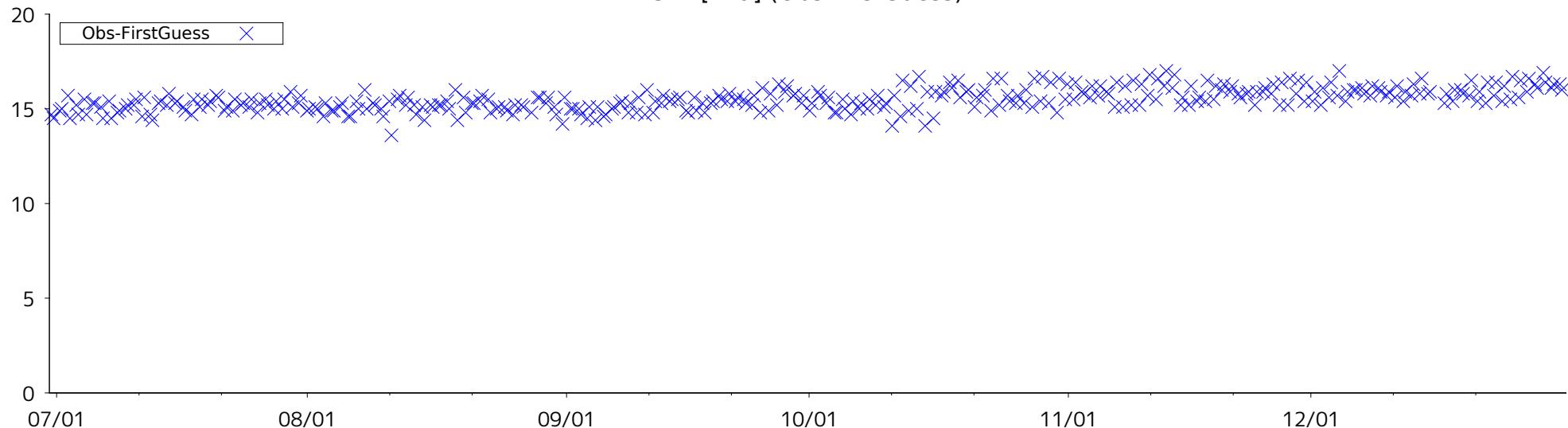
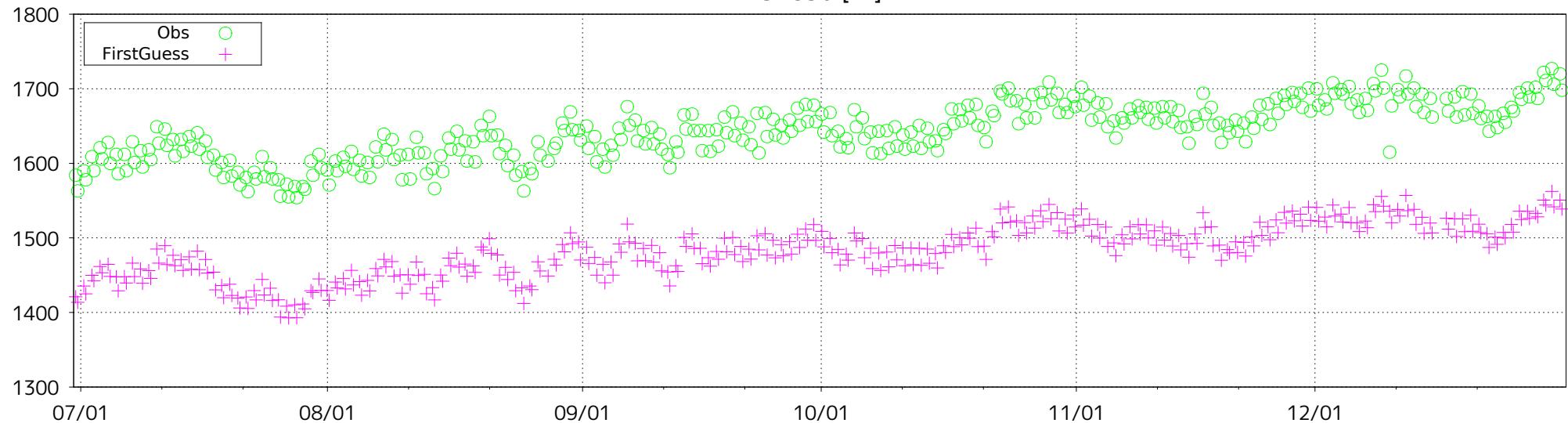


Figure 26(a) Time-series representation of SLP Obs minus FirstGuess for station 42295

ID: 42295 (lat: 27.1N, lon: 88.3E)

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

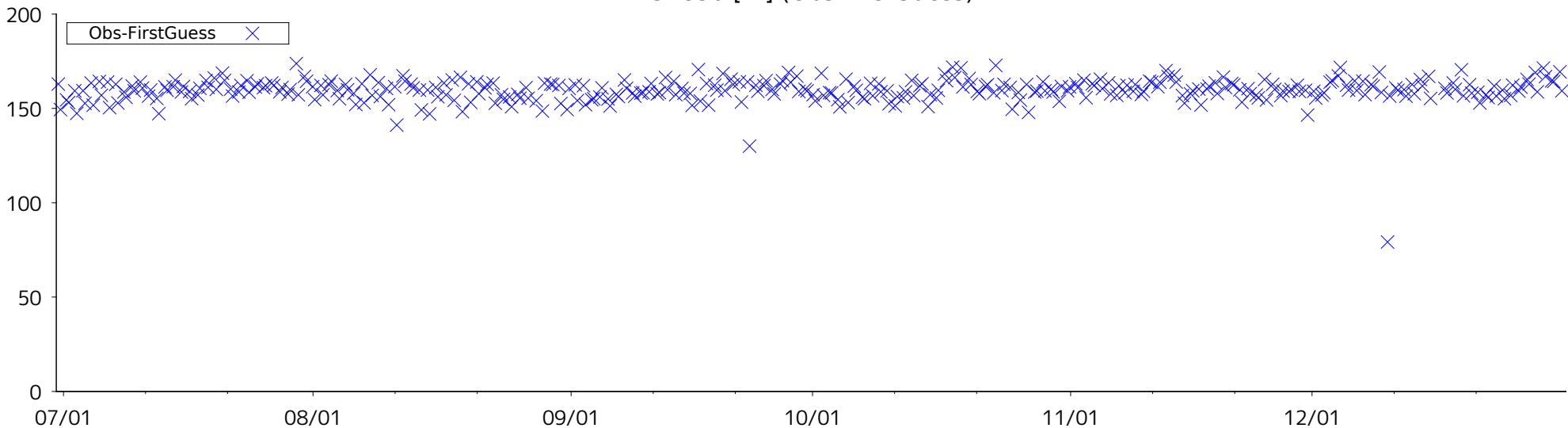
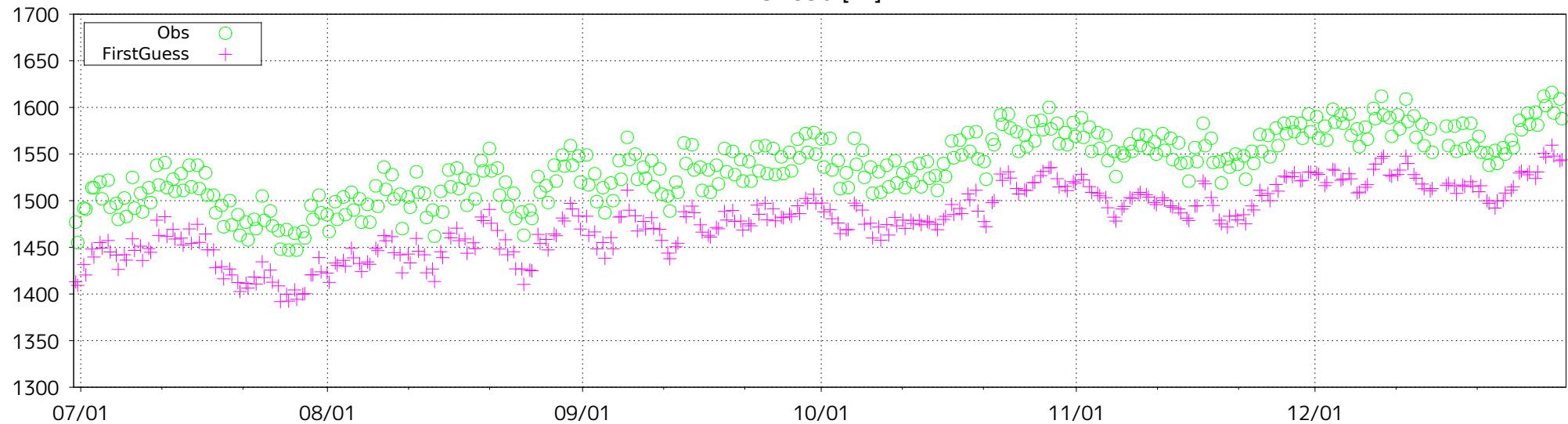


Figure 26(b) Time-series representation of GZ850 Obs minus FirstGuess for station 42295

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

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

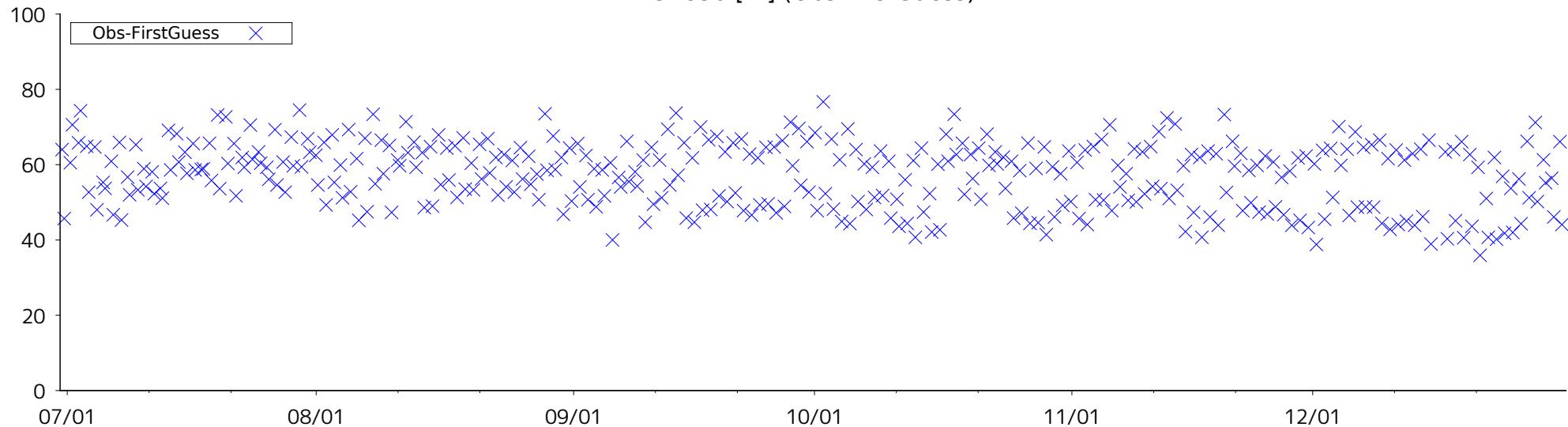


Figure 27 Time-series representation of GZ850 Obs minus FirstGuess for station 42299

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)

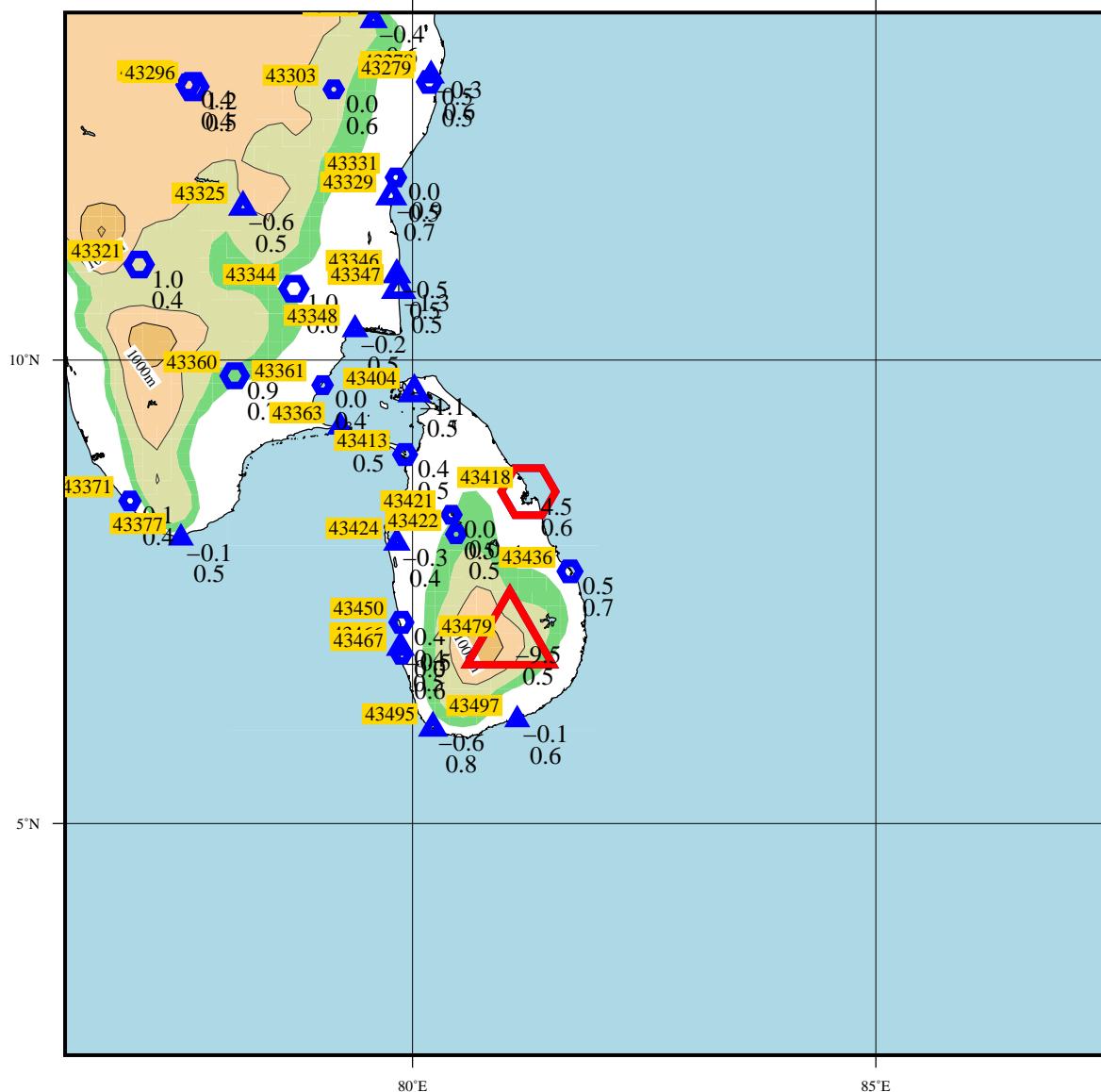
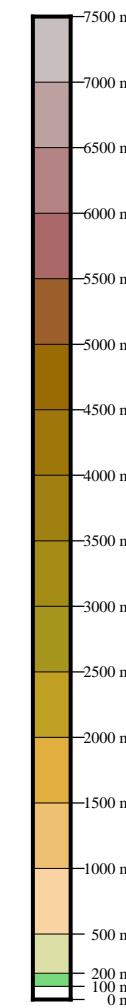


Figure 28 BIAS and SD of SLP for station 43418, 43479 (red) and surrounding stations (blue).

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.

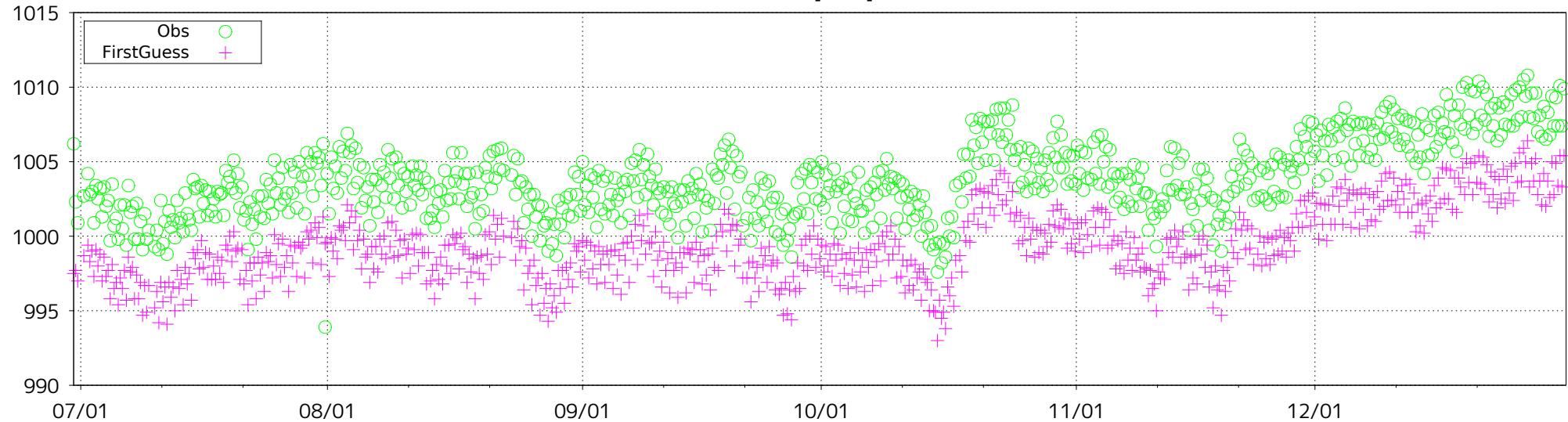
The size of each symbol is proportional to the value of BIAS, with hexagonal forms representing positive bias and triangular forms representing negative bias.

IDENT
BIAS
SD



ID: 43418 (lat: 8.6N, lon: 81.3E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

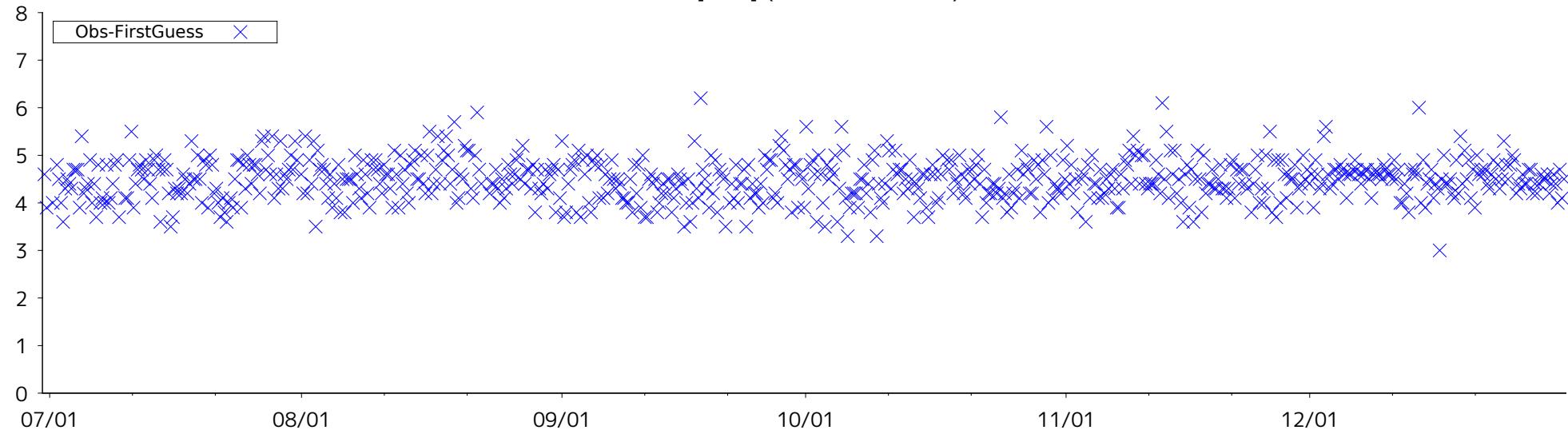
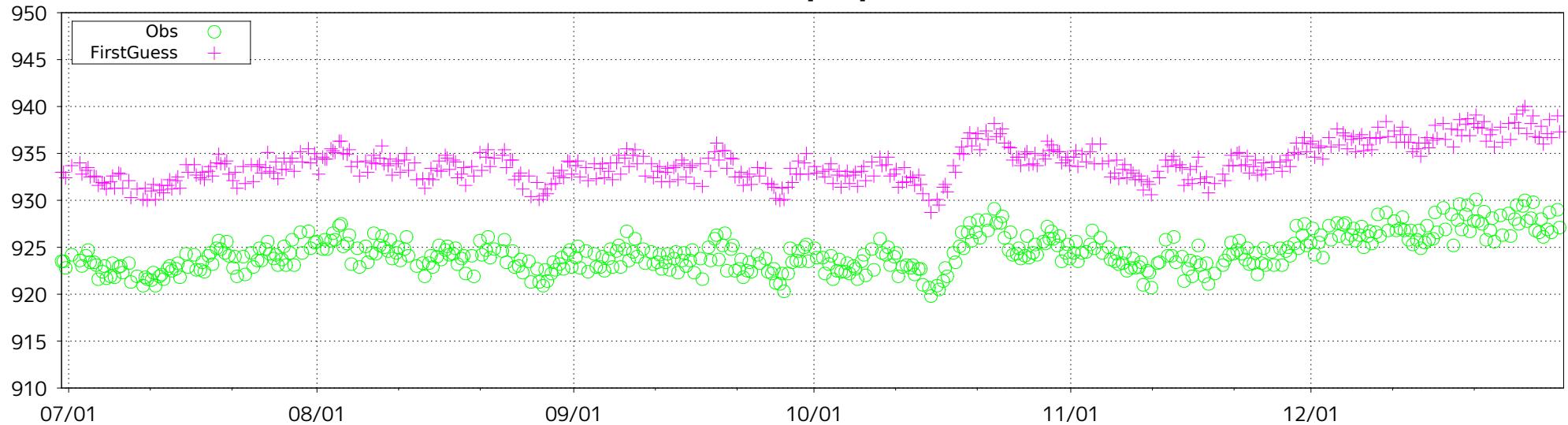


Figure 29 Time-series representation of SLP Obs minus FirstGuess for station 43418

ID: 43479 (lat: 7.0N, lon: 81.1E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

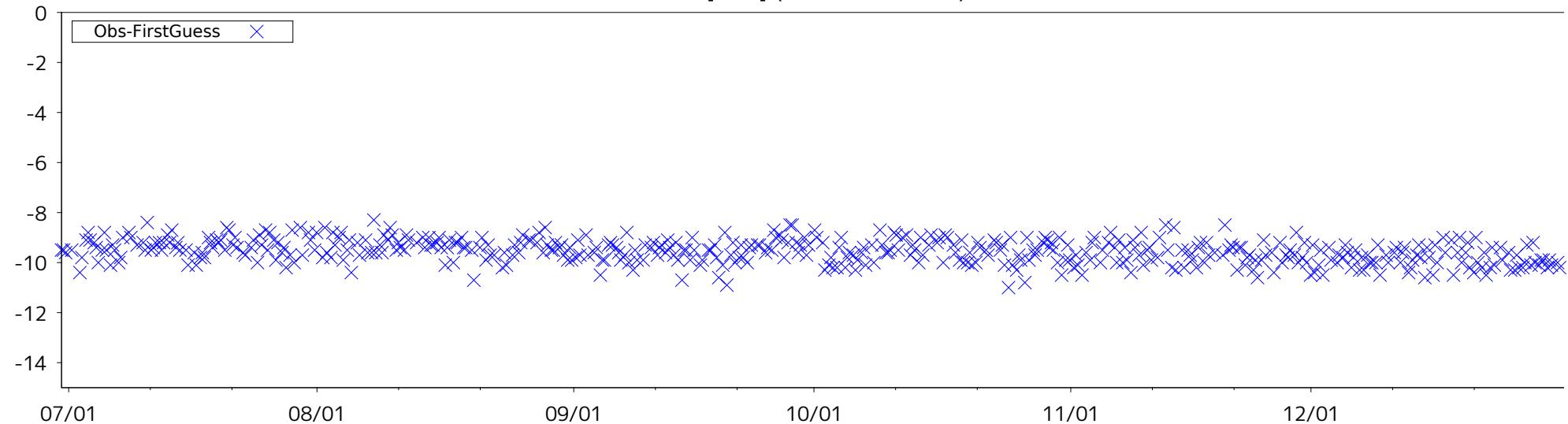
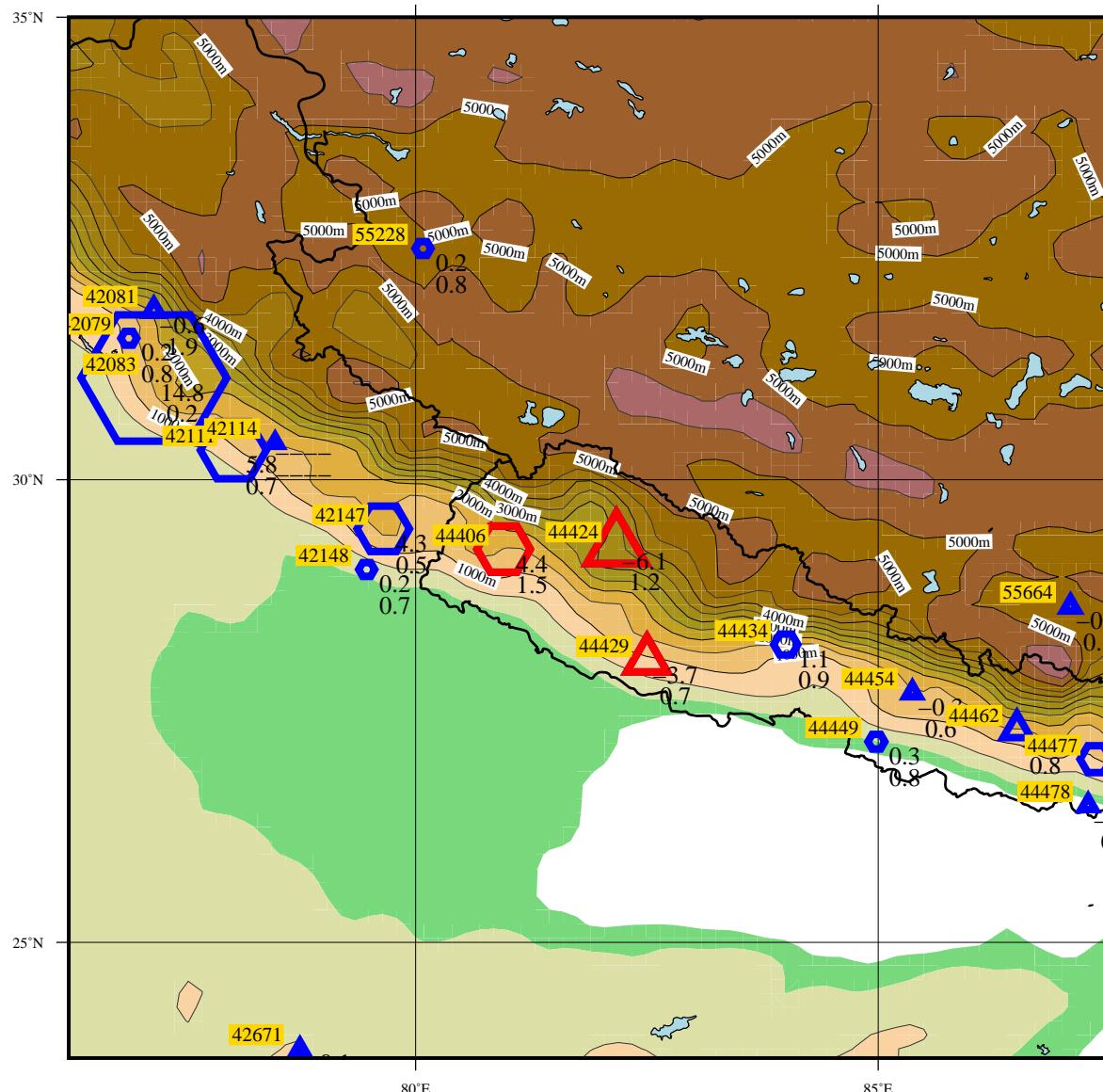


Figure 30 Time-series representation of SLP Obs minus FirstGuess for station 43479

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

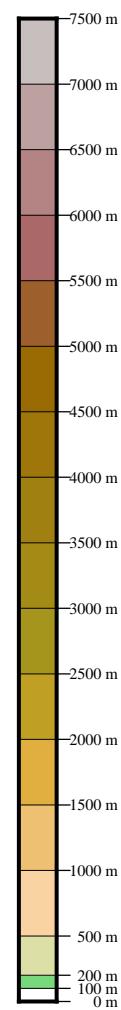


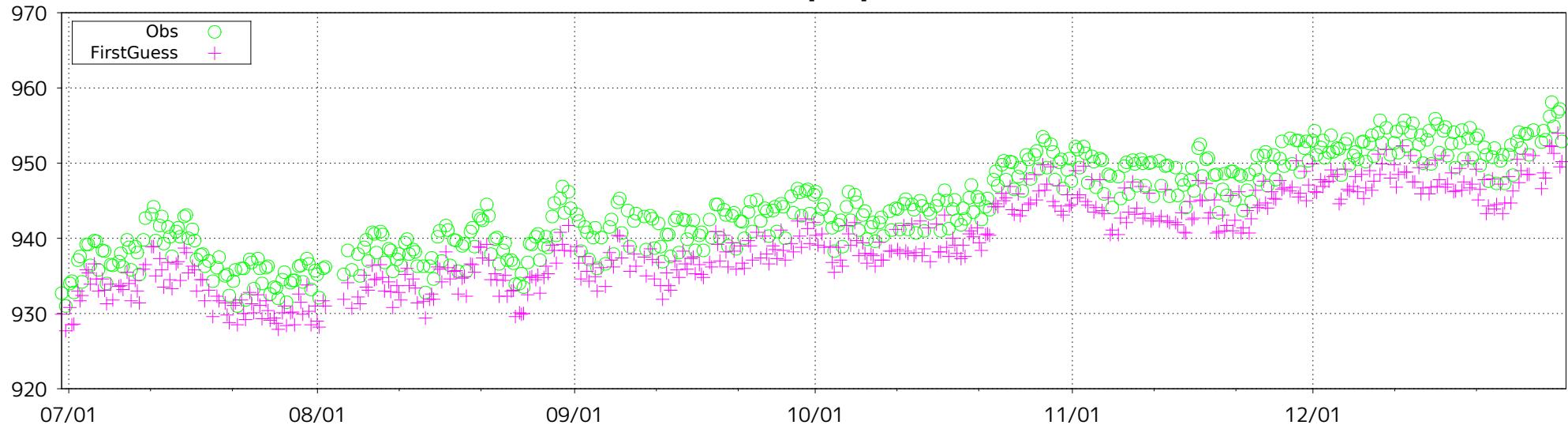
Figure 31 BIAS and SD of SLP for station 44406, 44424, 44429 (red) and surrounding stations (blue).

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: 44406 (lat: 29.3N, lon: 81.0E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

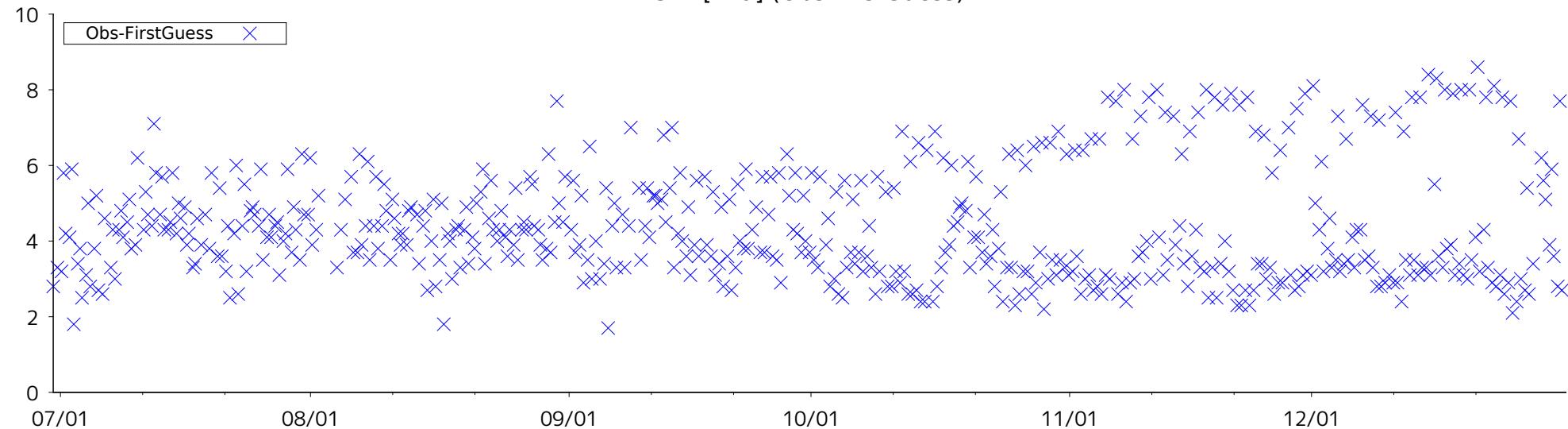
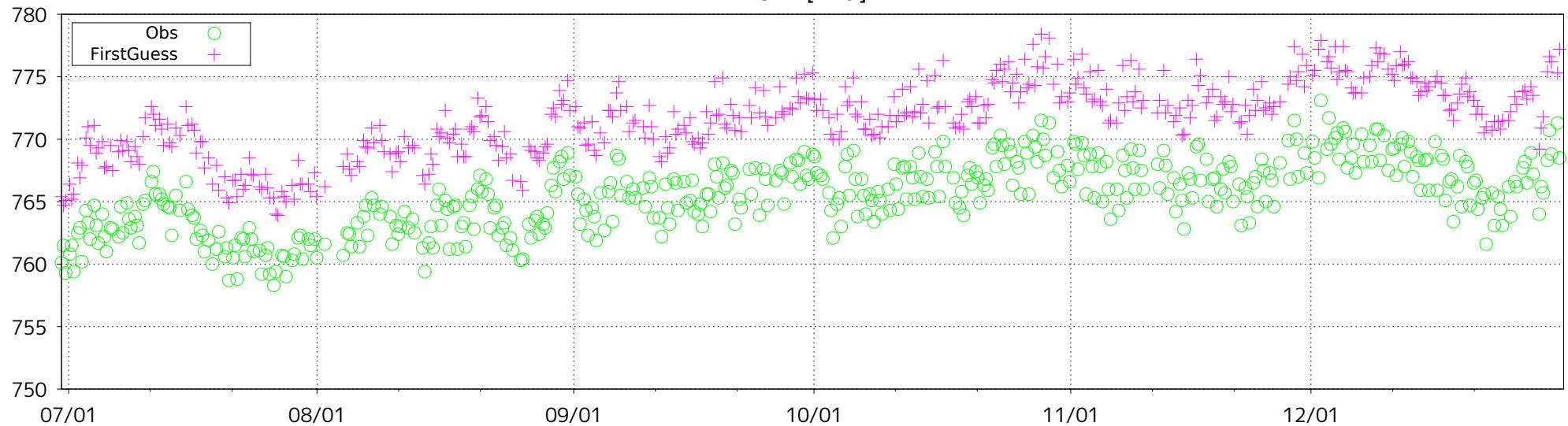


Figure 32 Time-series representation of SLP Obs minus FirstGuess for station 44406

ID: 44424 (lat: 29.3N, lon: 82.2E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

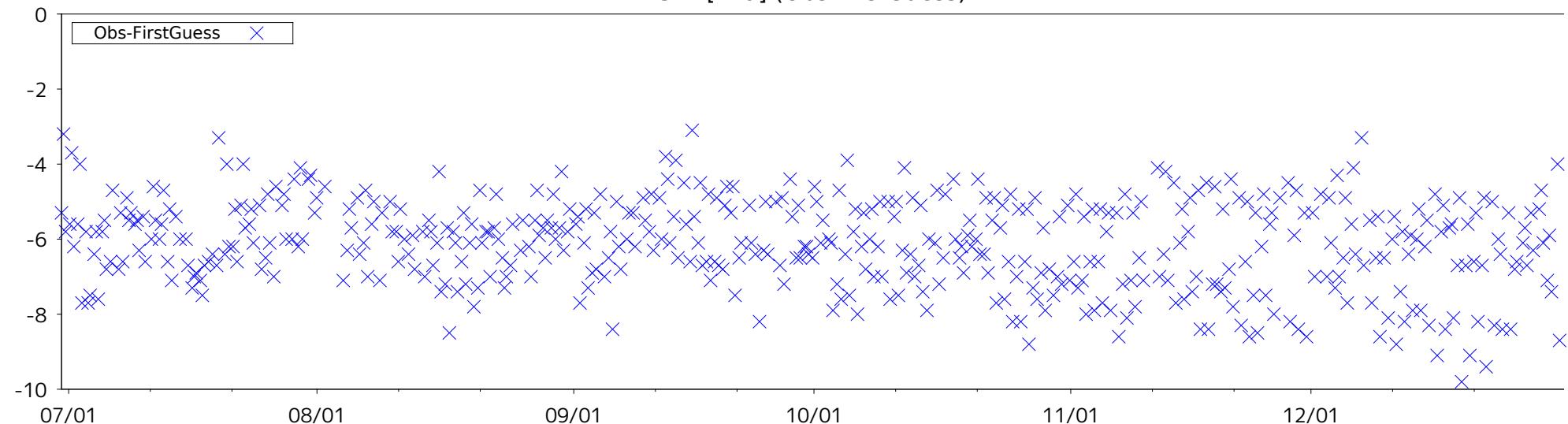
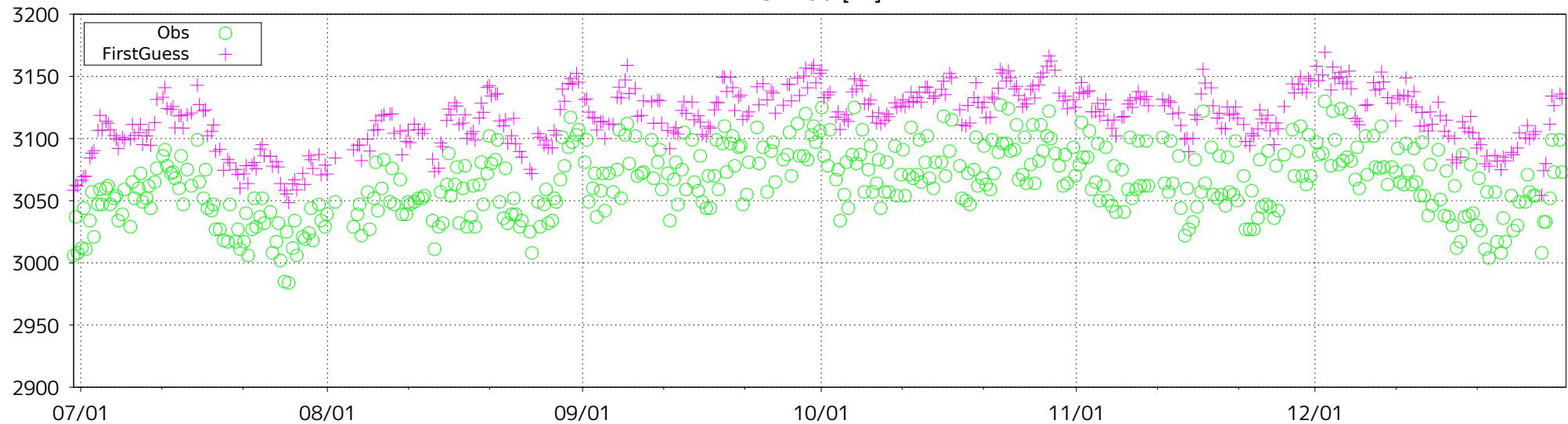


Figure 33(a) Time-series representation of SLP Obs minus FirstGuess for station 44424

ID: 44424 (lat: 29.3N, lon: 82.2E)

GZ700 [m]



GZ700 [m] (Obs-FirstGuess)

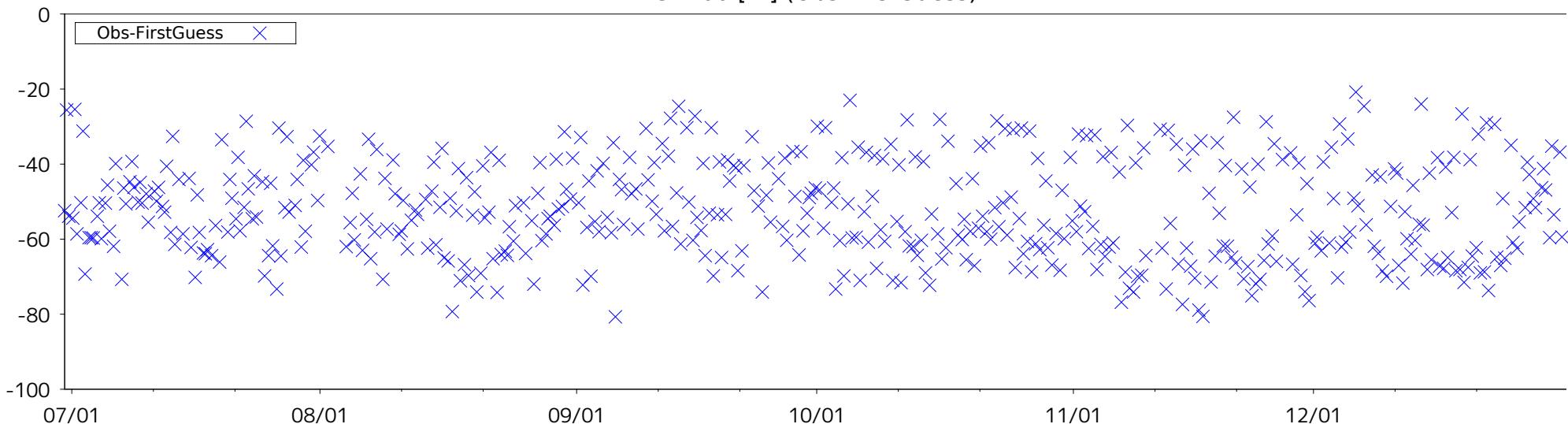
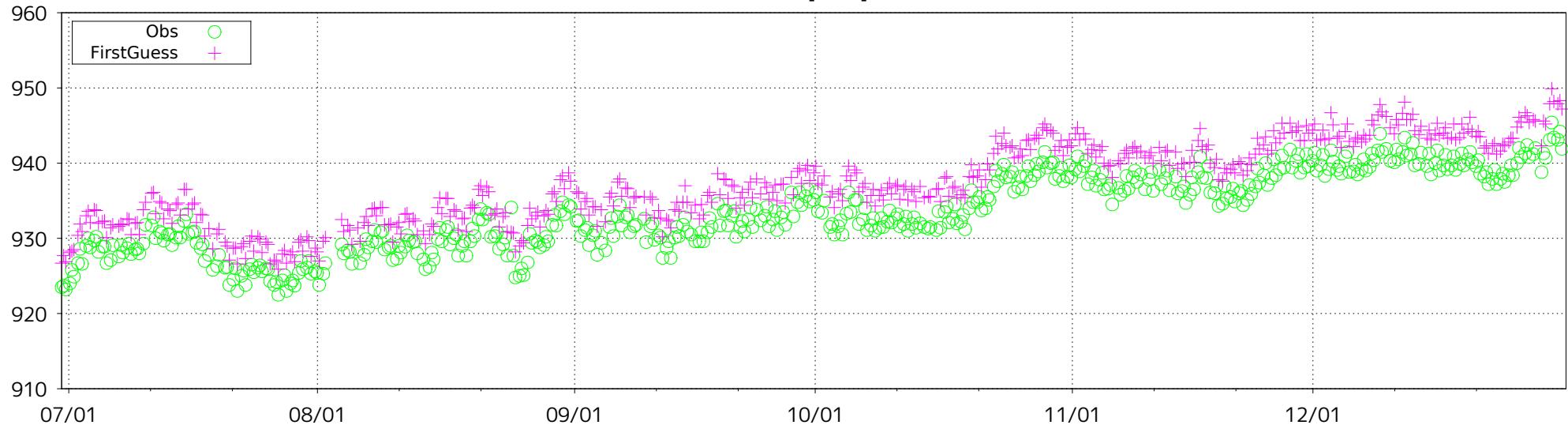


Figure 33(b) Time-series representation of GZ700 Obs minus FirstGuess for station 44424

ID: 44429 (lat: 28.1N, lon: 82.5E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

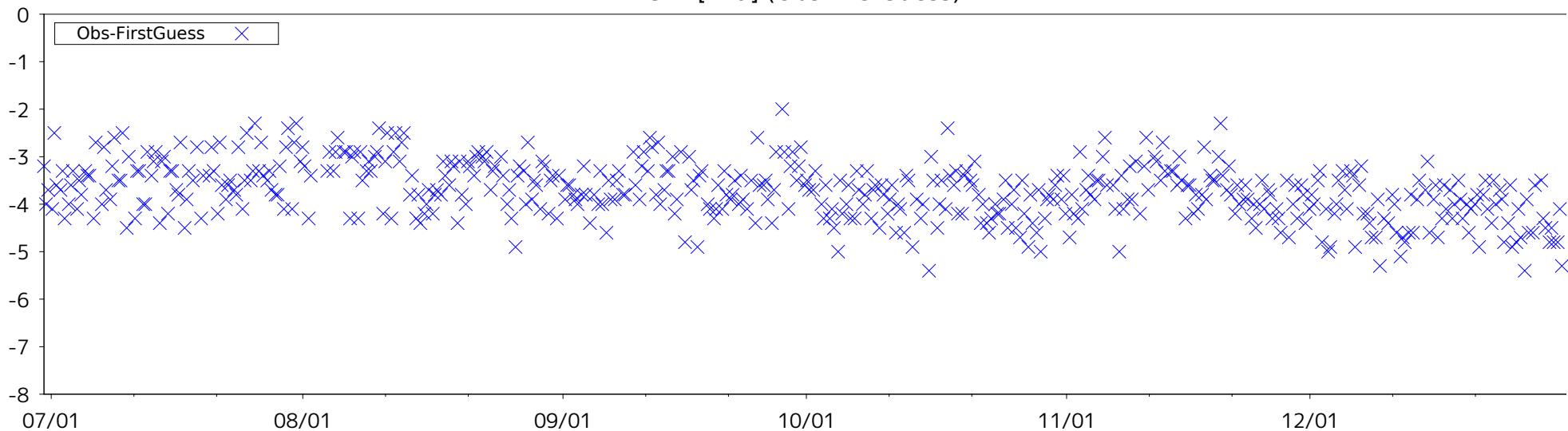


Figure 34 Time-series representation of SLP Obs minus FirstGuess for station 44429

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)

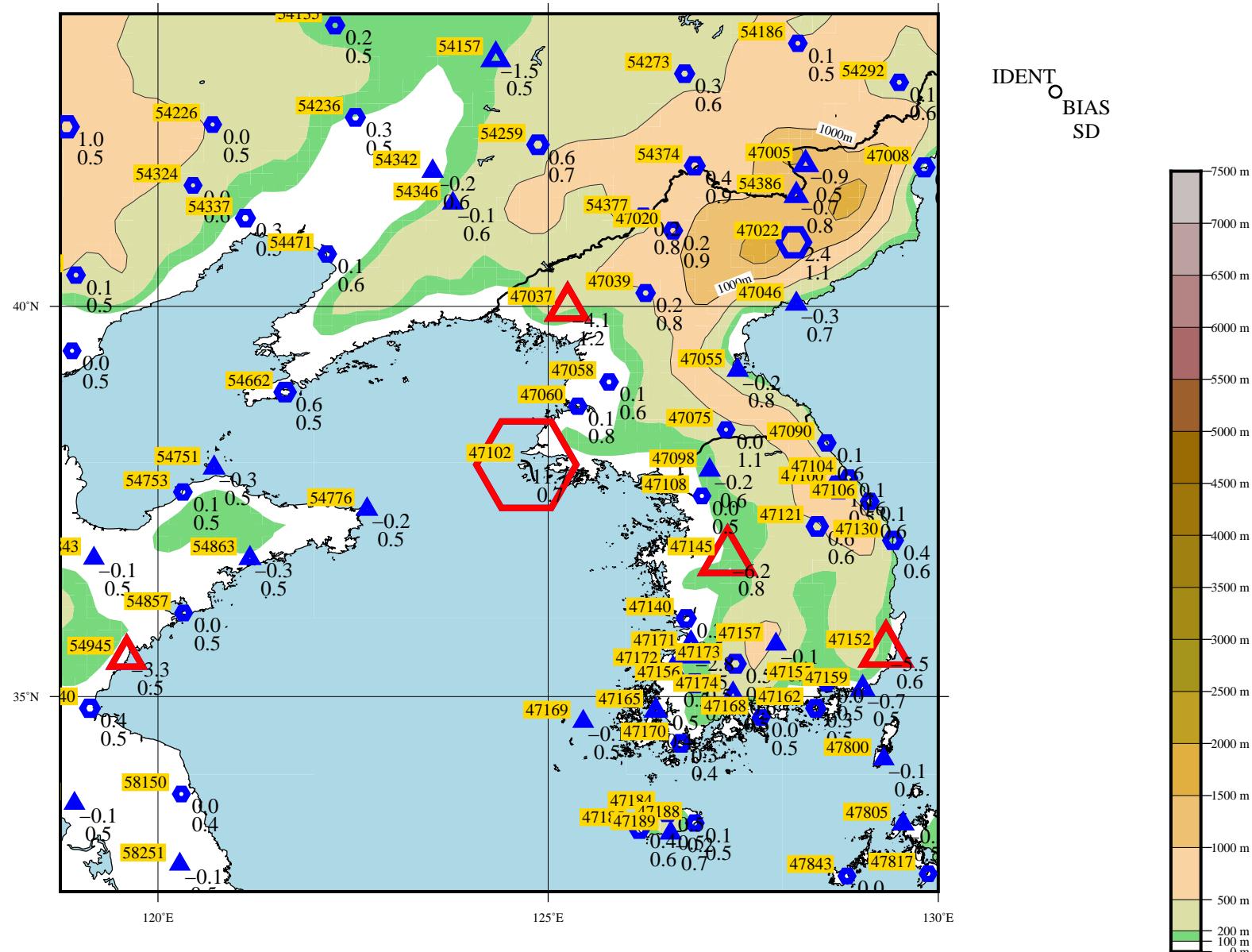


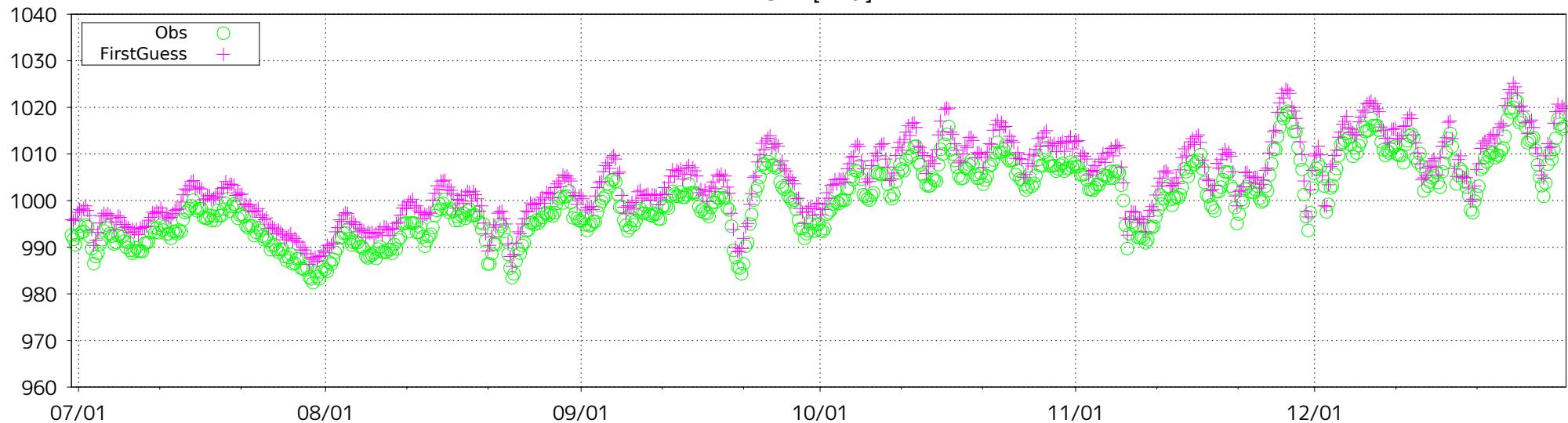
Figure 35 BIAS and SD of SLP for station 47037, 47102, 47145, 47152, 54945 (red) and surrounding stations (blue).

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)

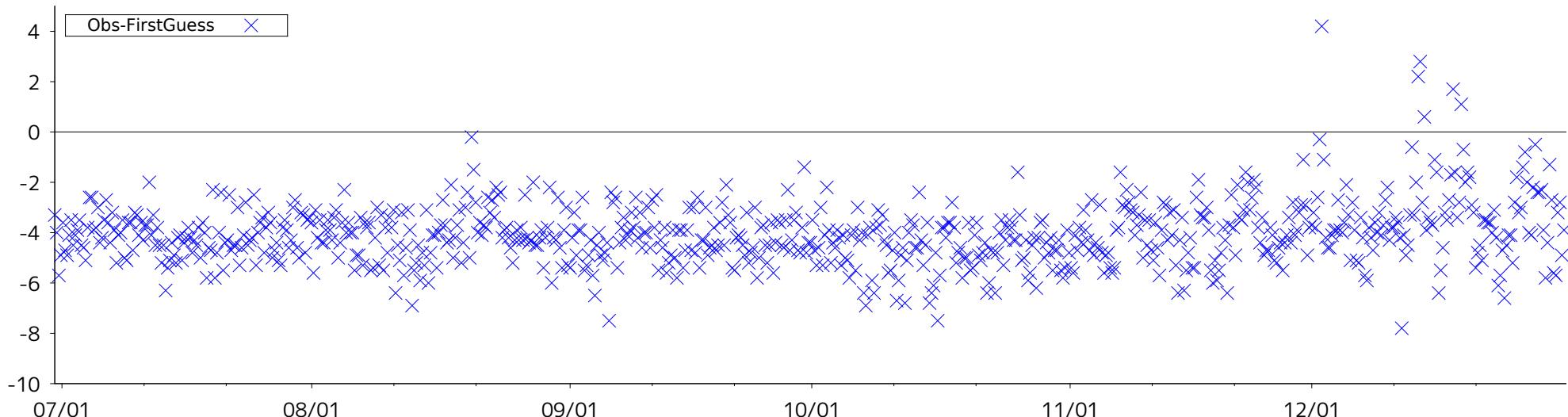
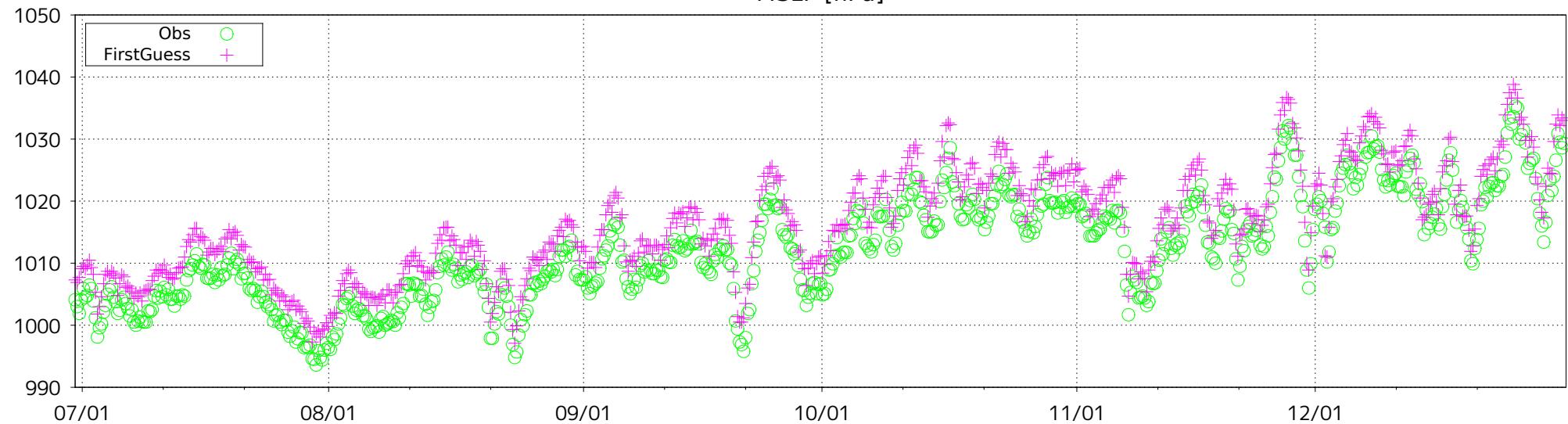


Figure 36(a) Time-series representation of SLP Obs minus FirstGuess for station 47037

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

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

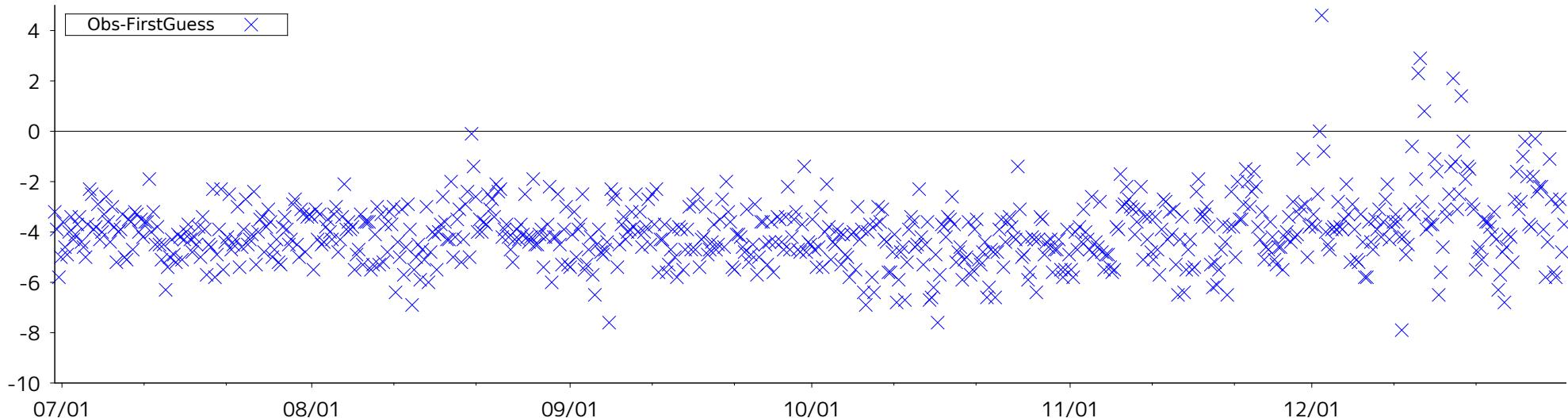


Figure 36(b) Time-series representation of MSLP Obs minus FirstGuess for station 47037

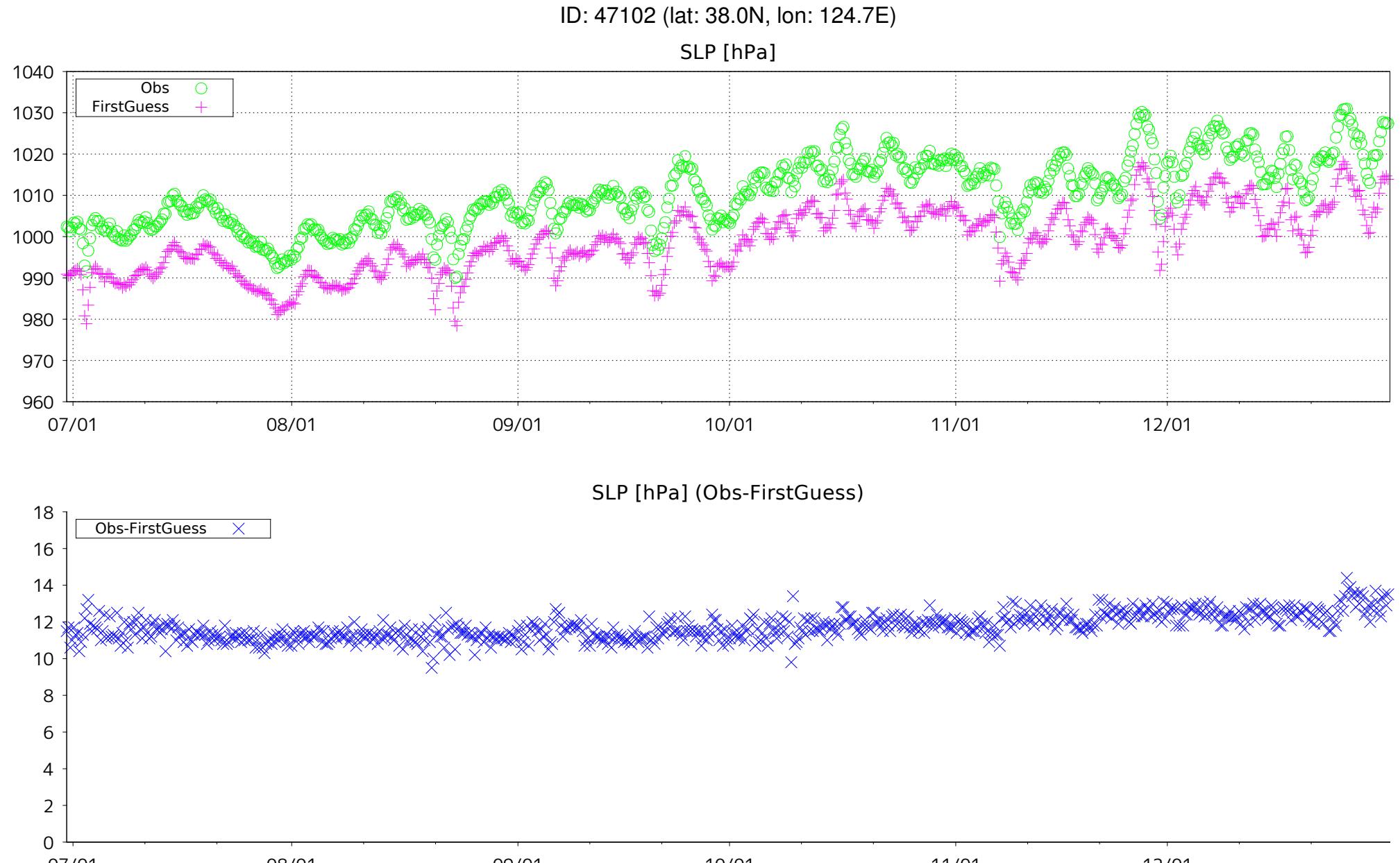
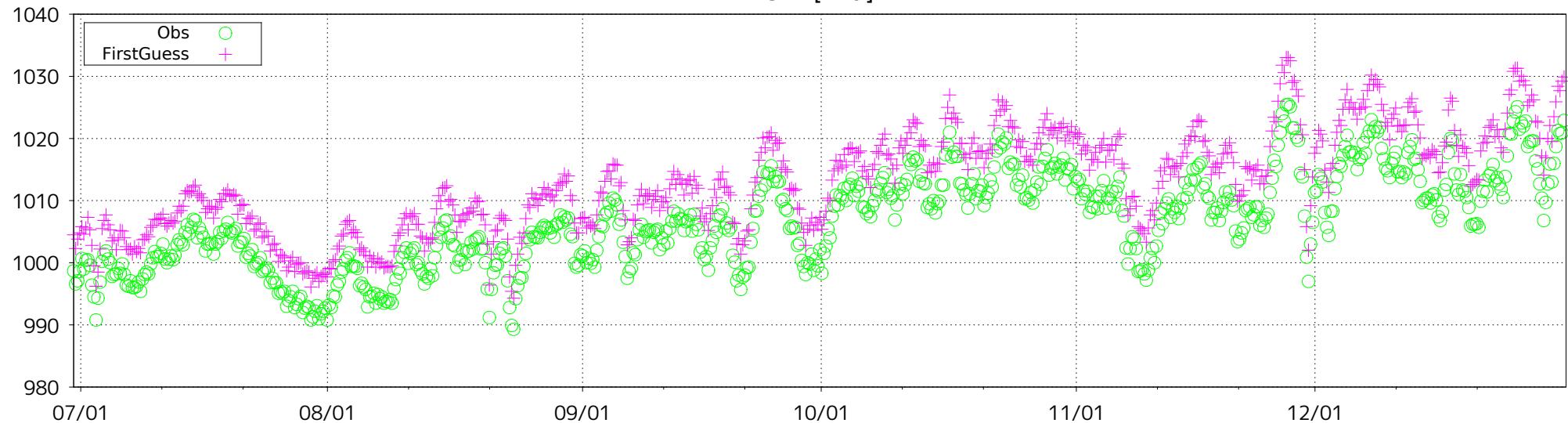


Figure 37 Time-series representation of SLP Obs minus FirstGuess for station 47102

ID: 47145 (lat: 36.8N, lon: 127.3E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

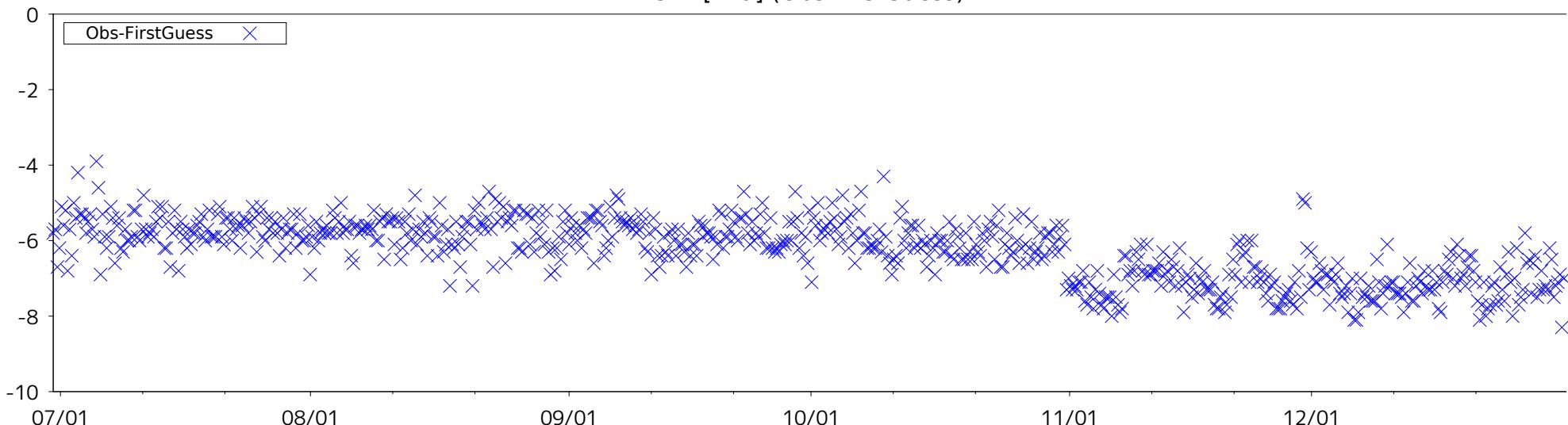
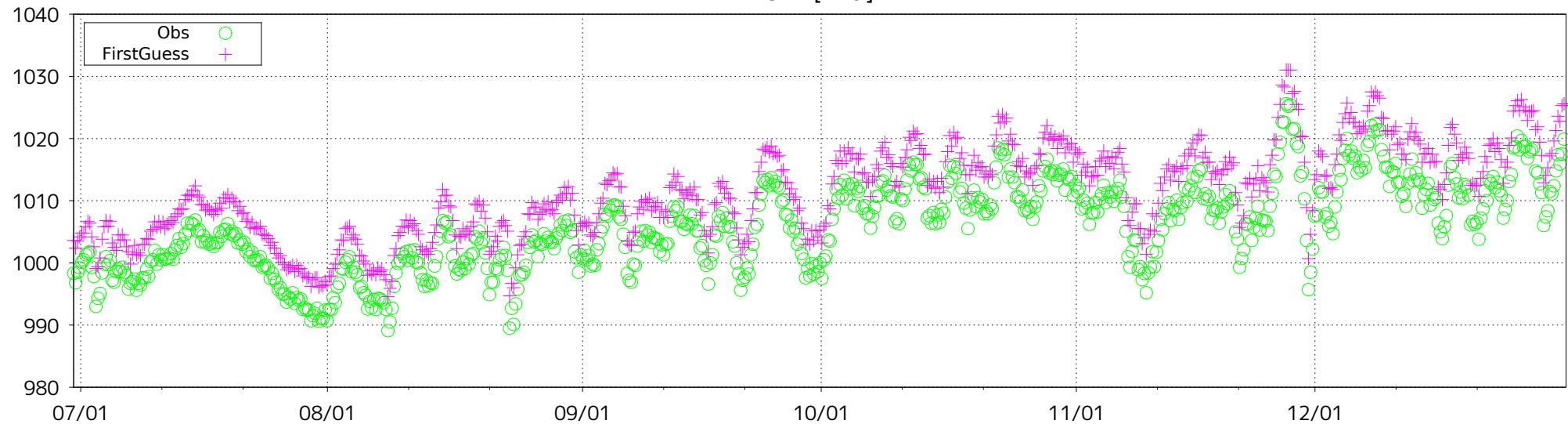


Figure 38 Time-series representation of SLP Obs minus FirstGuess for station 47145

ID: 47152 (lat: 35.6N, lon: 129.3E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

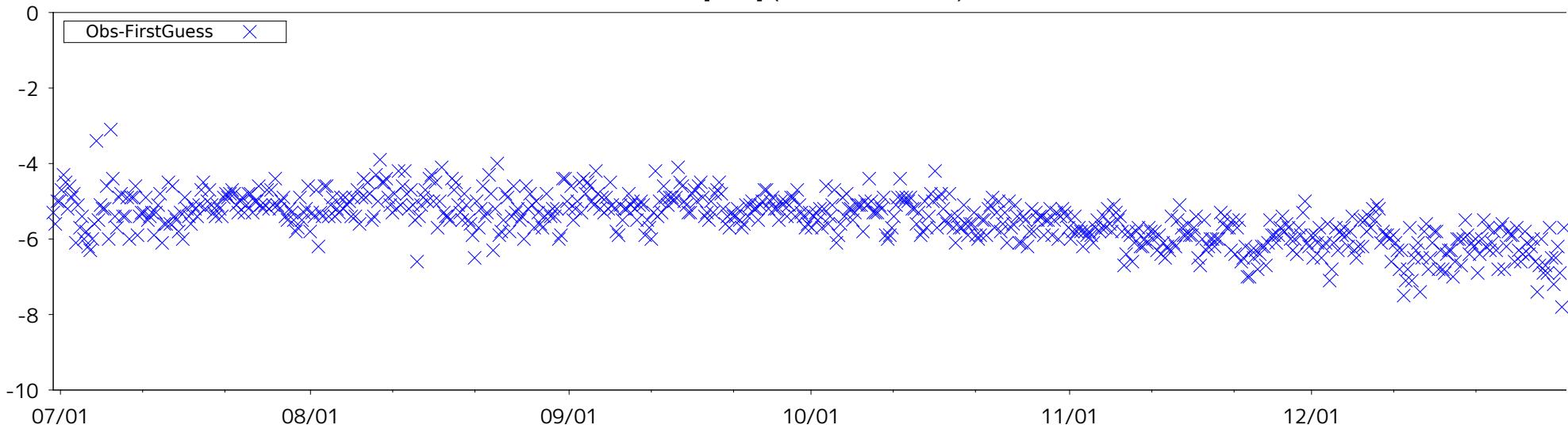
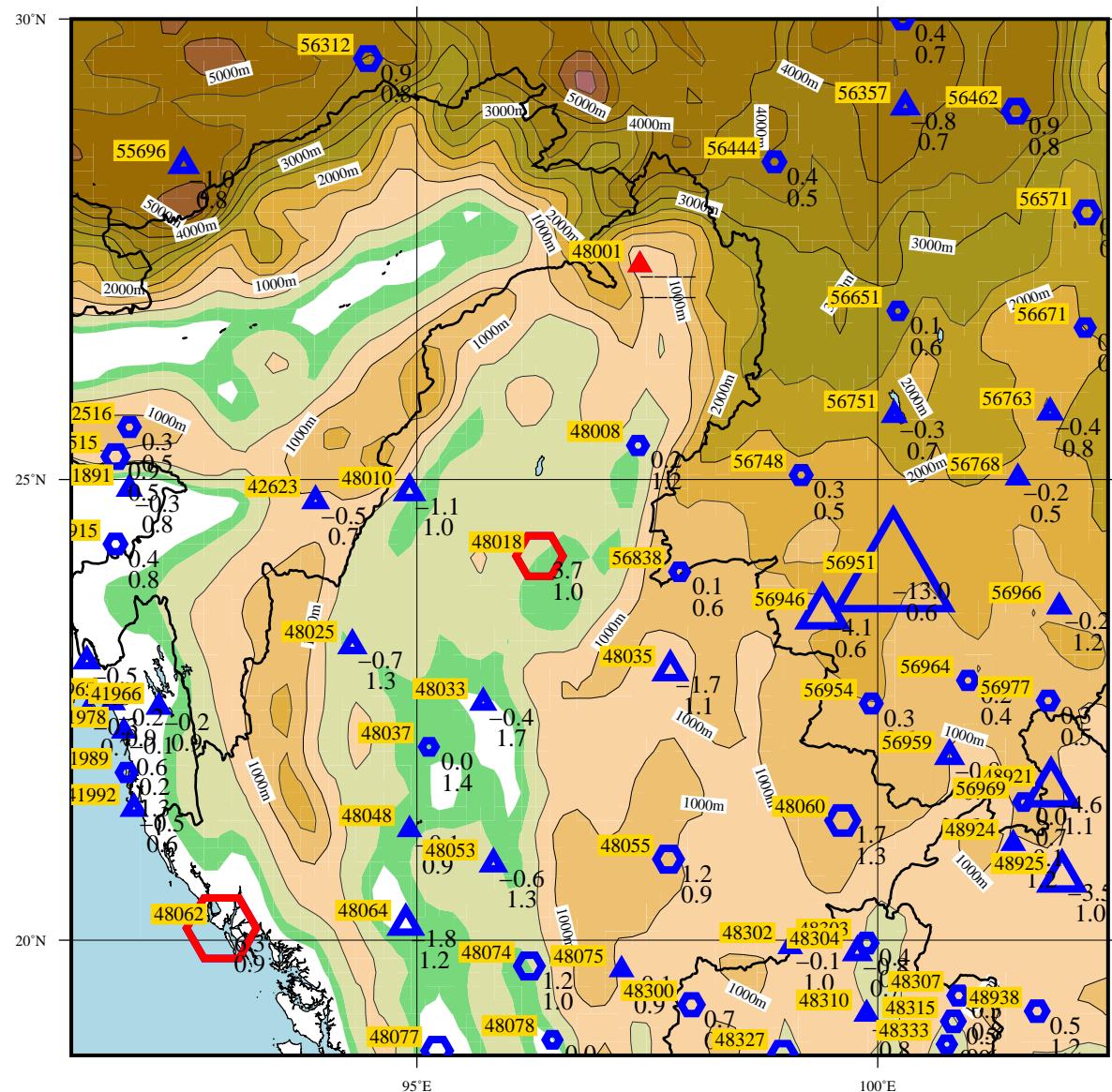


Figure 39 Time-series representation of SLP Obs minus FirstGuess for station 47152

LEVEL = SUR

ELEMENT = SLP

2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

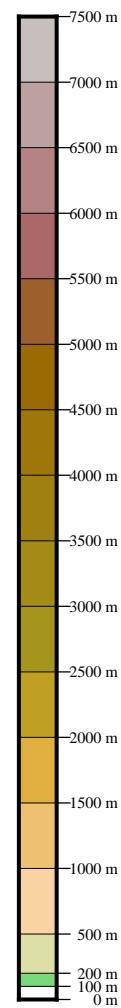


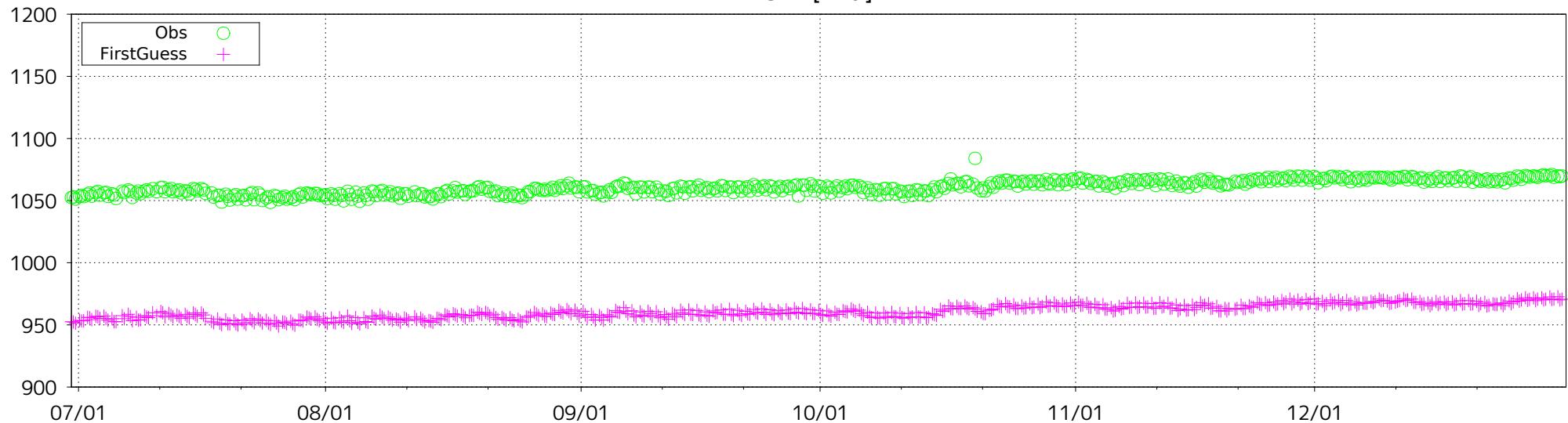
Figure 40 BIAS and SD of SLP for station 48001, 48018, 48062 (red) and surrounding stations (blue).

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

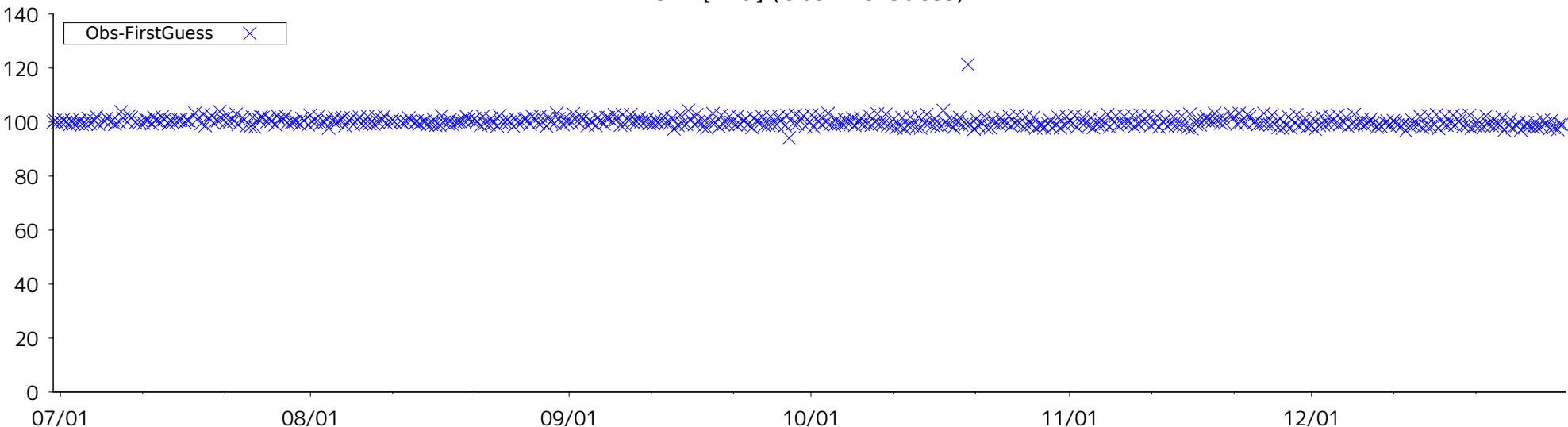
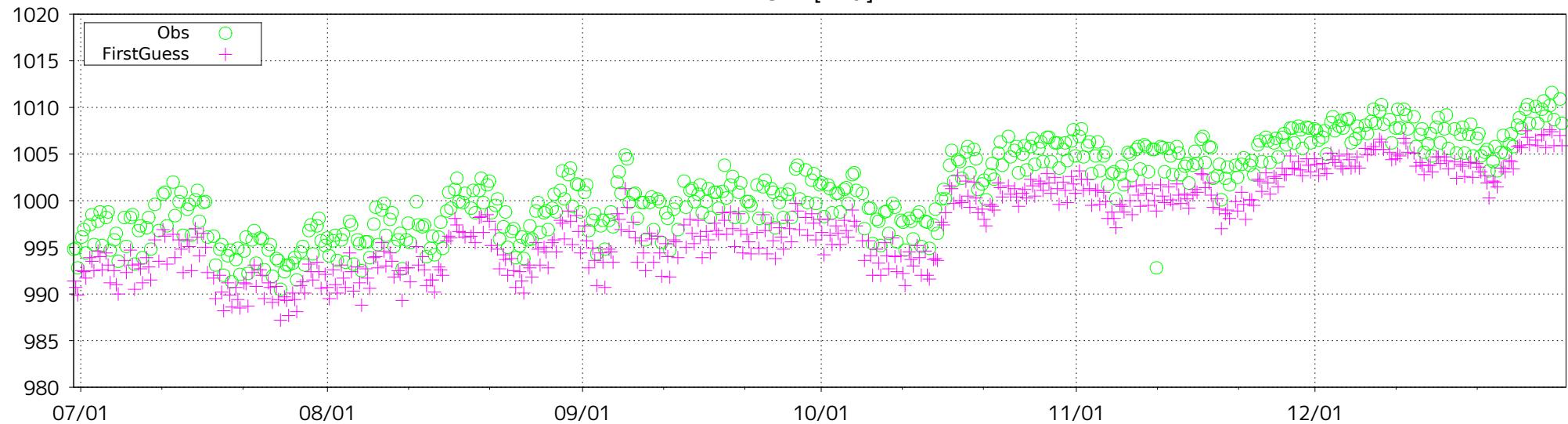


Figure 41 Time-series representation of SLP Obs minus FirstGuess for station 48001

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

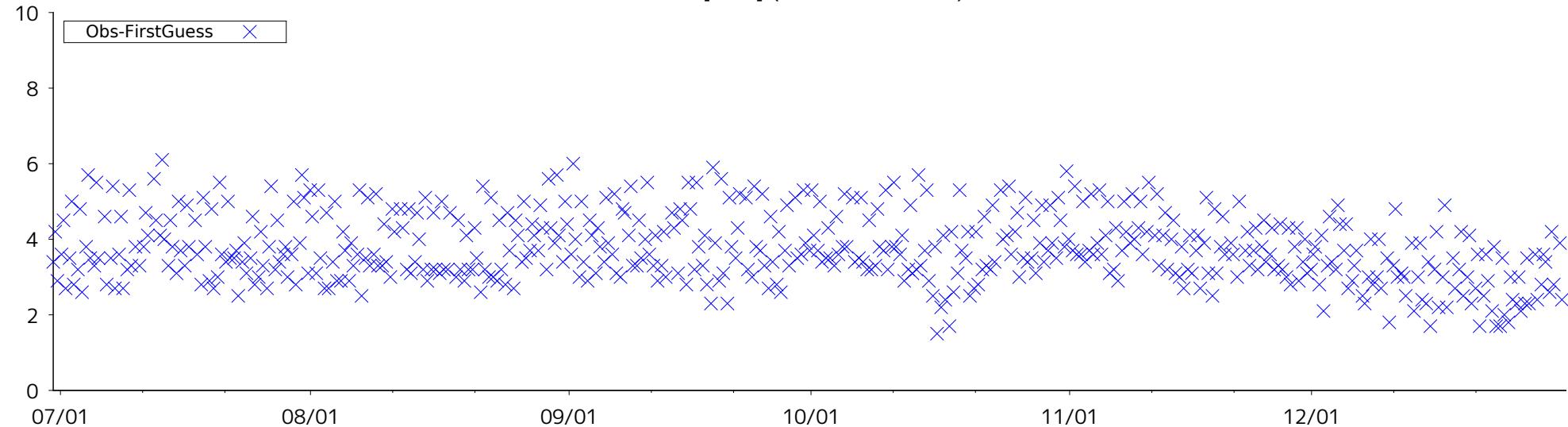
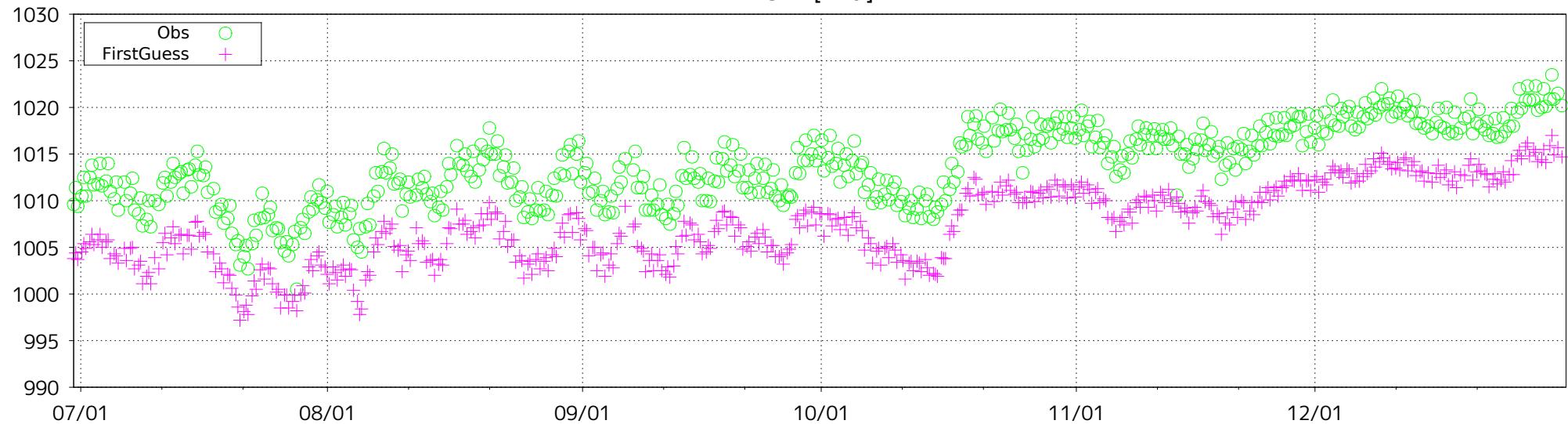


Figure 42 Time-series representation of SLP Obs minus FirstGuess for station 48018

ID: 48062 (lat: 20.1N, lon: 92.9E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

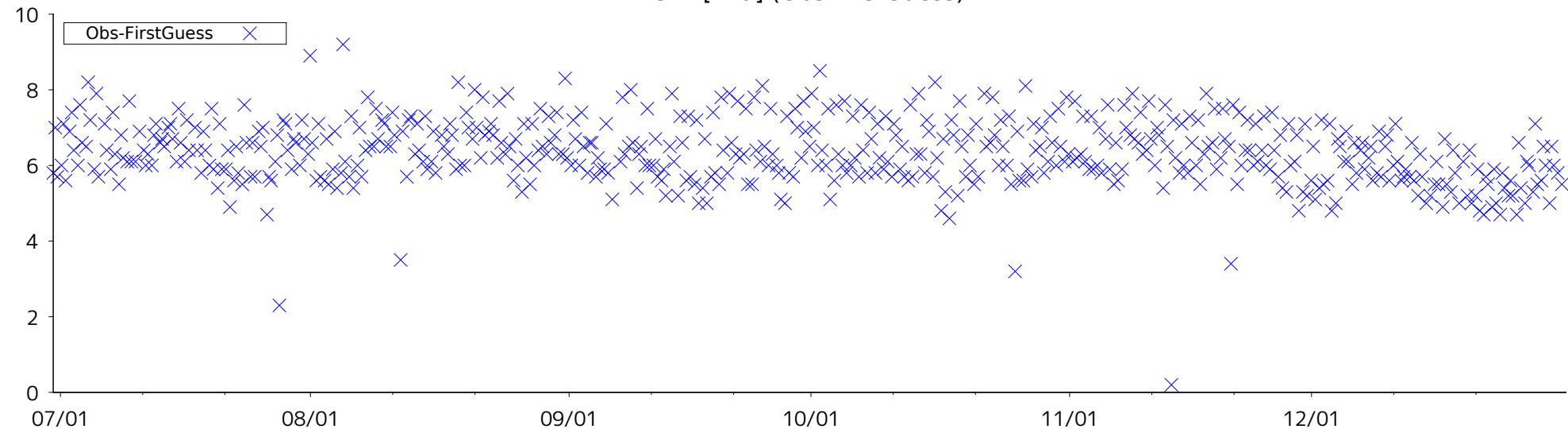


Figure 43 Time-series representation of SLP Obs minus FirstGuess for station 48062

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)

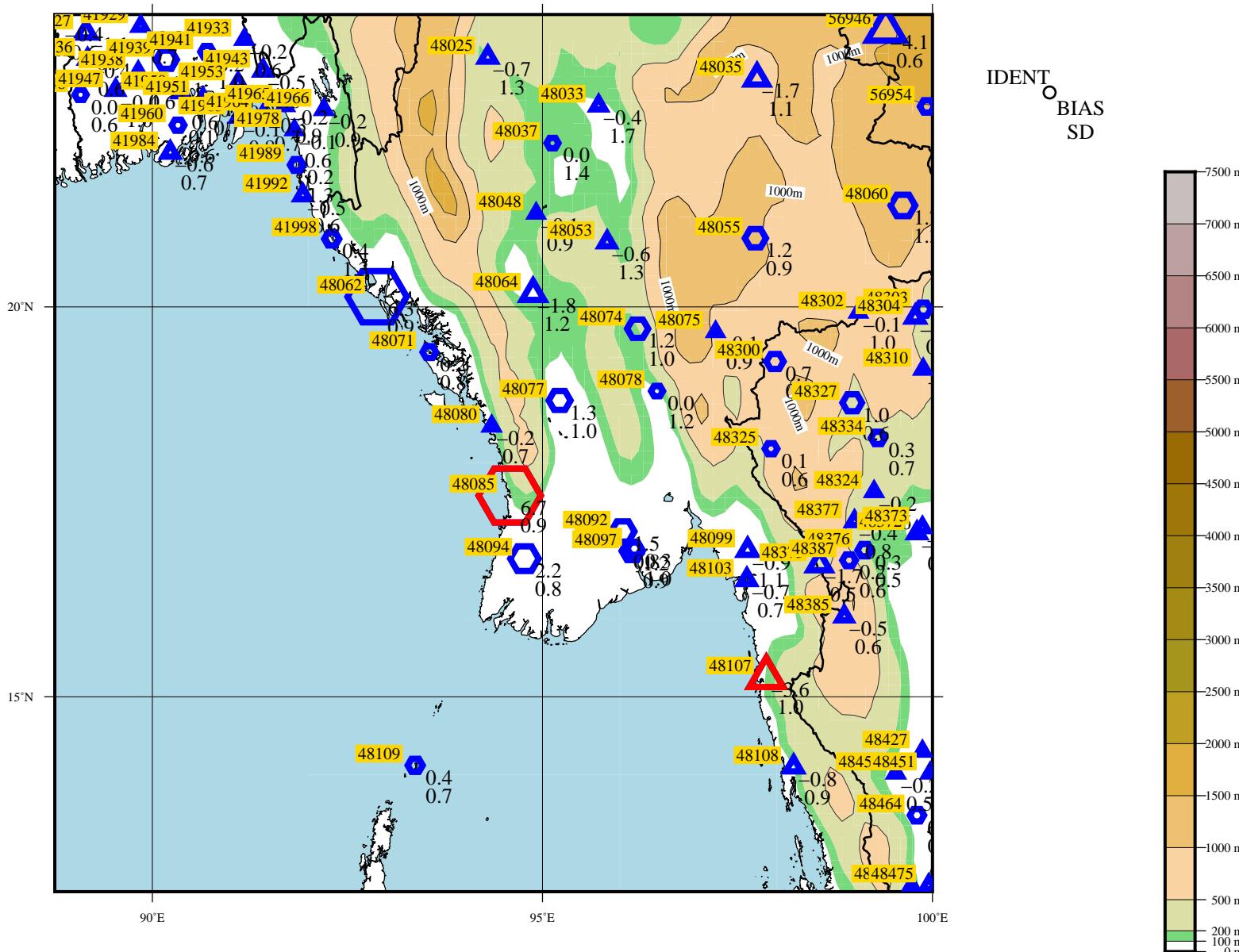


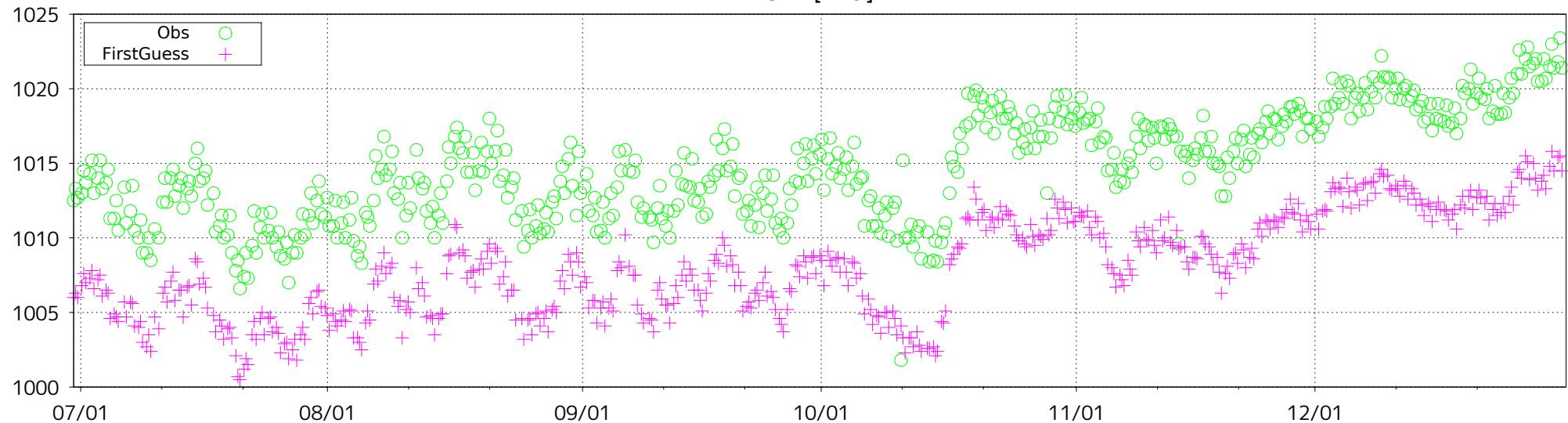
Figure 44 BIAS and SD of SLP for station 48085, 48107 (red) and surrounding stations (blue).

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: 48085 (lat: 17.6N, lon: 94.6E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

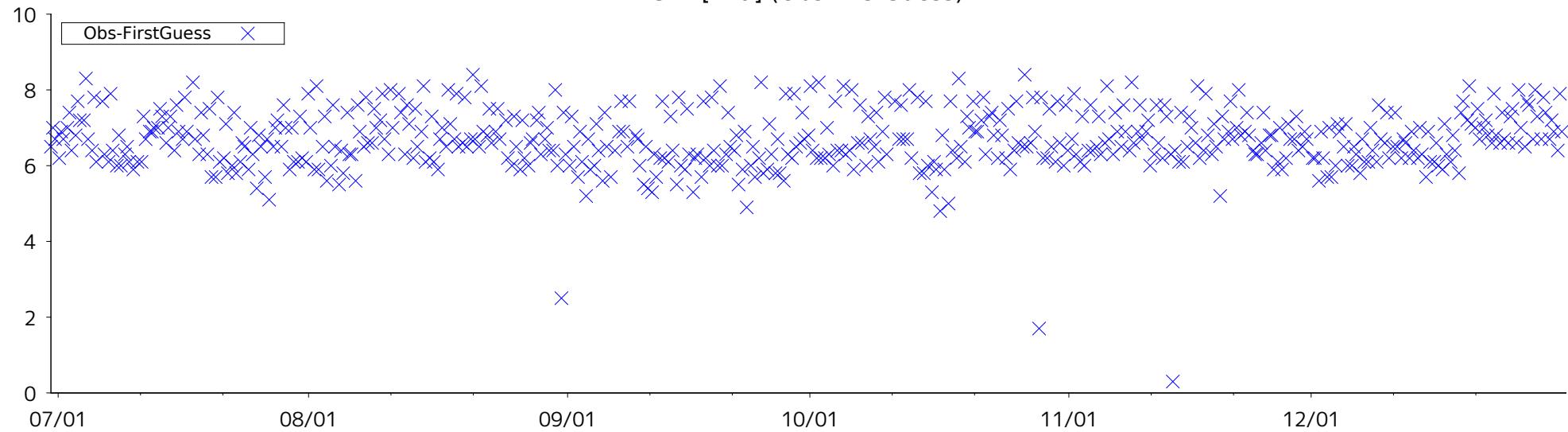
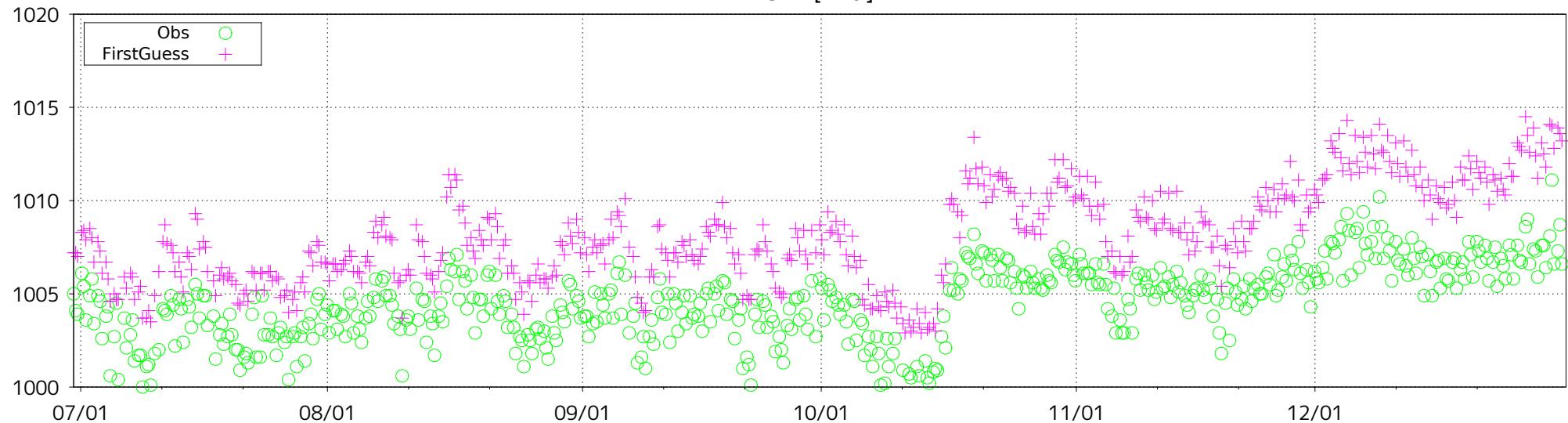


Figure 45 Time-series representation of SLP Obs minus FirstGuess for station 48085

ID: 48107 (lat: 15.3N, lon: 97.9E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

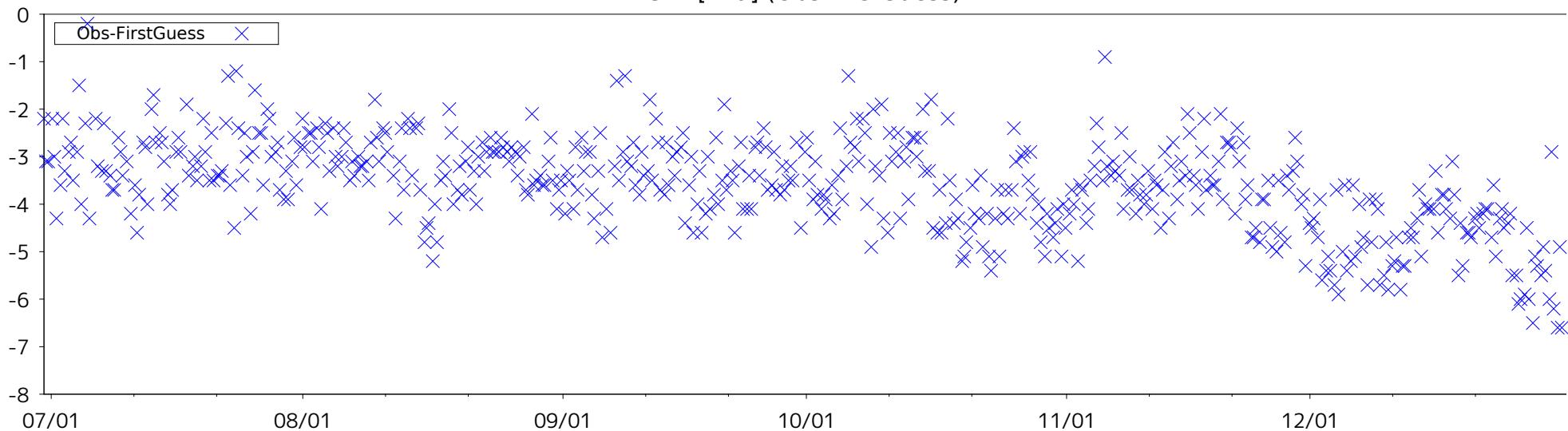
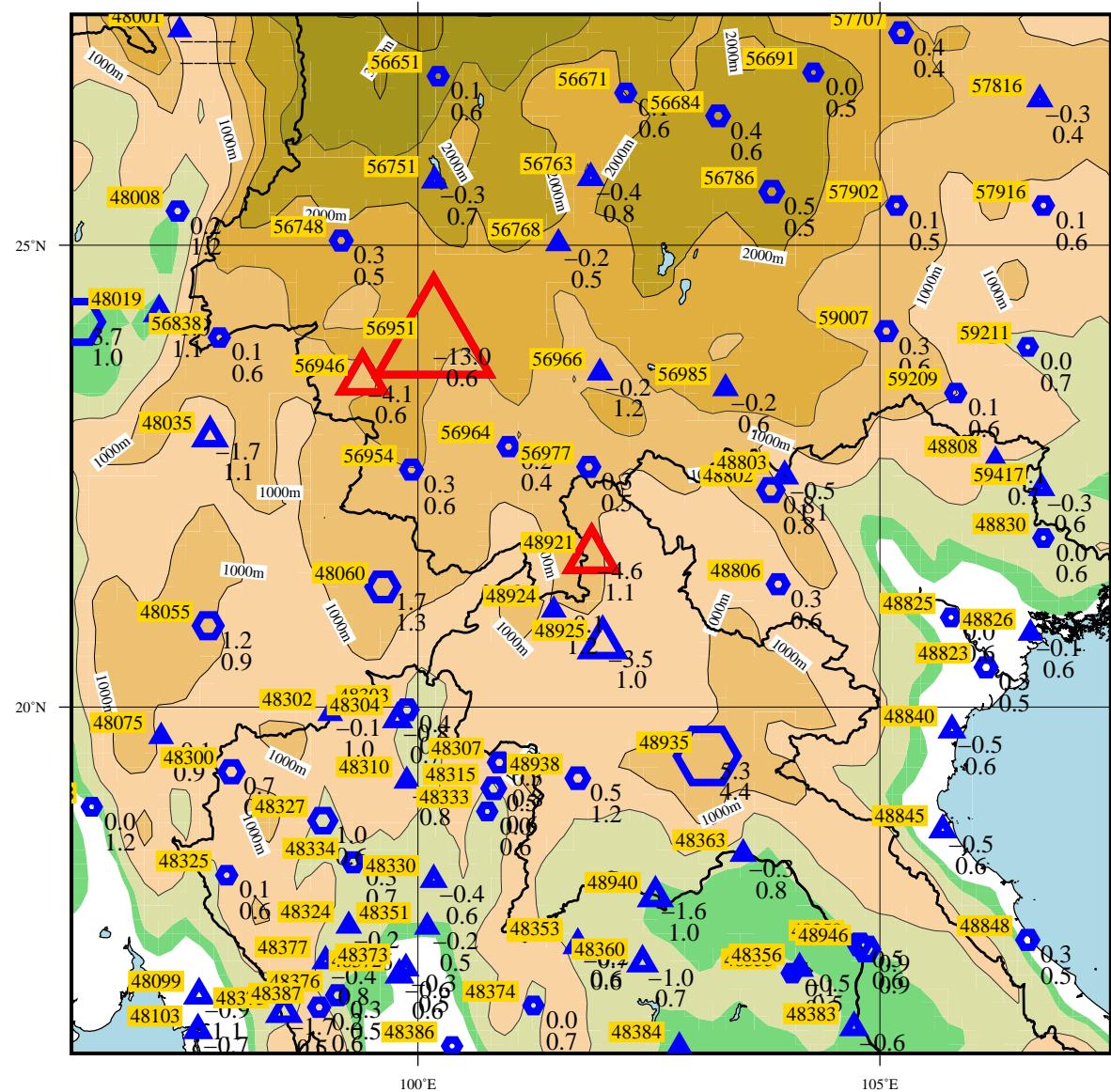


Figure 46 Time-series representation of SLP Obs minus FirstGuess for station 48107

LEVEL = SUR

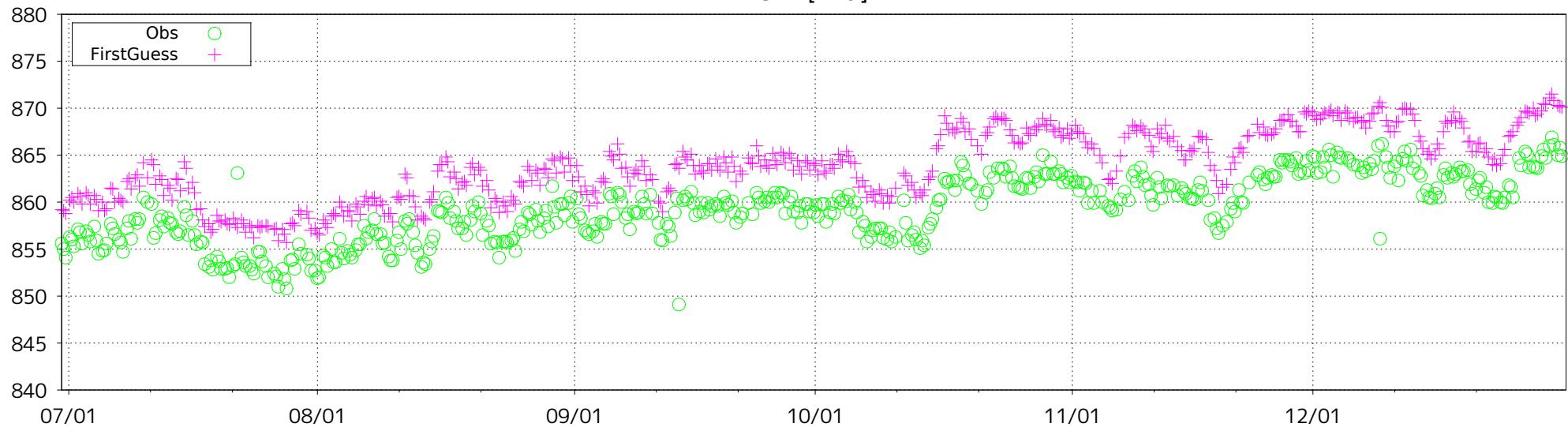
ELEMENT = SLP

2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

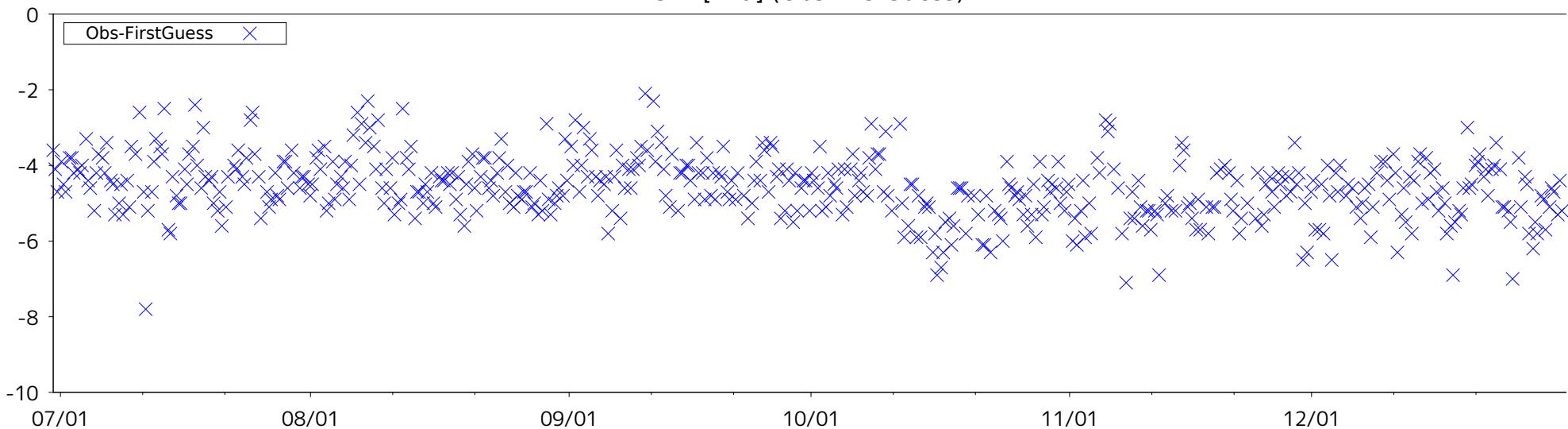
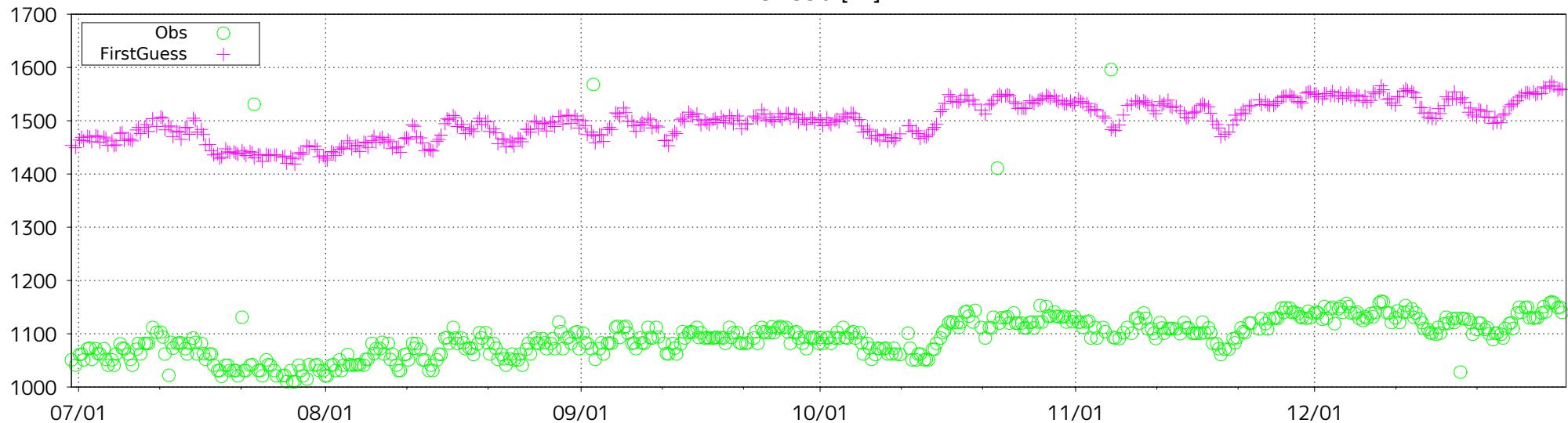


Figure 48(a) Time-series representation of SLP Obs minus FirstGuess for station 48921

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

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

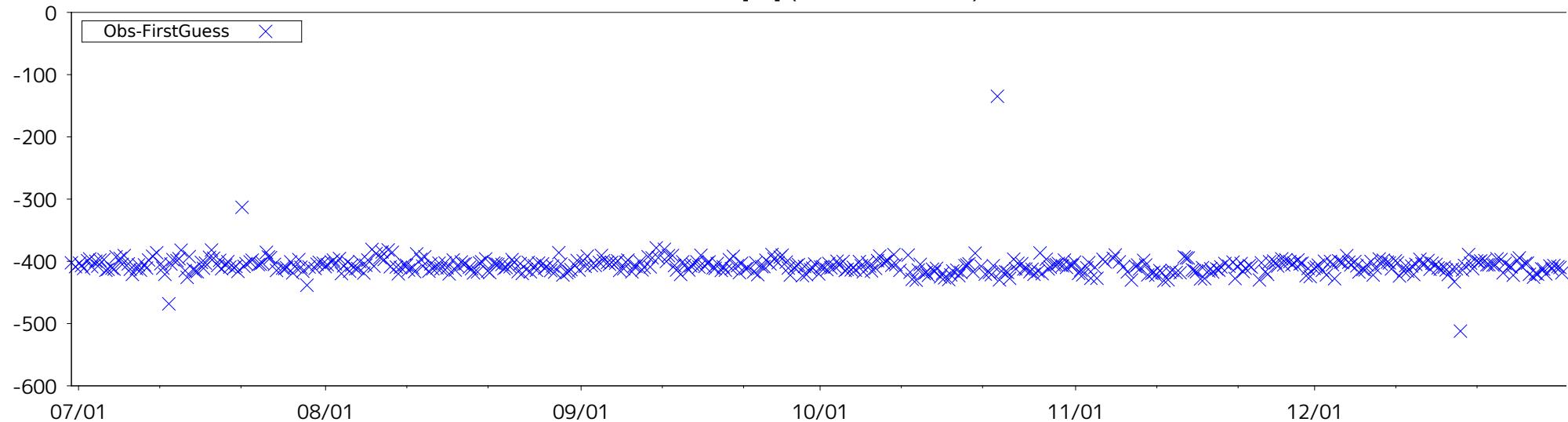
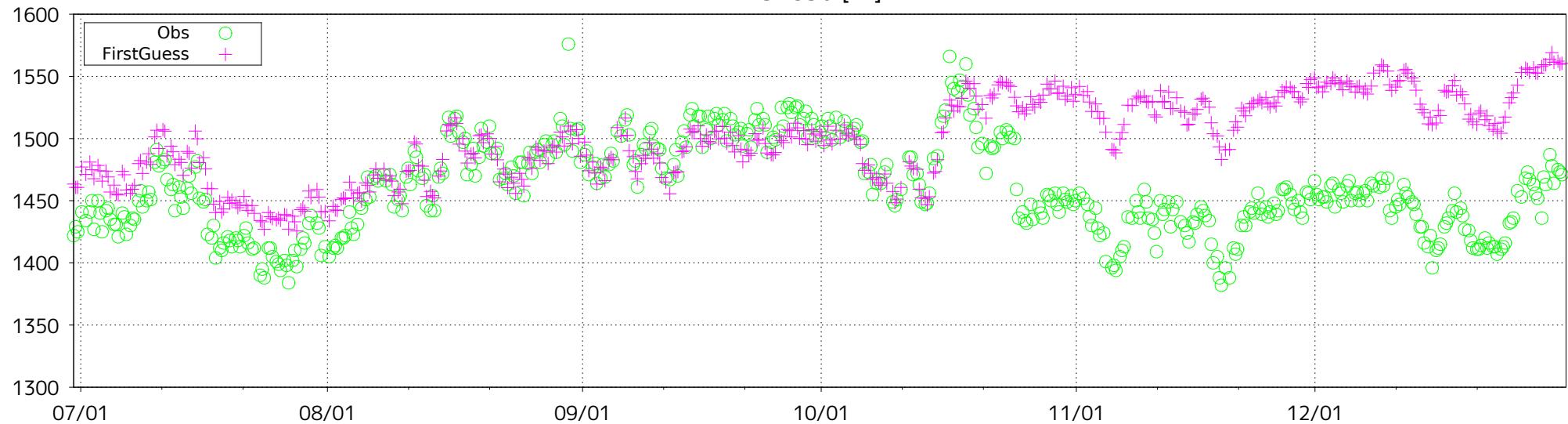


Figure 48(b) Time-series representation of GZ850 Obs minus FirstGuess for station 48921

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

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

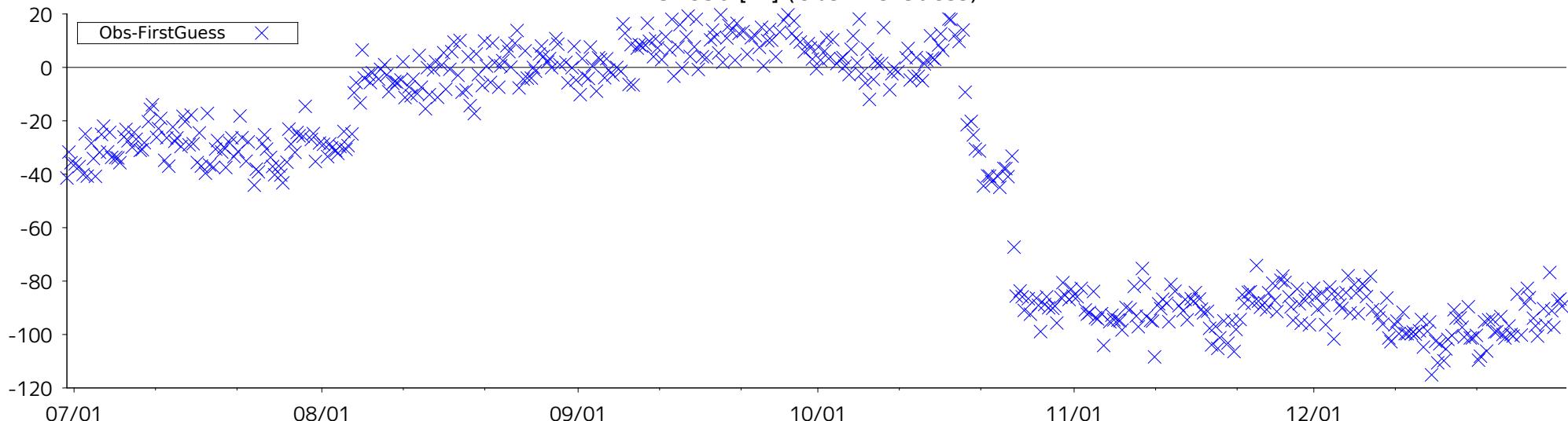
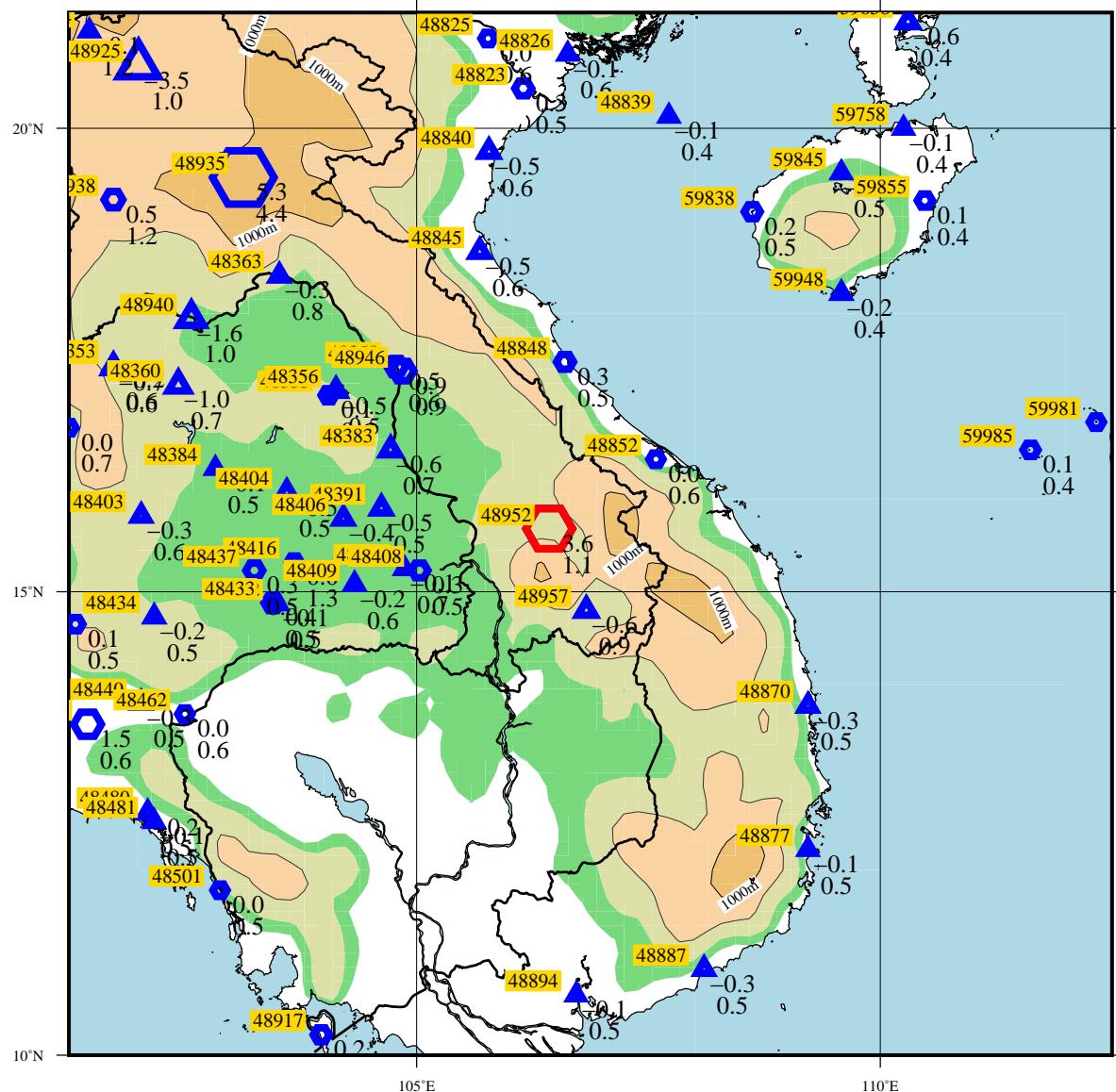


Figure 49 Time-series representation of GZ850 Obs minus FirstGuess for station 48935

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

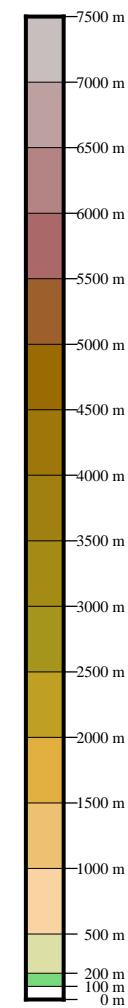


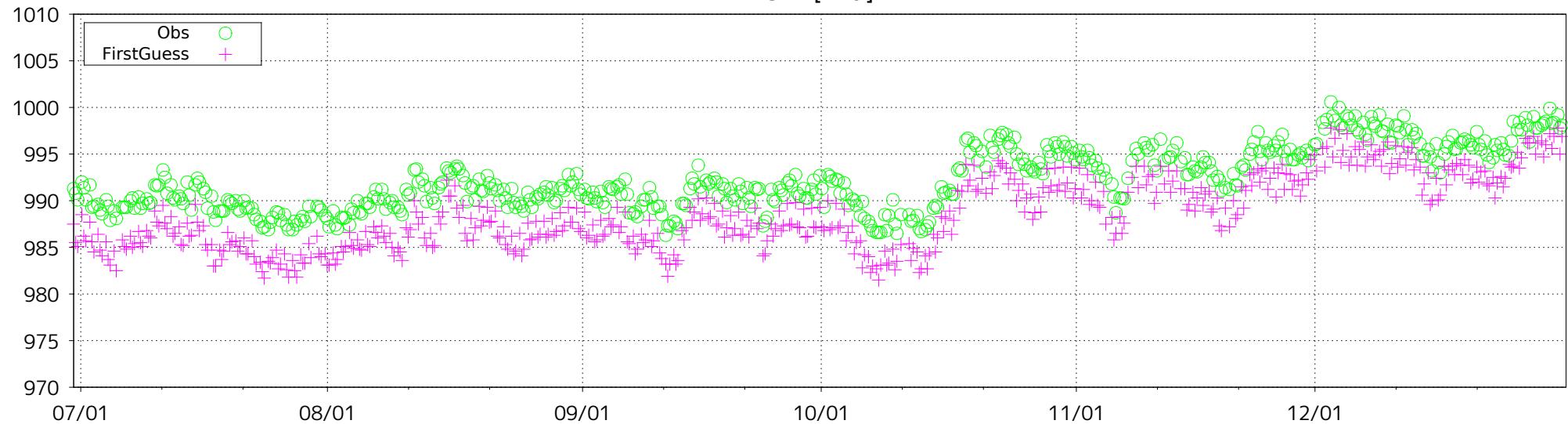
Figure 50 BIAS and SD of SLP for station 48952 (red) and surrounding stations (blue).

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

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

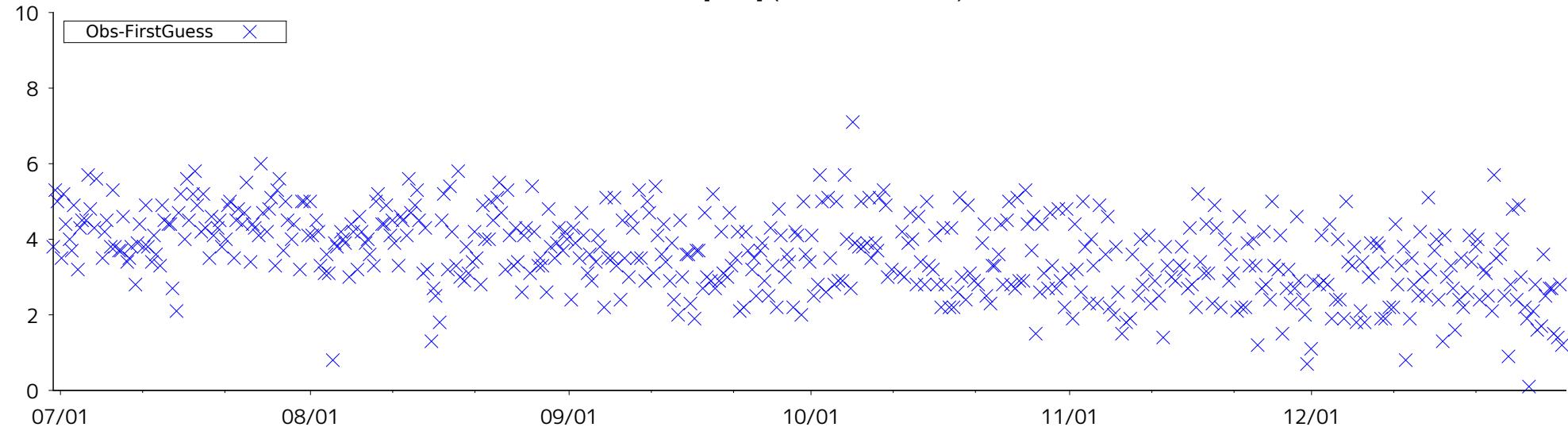
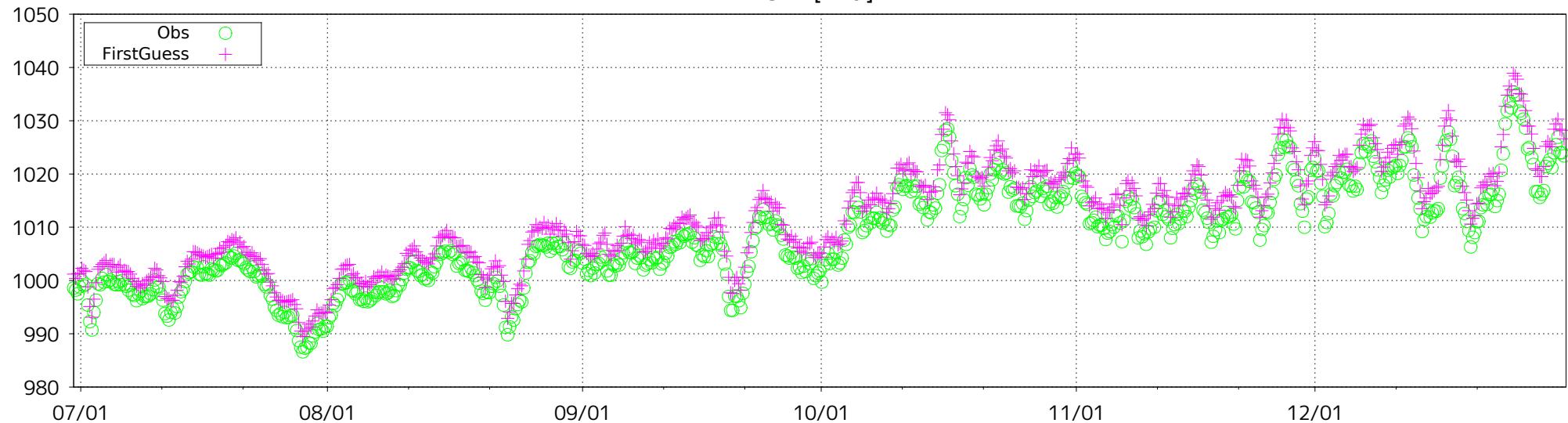


Figure 51 Time-series representation of SLP Obs minus FirstGuess for station 48952

ID: 54945 (lat: 35.5N, lon: 119.6E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

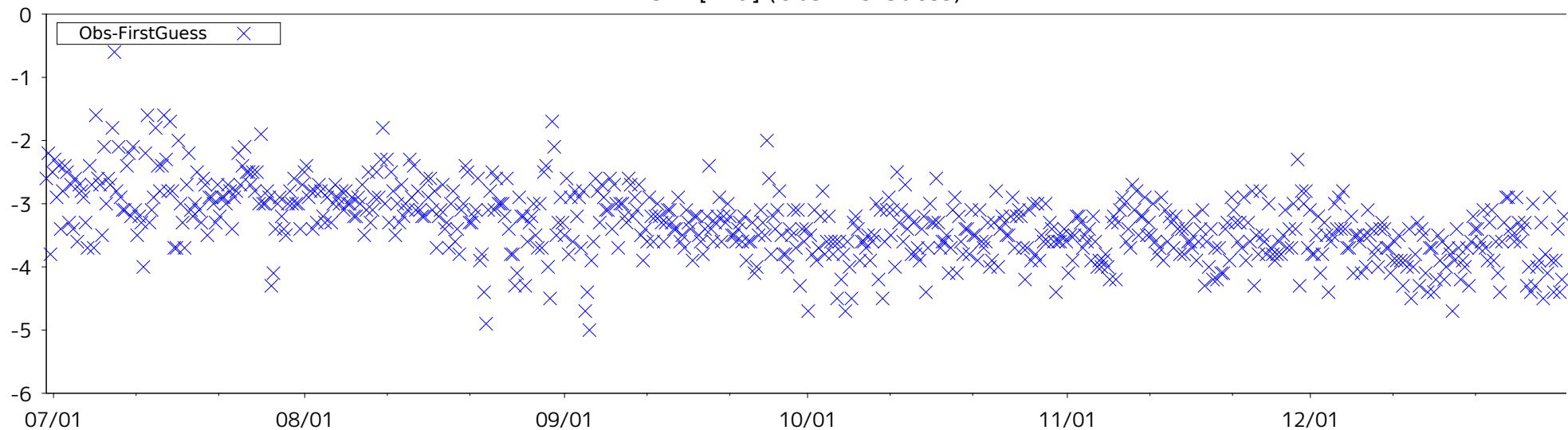
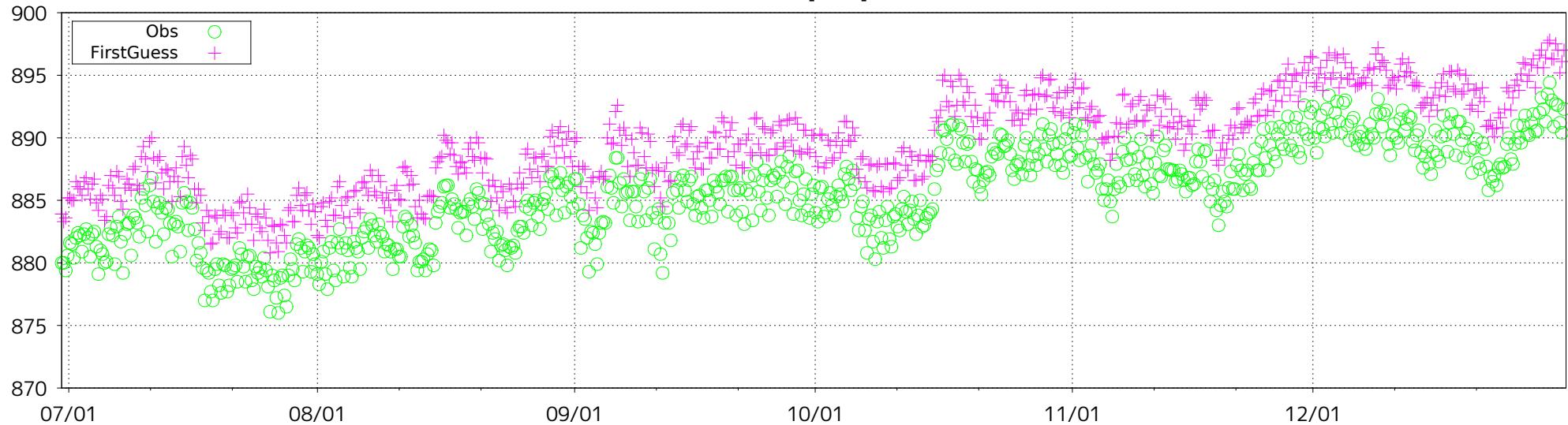


Figure 52 Time-series representation of SLP Obs minus FirstGuess for station 54945

ID: 56946 (lat: 23.6N, lon: 99.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

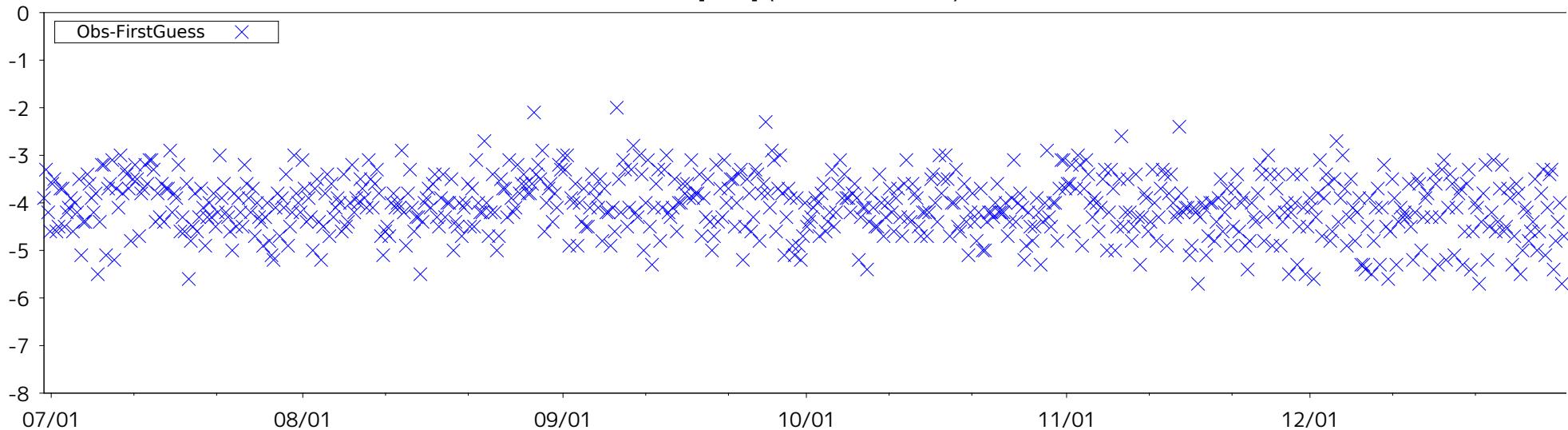
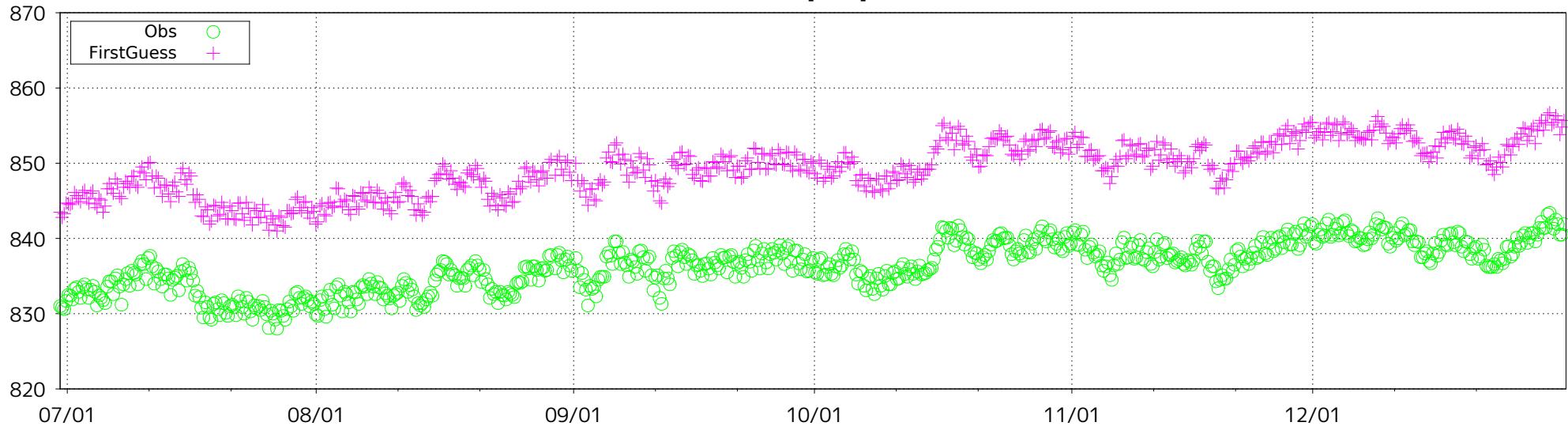


Figure 53 Time-series representation of SLP Obs minus FirstGuess for station 56946

ID: 56951 (lat: 24.0N, lon: 100.2E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

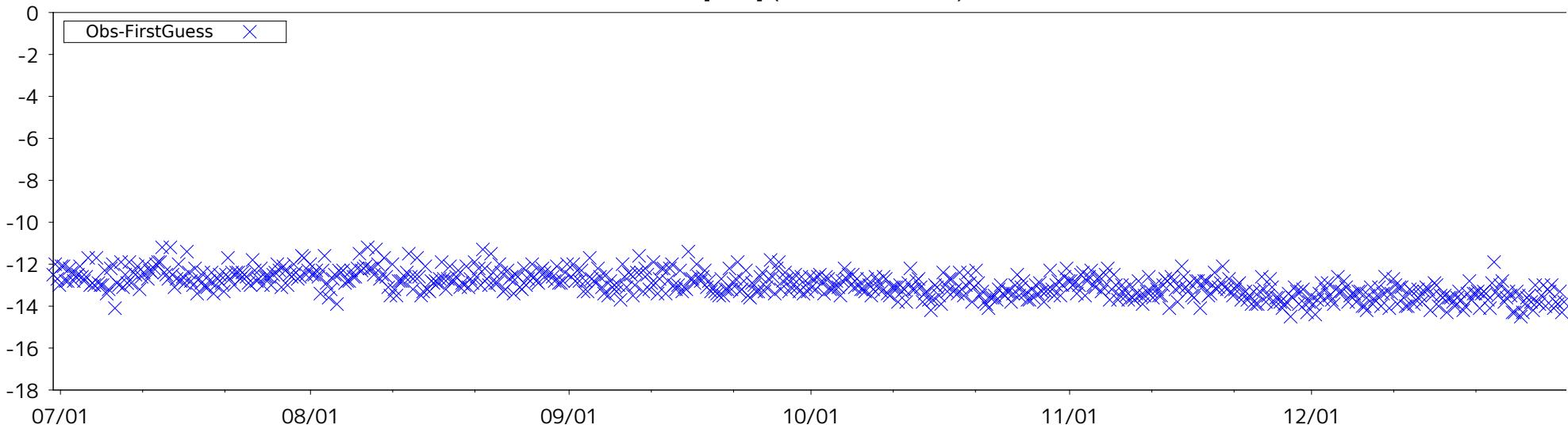
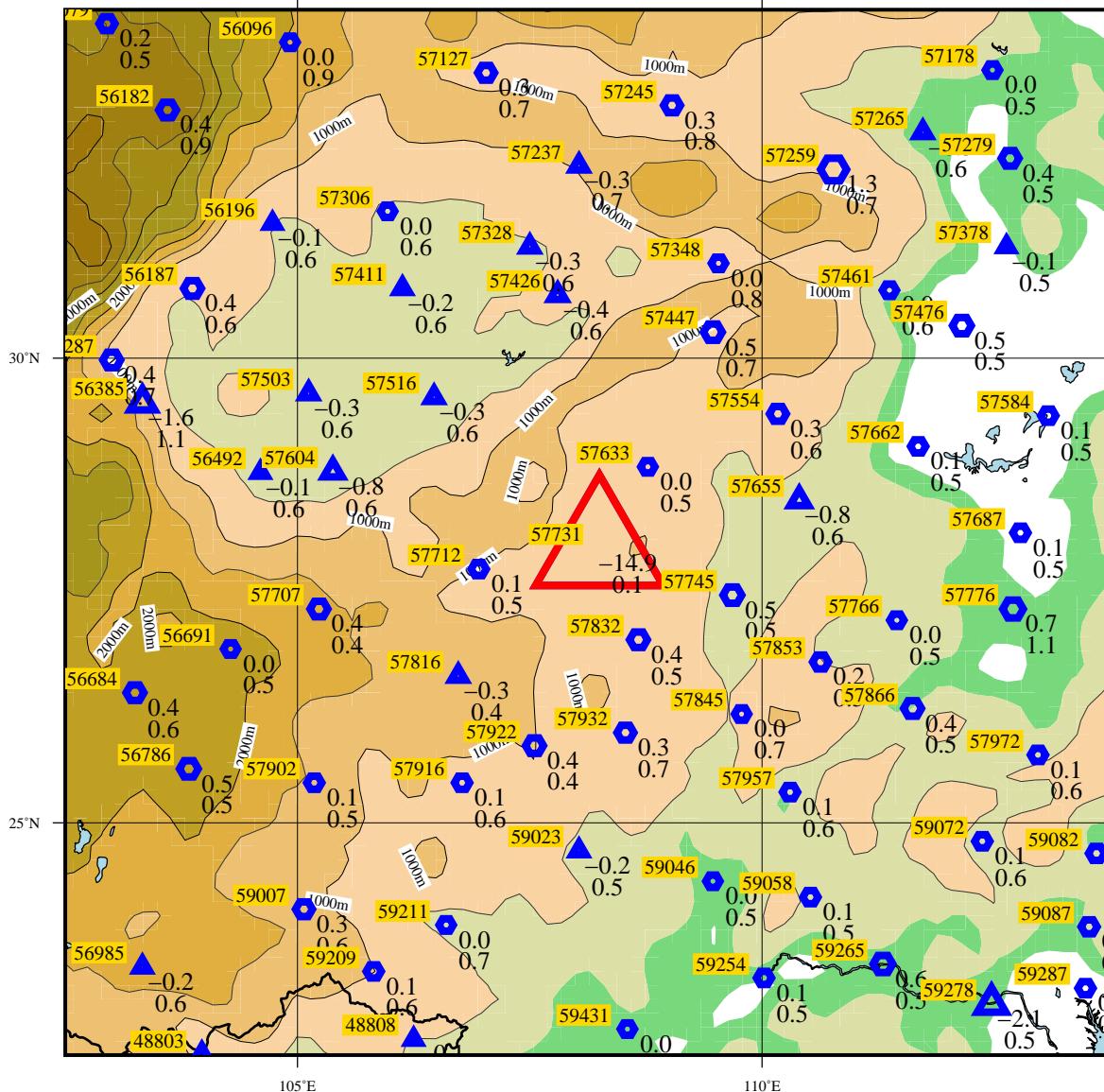


Figure 54 Time-series representation of SLP Obs minus FirstGuess for station 56951

LEVEL = SUR

ELEMENT = SLP

2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

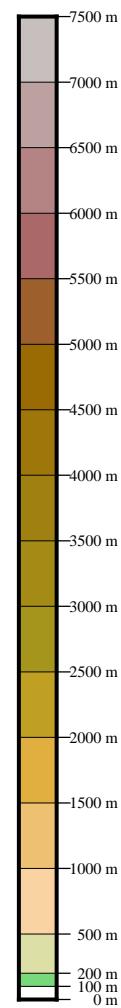


Figure 55 BIAS and SD of SLP for station 57731 (red) and surrounding stations (blue).

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.

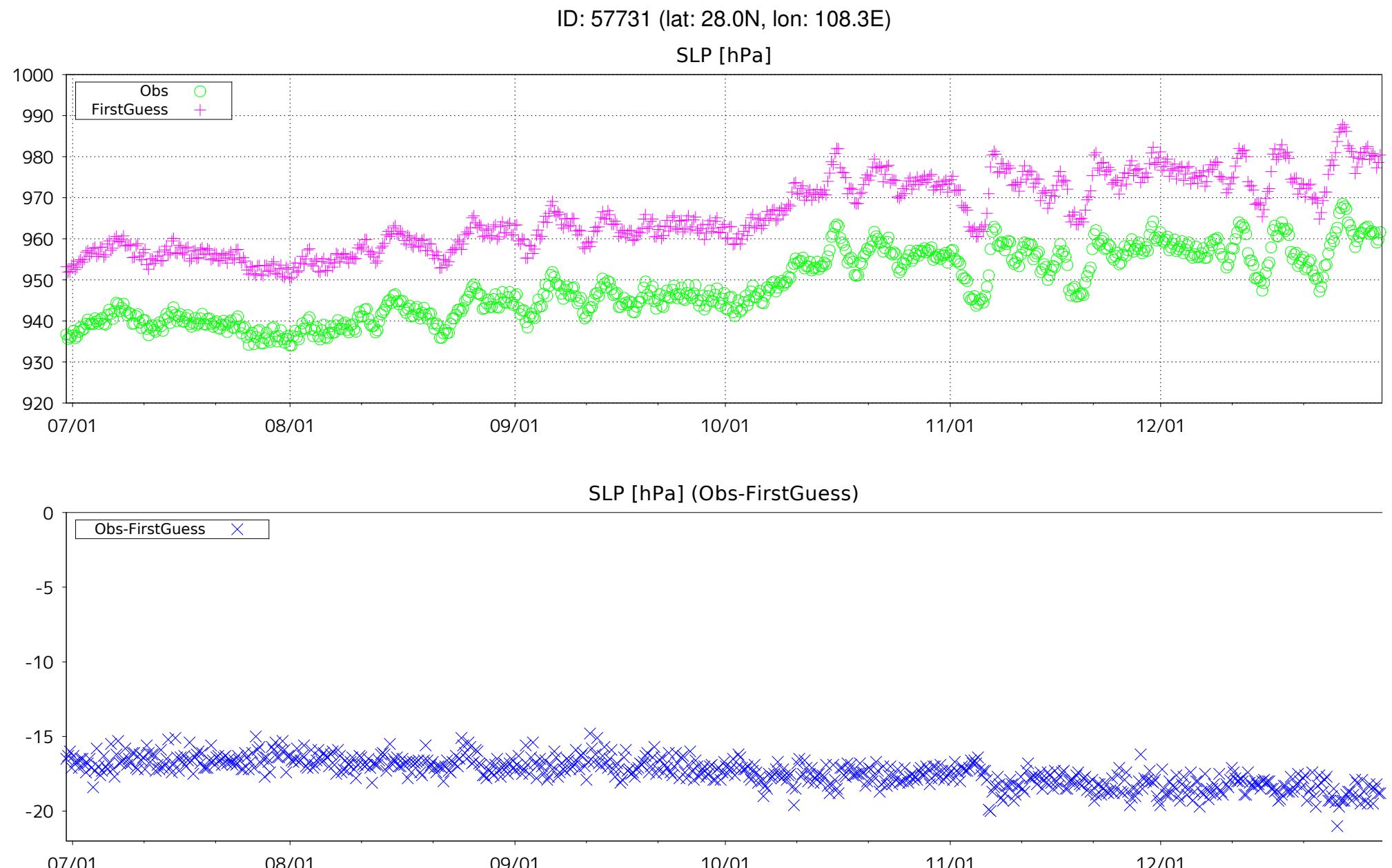
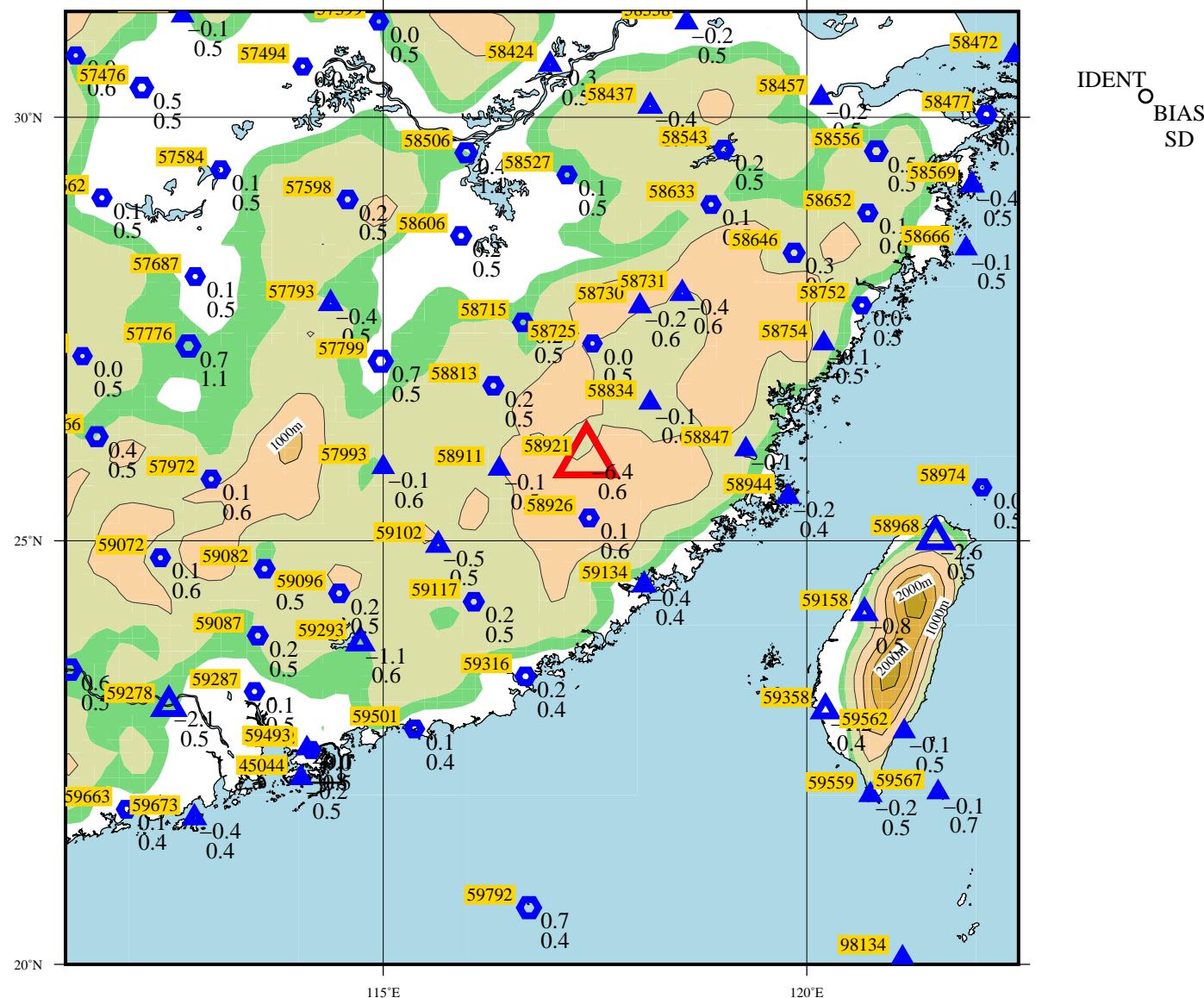


Figure 56 Time-series representation of SLP Obs minus FirstGuess for station 57731

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

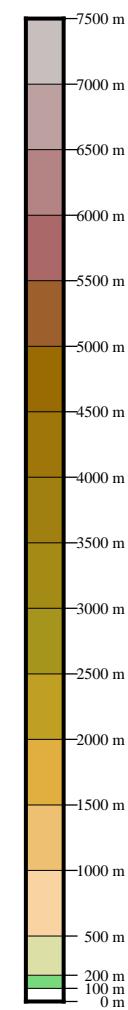


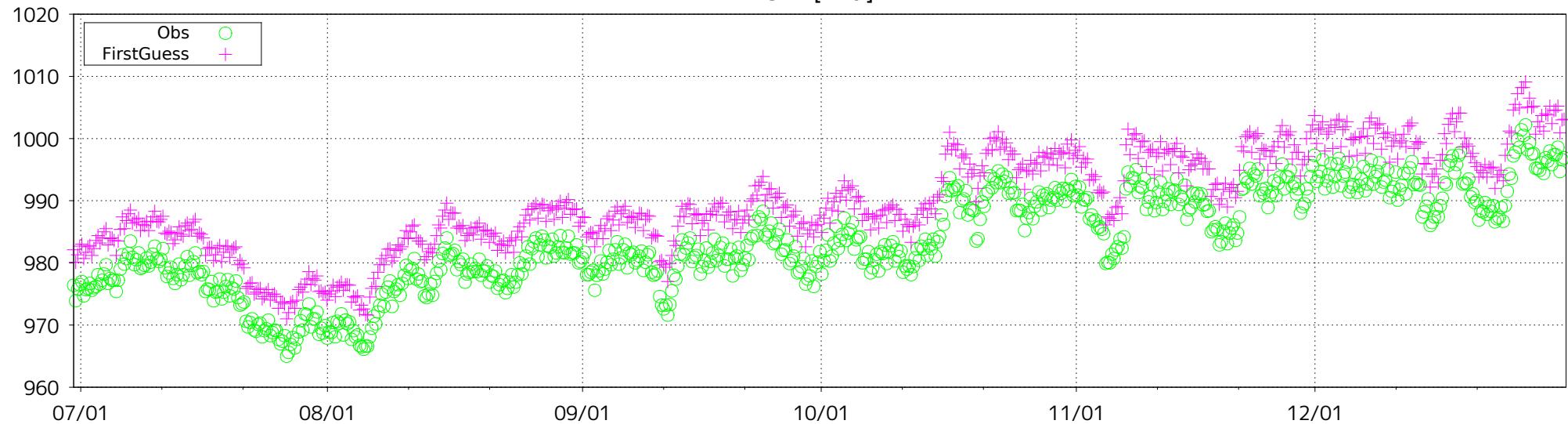
Figure 57 BIAS and SD of SLP for station 58921 (red) and surrounding stations (blue).

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: 58921 (lat: 26.0N, lon: 117.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

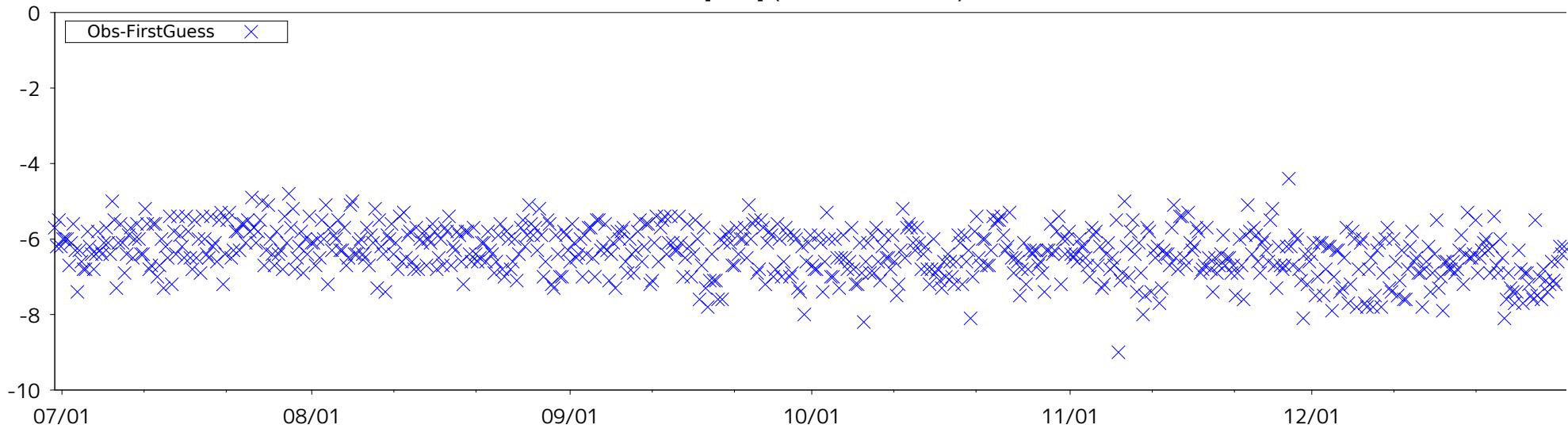
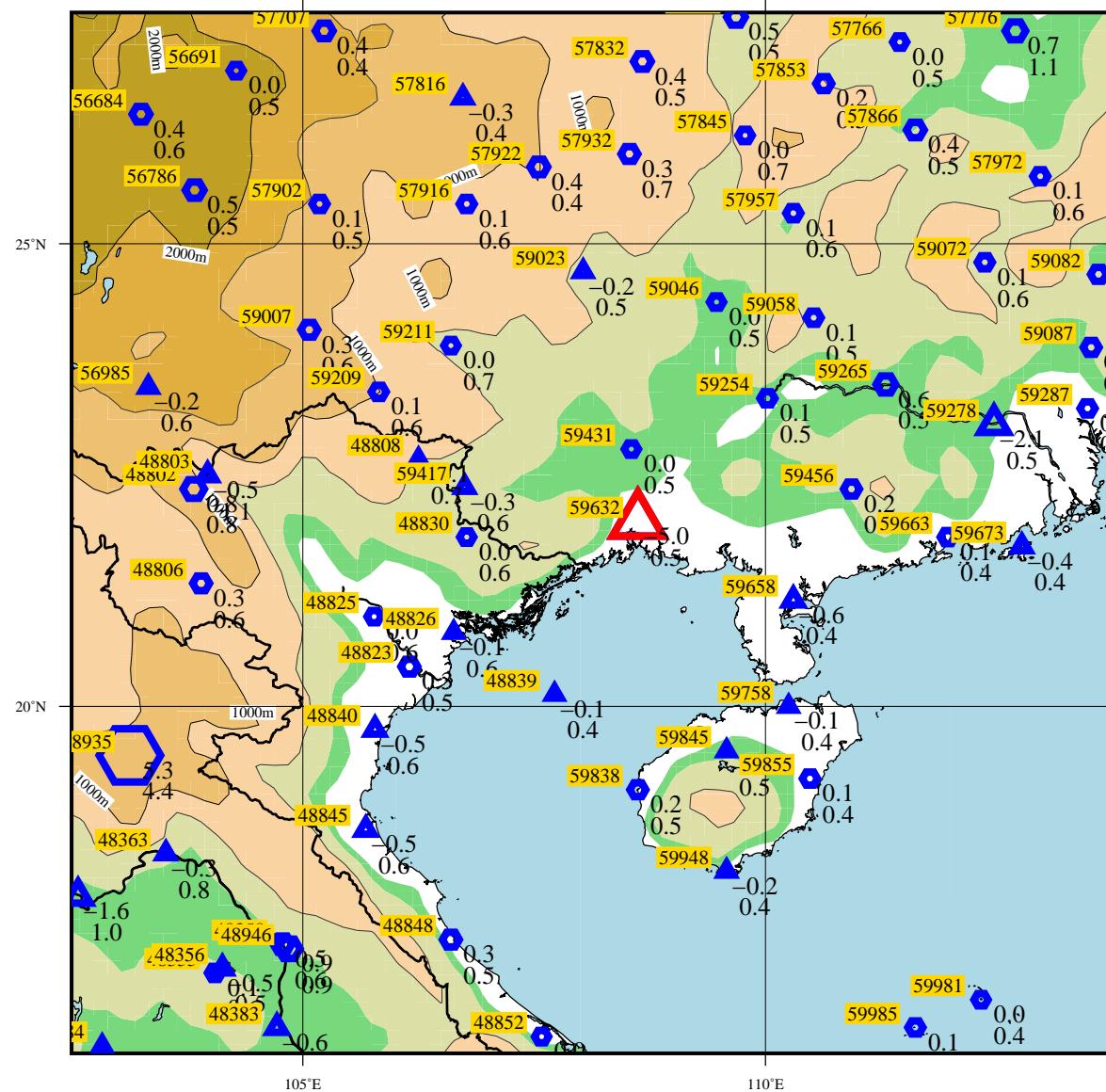


Figure 58 Time-series representation of SLP Obs minus FirstGuess for station 58921

LEVEL = SUR

ELEMENT = SLP

2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)



IDENT
BIAS
SD

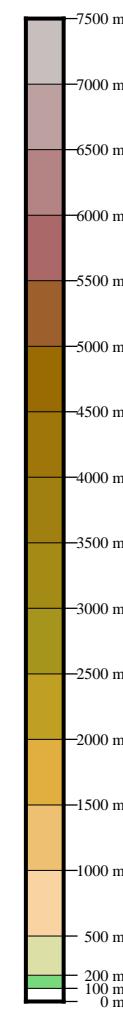


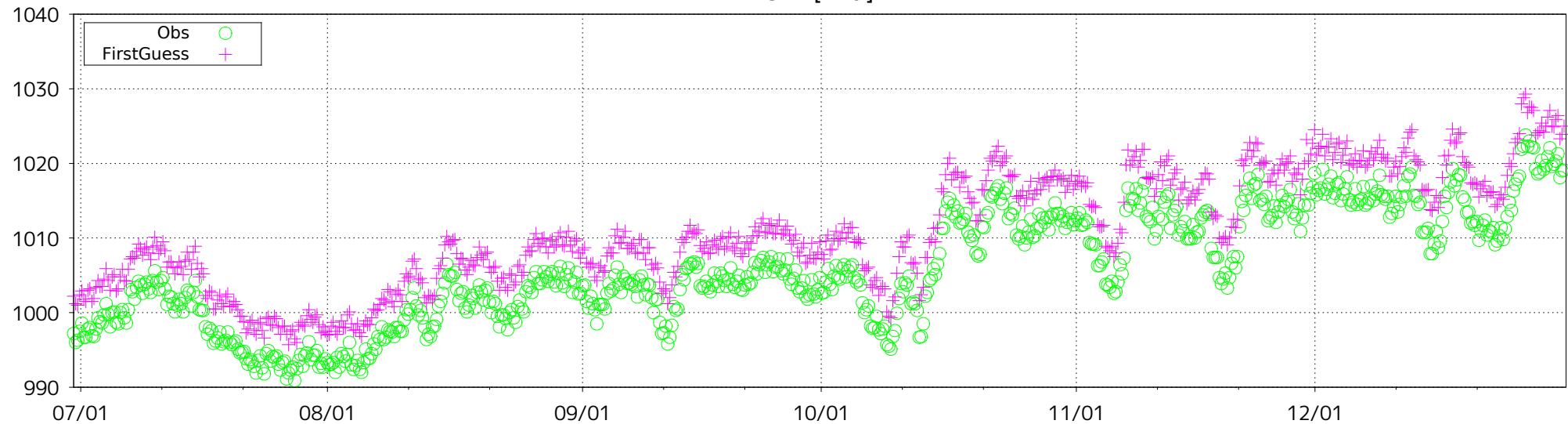
Figure 59 BIAS and SD of SLP for station 59632 (red) and surrounding stations (blue).

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: 59632 (lat: 22.0N, lon: 108.6E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

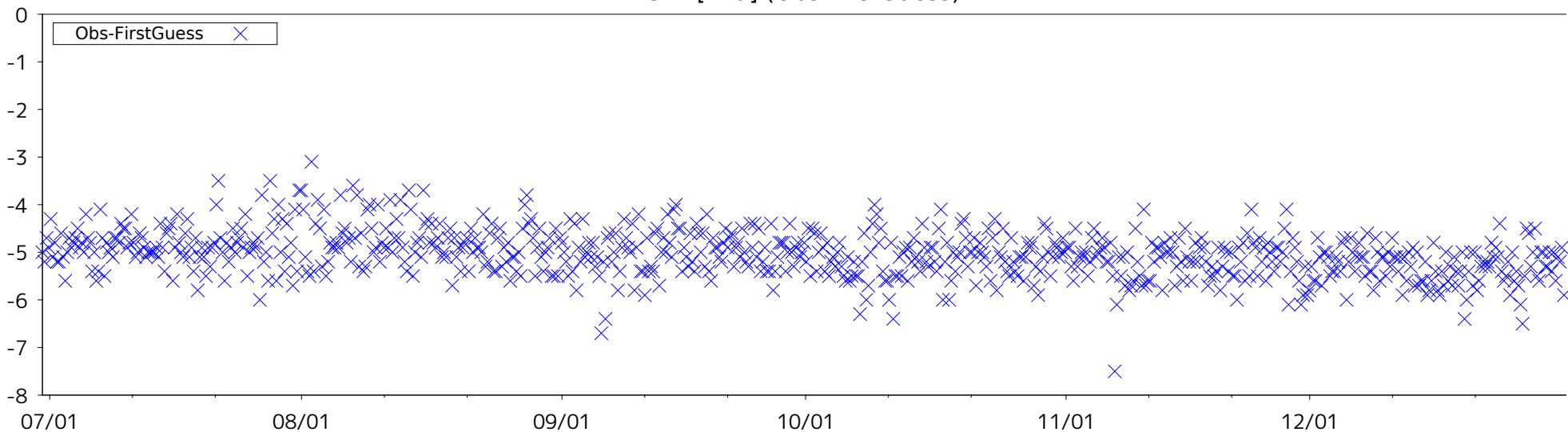
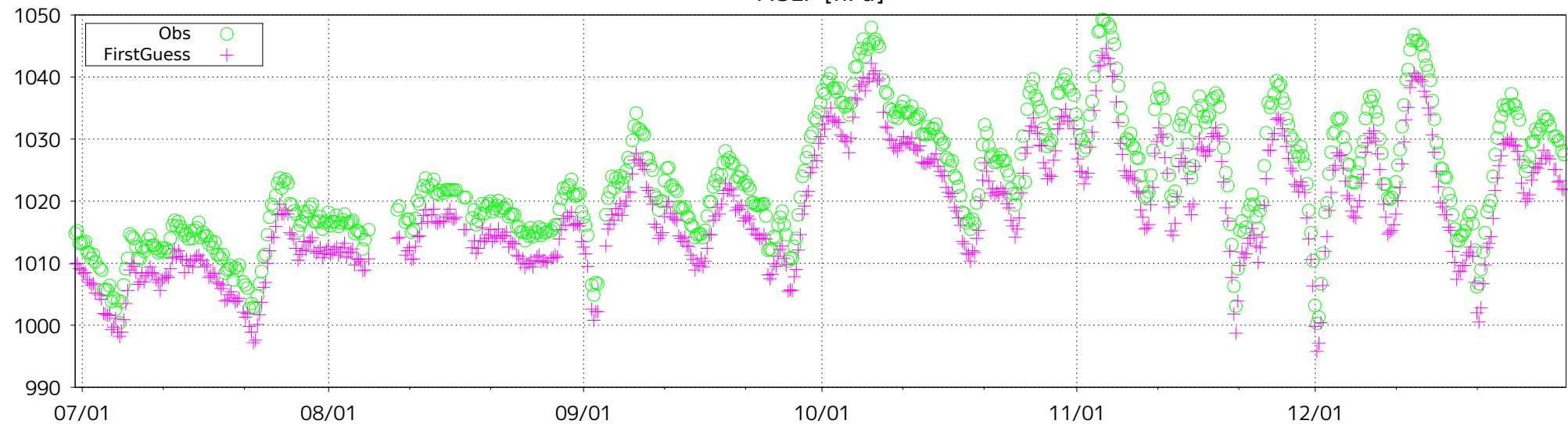


Figure 60 Time-series representation of SLP Obs minus FirstGuess for station 59632

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

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

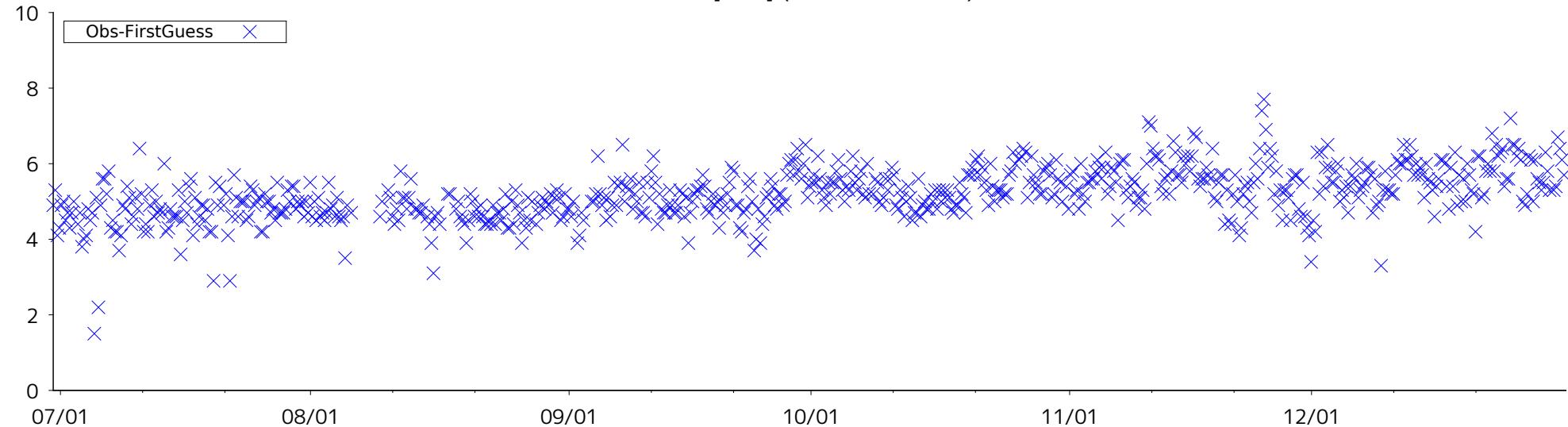
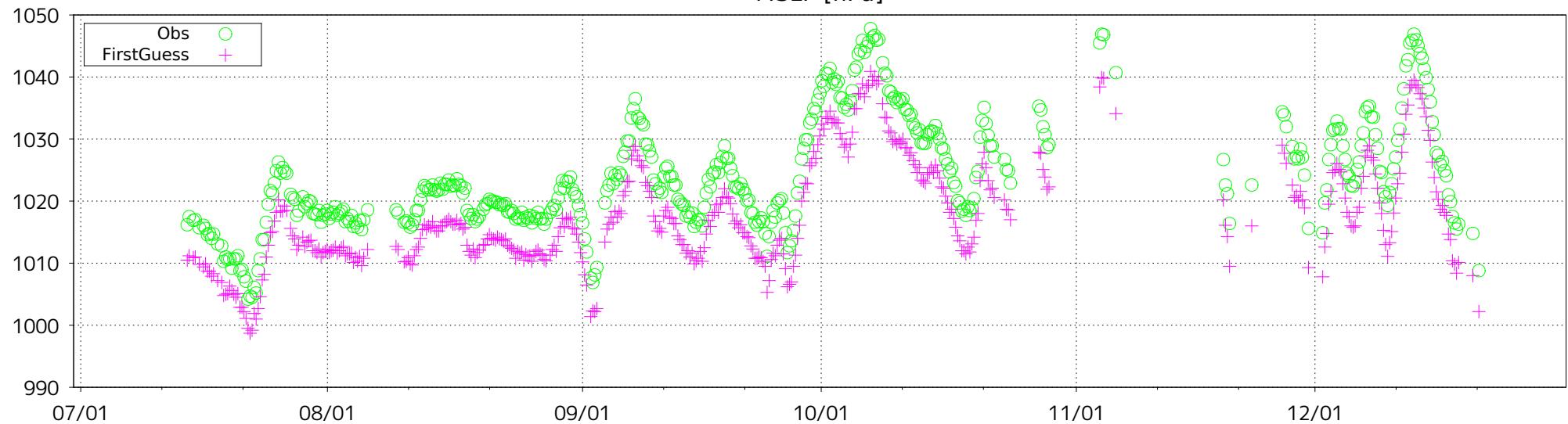


Figure 61 Time-series representation of MSLP Obs minus FirstGuess for station 35615

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

MSLP [hPa]



MSLP [hPa] (Obs-FirstGuess)

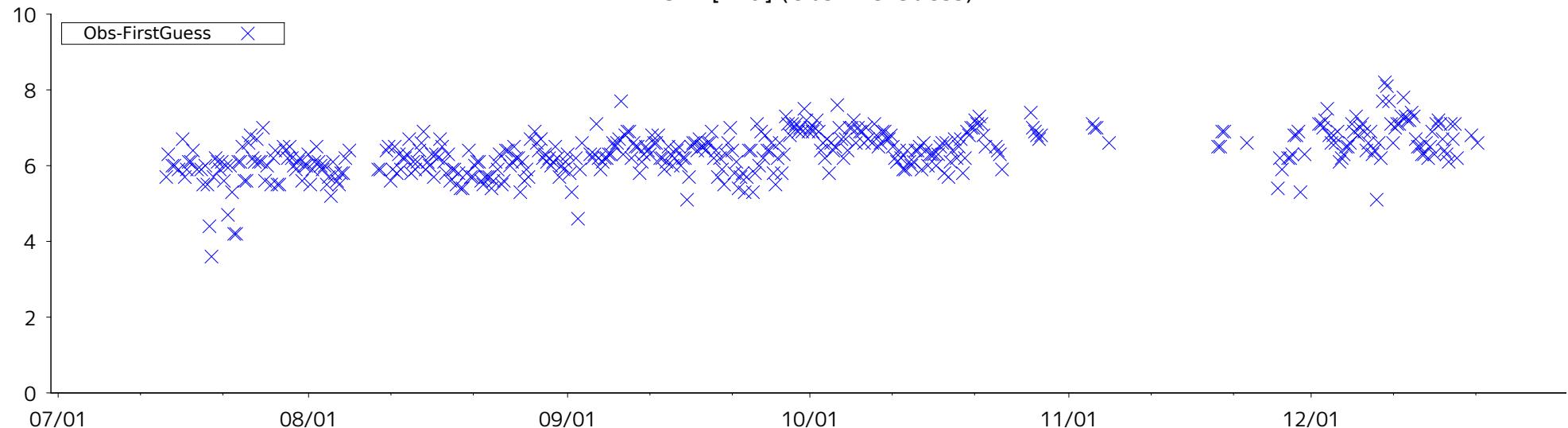


Figure 62 Time-series representation of MSLP Obs minus FirstGuess for station 35701

LEVEL = SUR ELEMENT = SLP
 2021 07 01 00 UTC → 2021 12 31 18 UTC (184 DAYS)

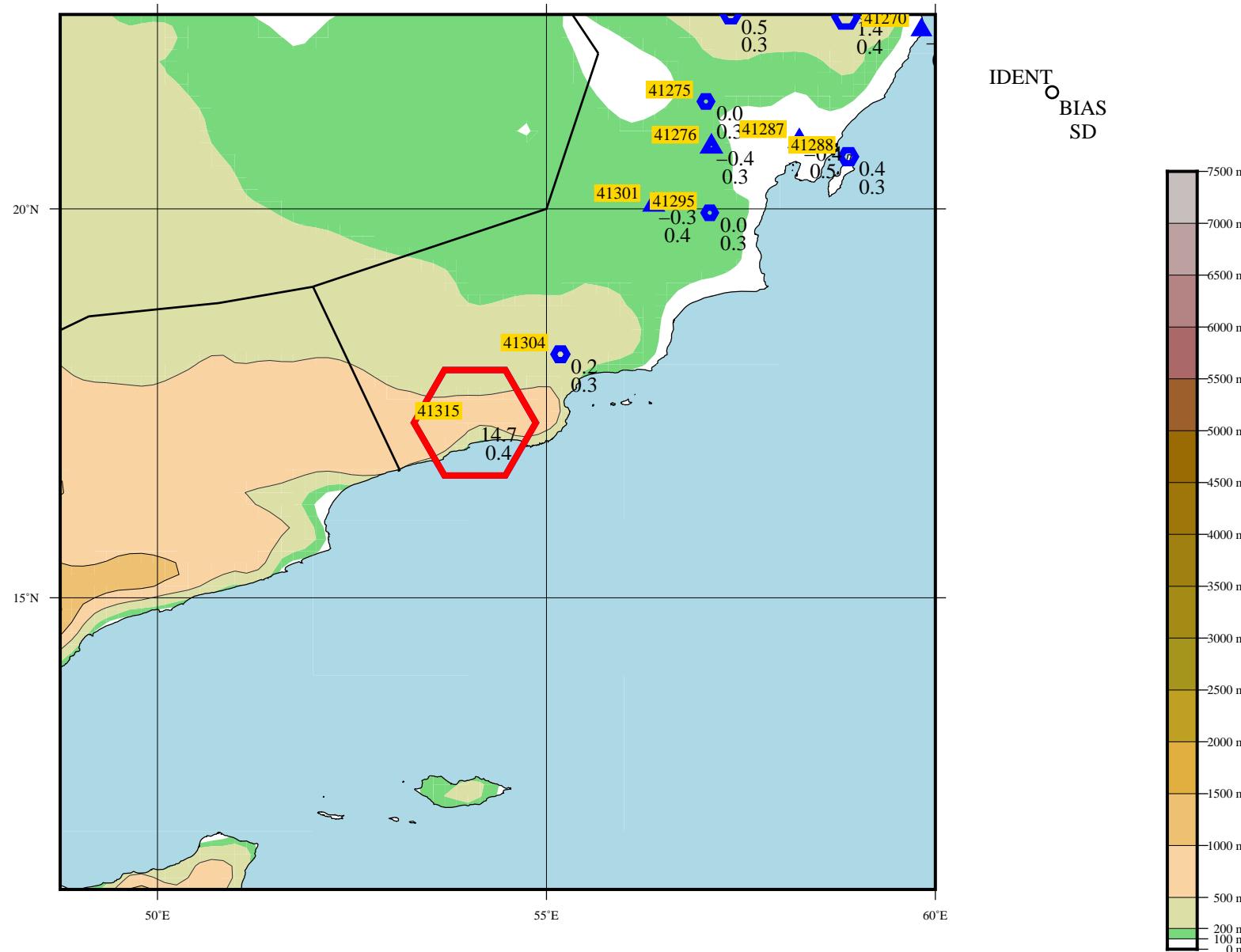


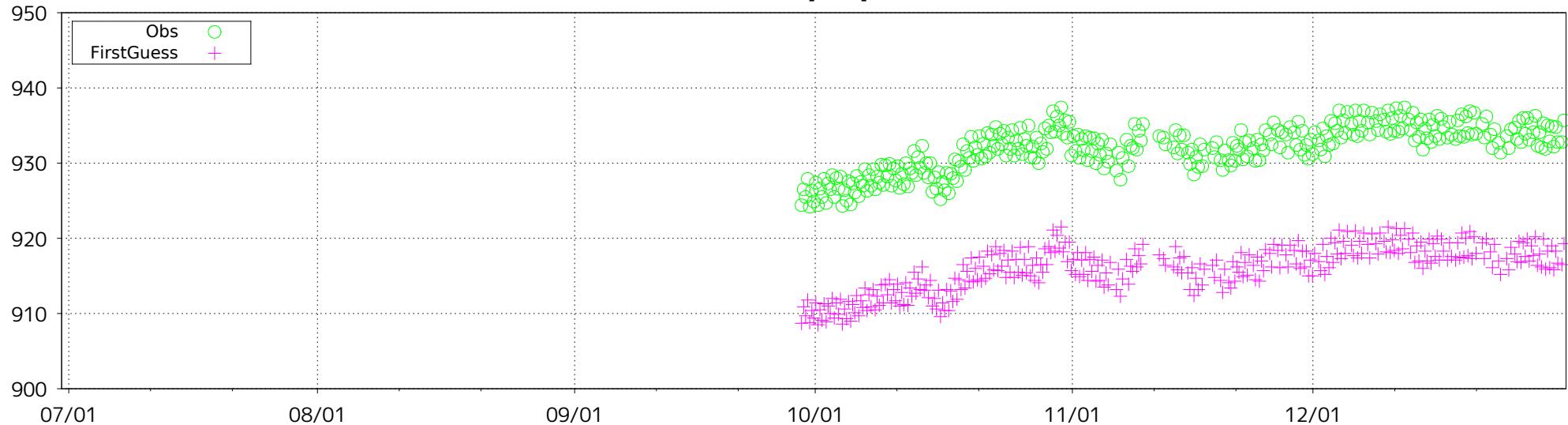
Figure 63 BIAS and SD of SLP for station 41315 (red) and surrounding stations (blue).

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)

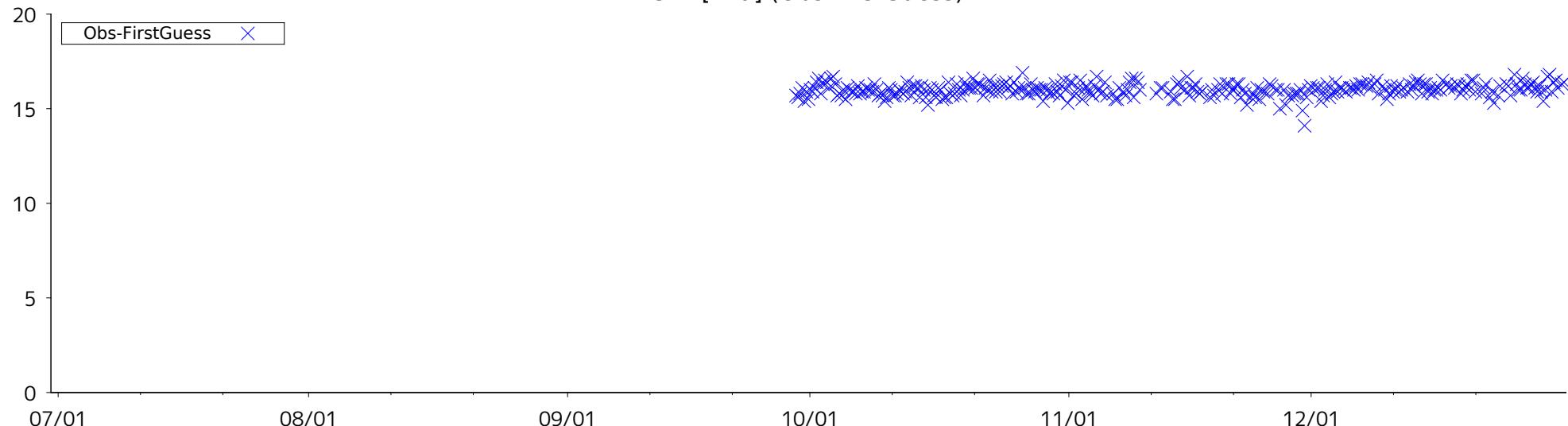
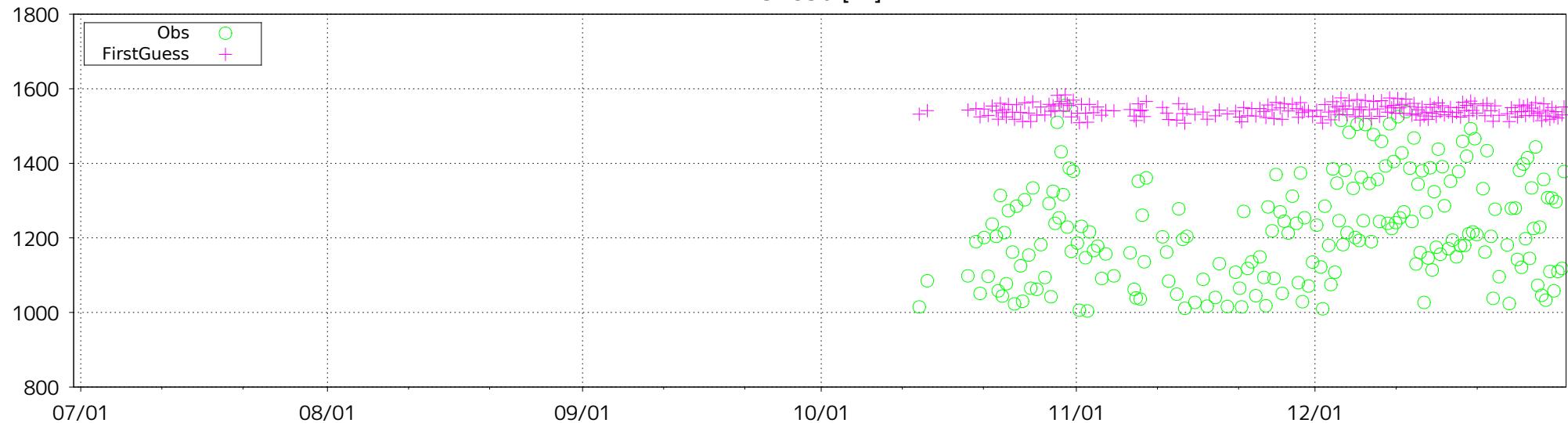


Figure 64(a) Time-series representation of SLP Obs minus FirstGuess for station 41315

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

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

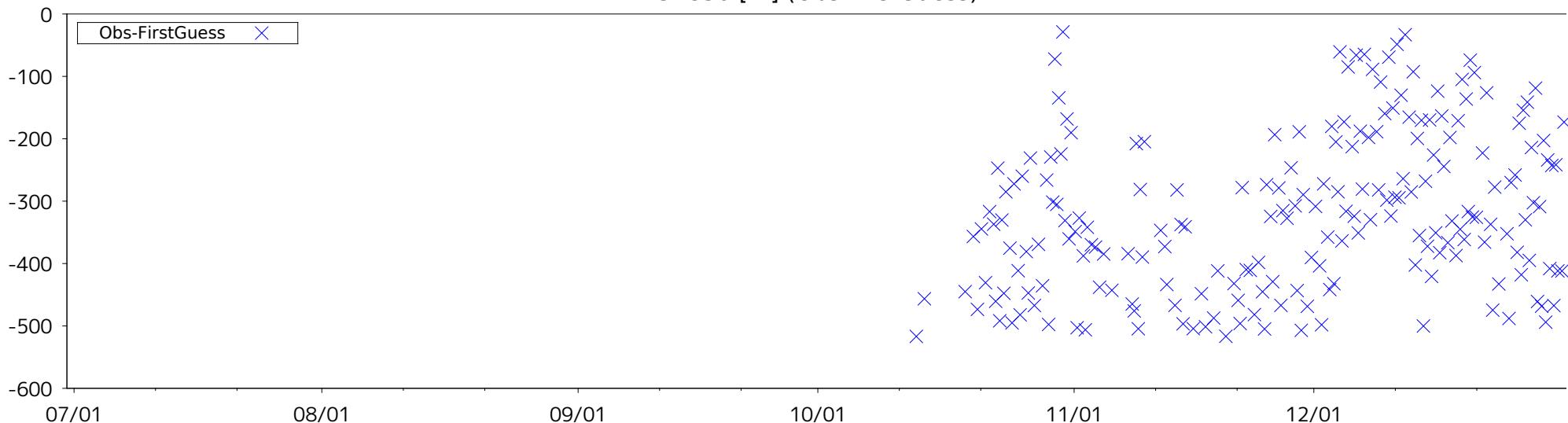
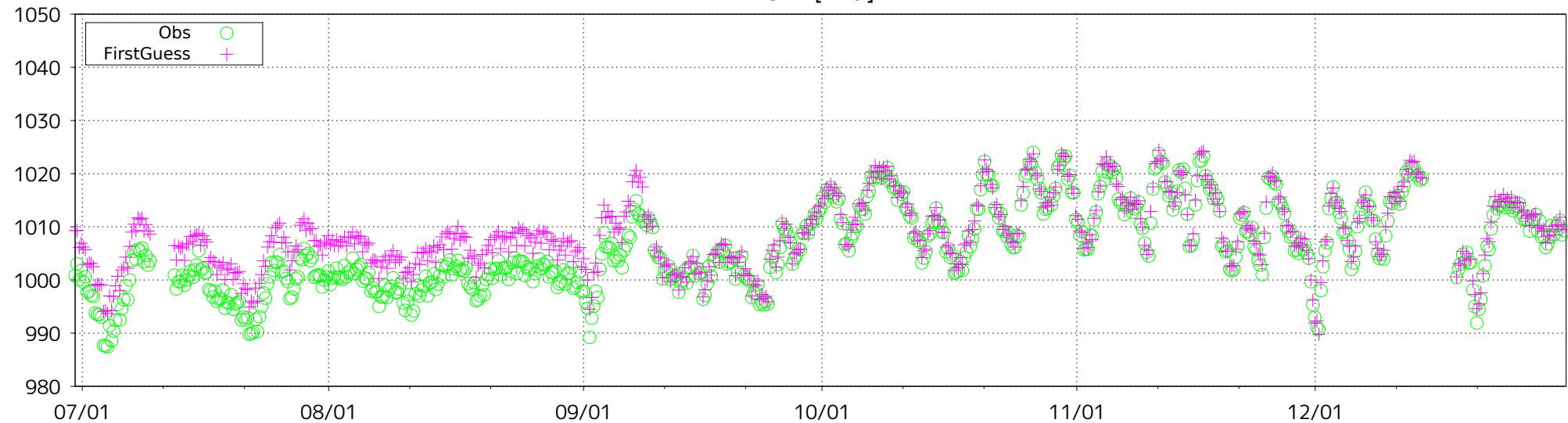


Figure 64(b) Time-series representation of GZ850 Obs minus FirstGuess for station 41315

ID: 40700 (lat: 39.6N, lon: 47.9E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

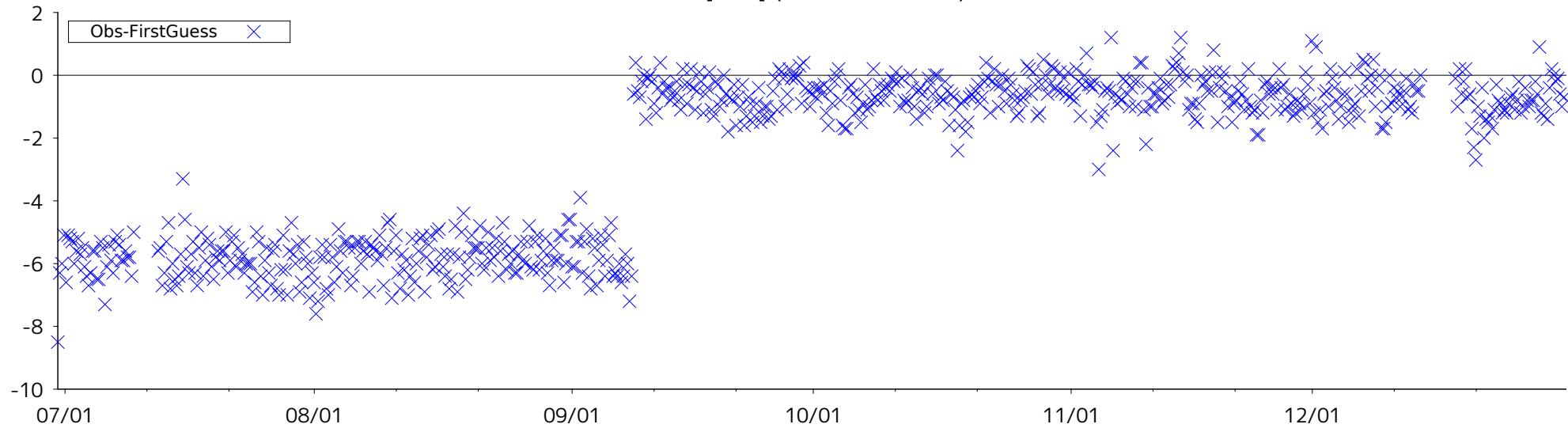
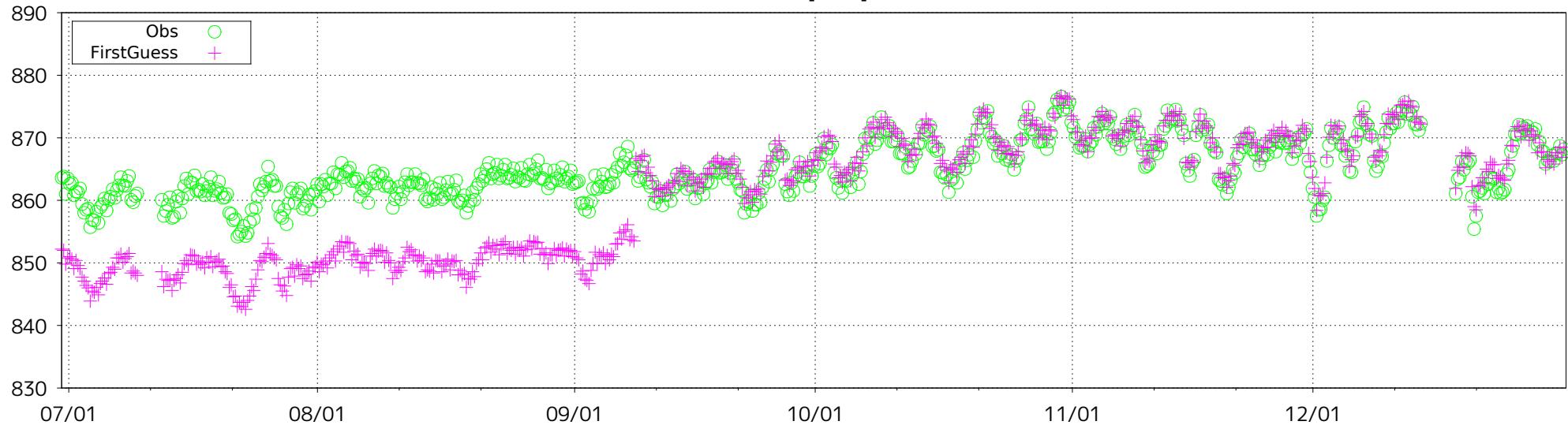


Figure 65 Time-series representation of SLP Obs minus FirstGuess for station 40700

ID: 40713 (lat: 37.4N, lon: 46.2E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

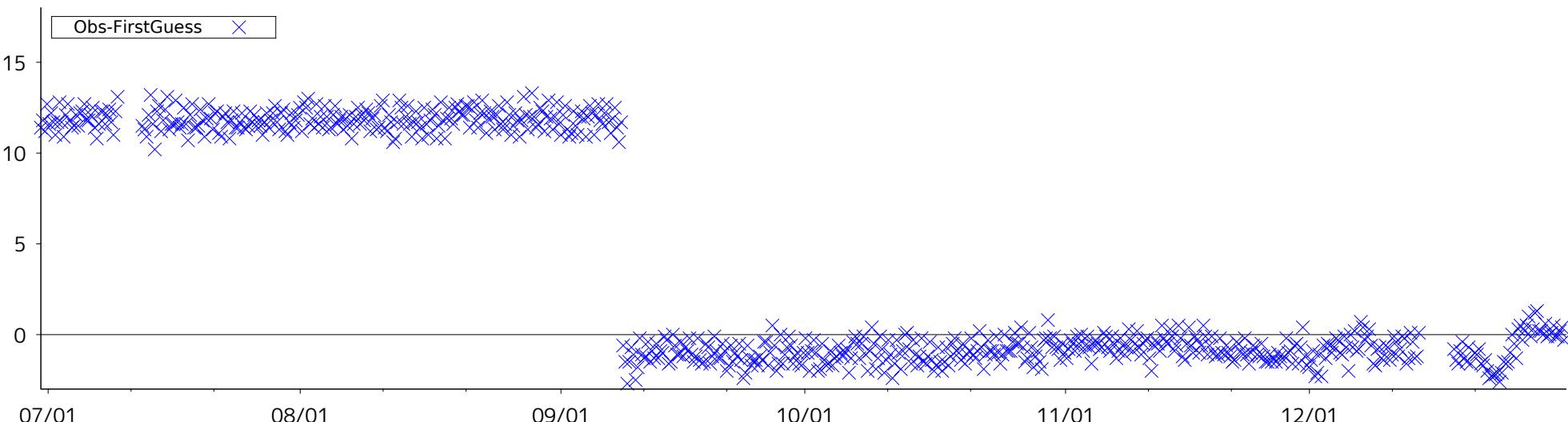
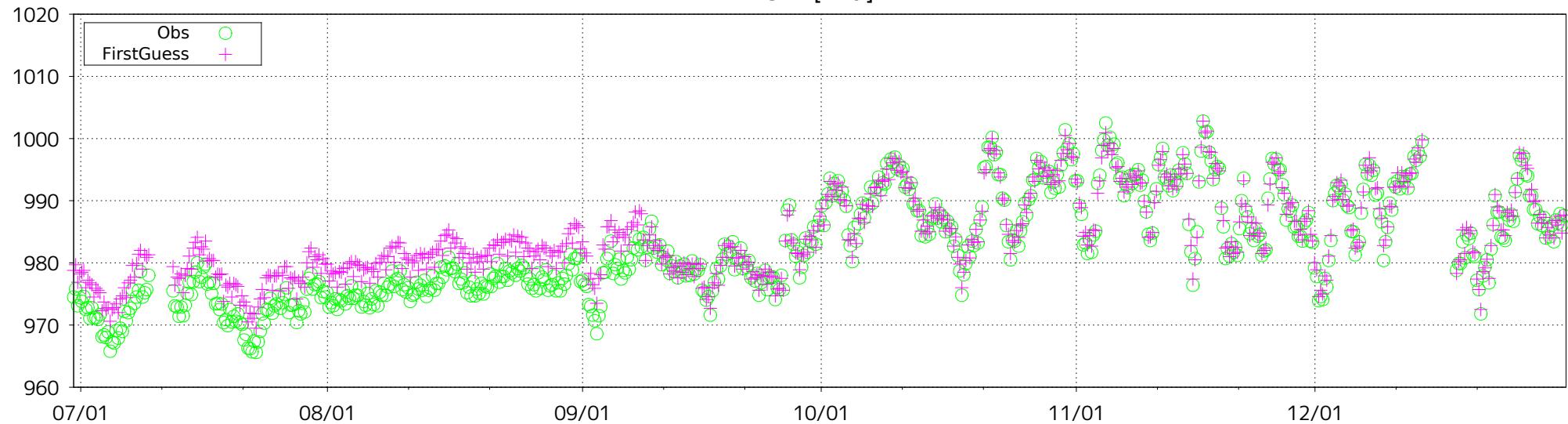


Figure 66 Time-series representation of SLP Obs minus FirstGuess for station 40713

ID: 40741 (lat: 36.5N, lon: 61.2E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

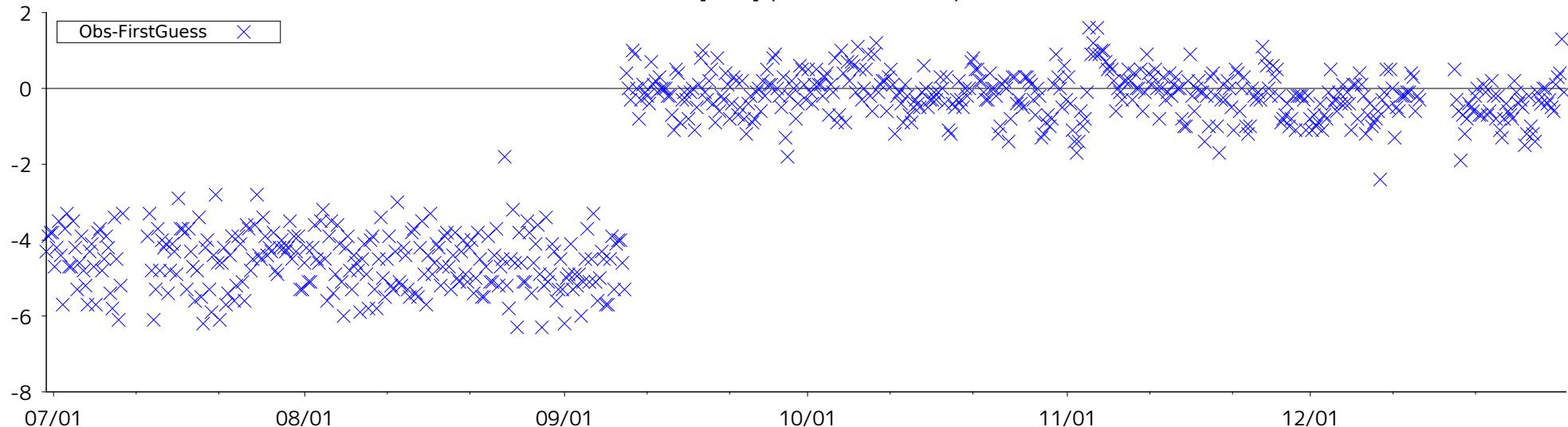
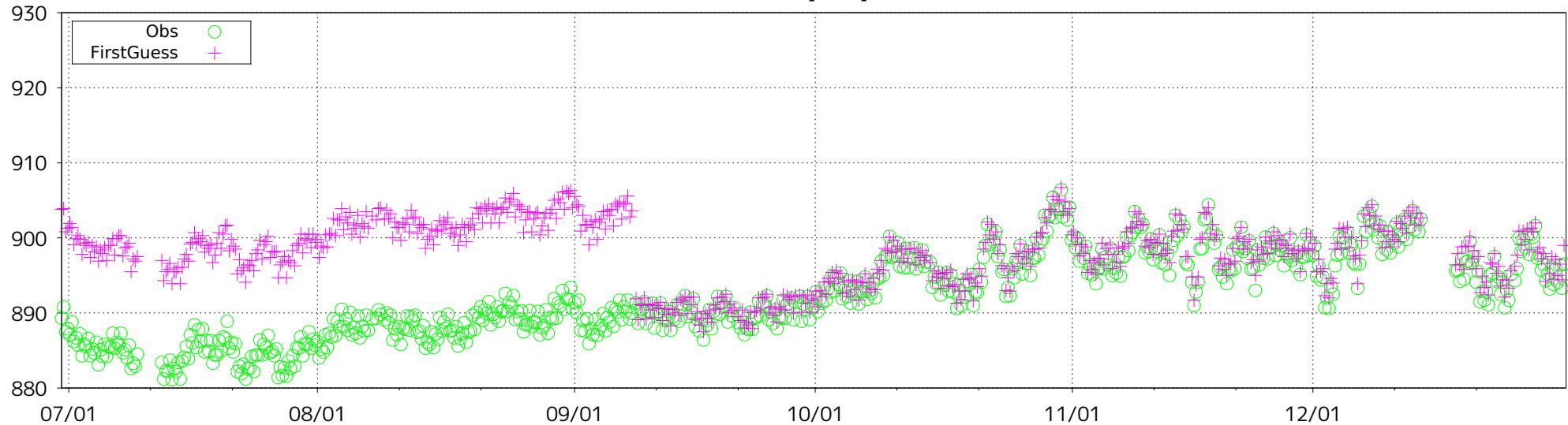


Figure 67 Time-series representation of SLP Obs minus FirstGuess for station 40741

ID: 40854 (lat: 29.1N, lon: 58.4E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

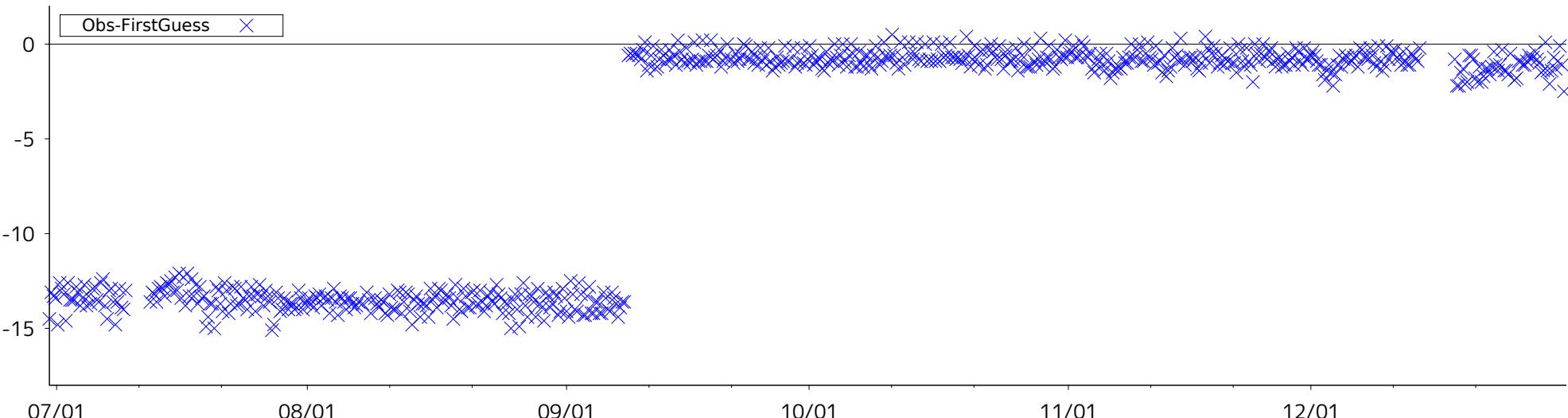
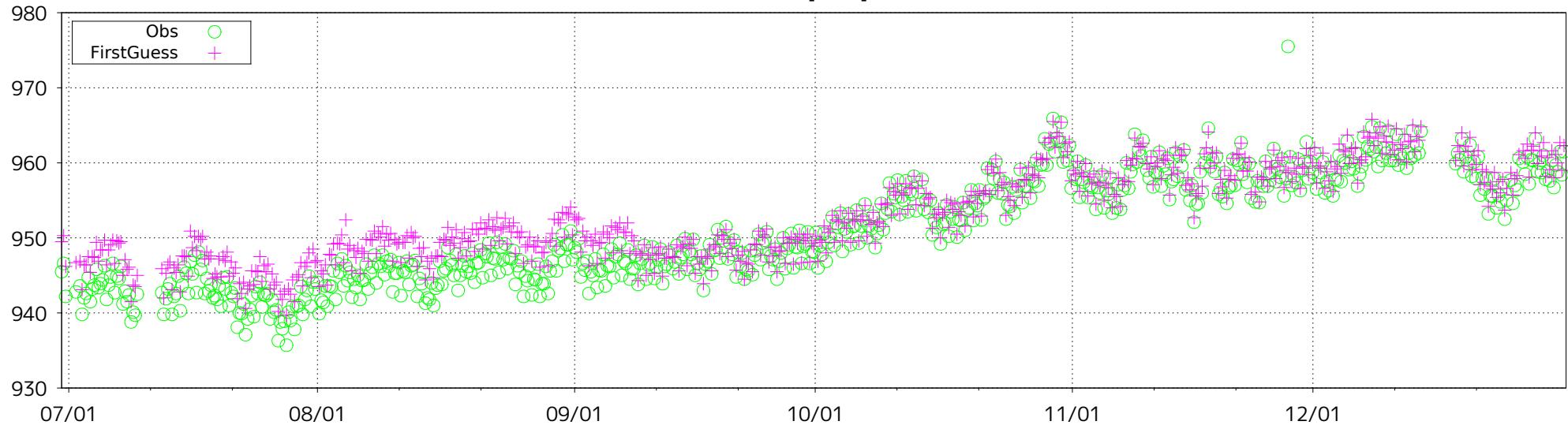


Figure 68 Time-series representation of SLP Obs minus FirstGuess for station 40854

ID: 40877 (lat: 28.0N, lon: 57.7E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

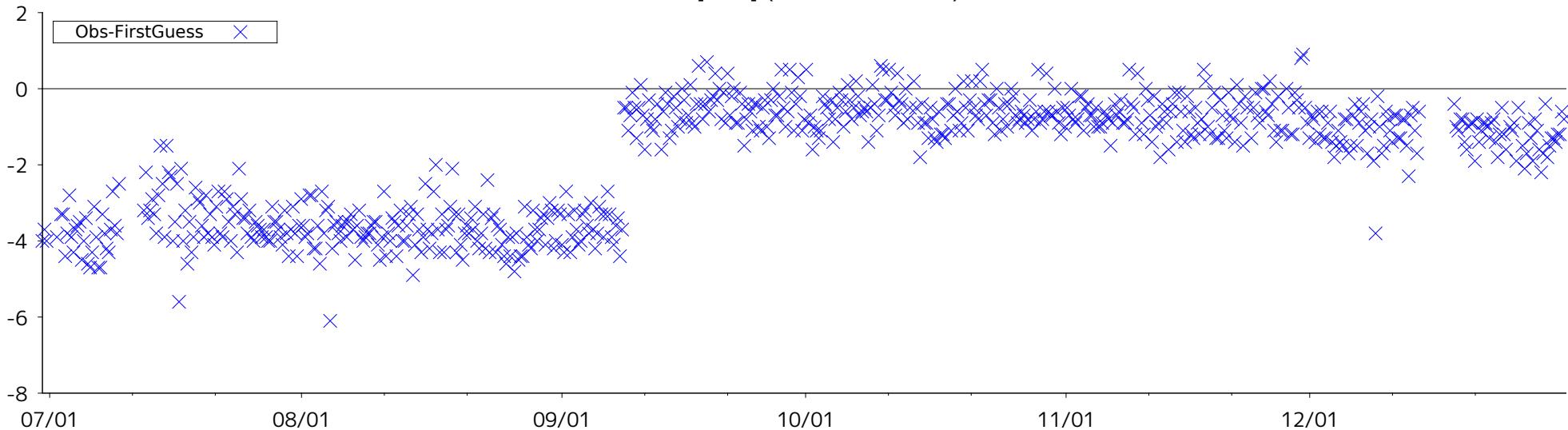
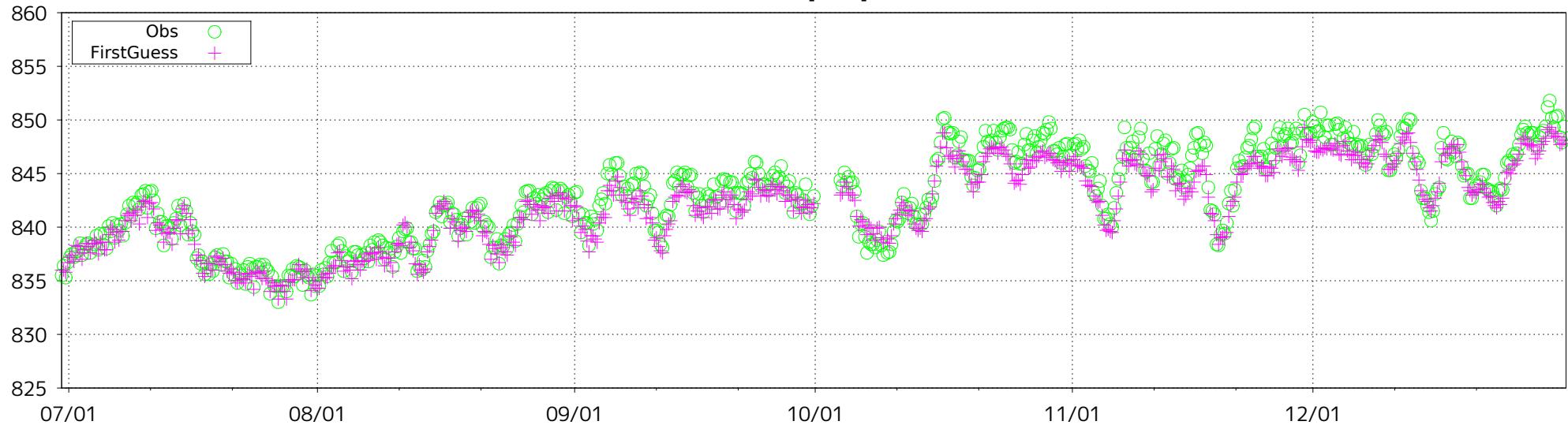


Figure 69 Time-series representation of SLP Obs minus FirstGuess for station 40877

ID: 48802 (lat: 22.4N, lon: 103.8E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

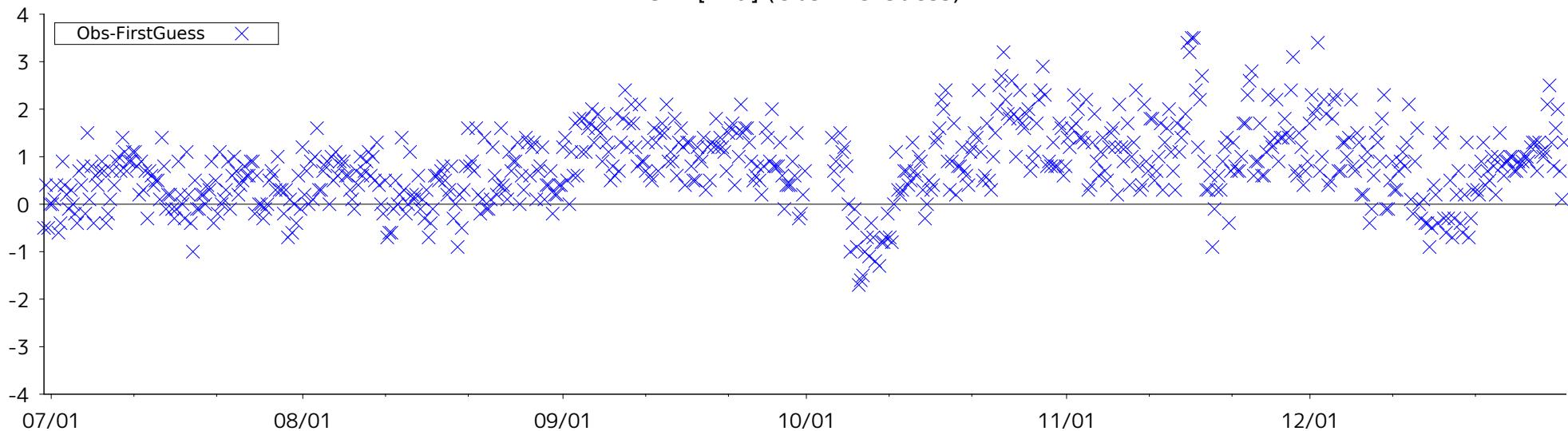
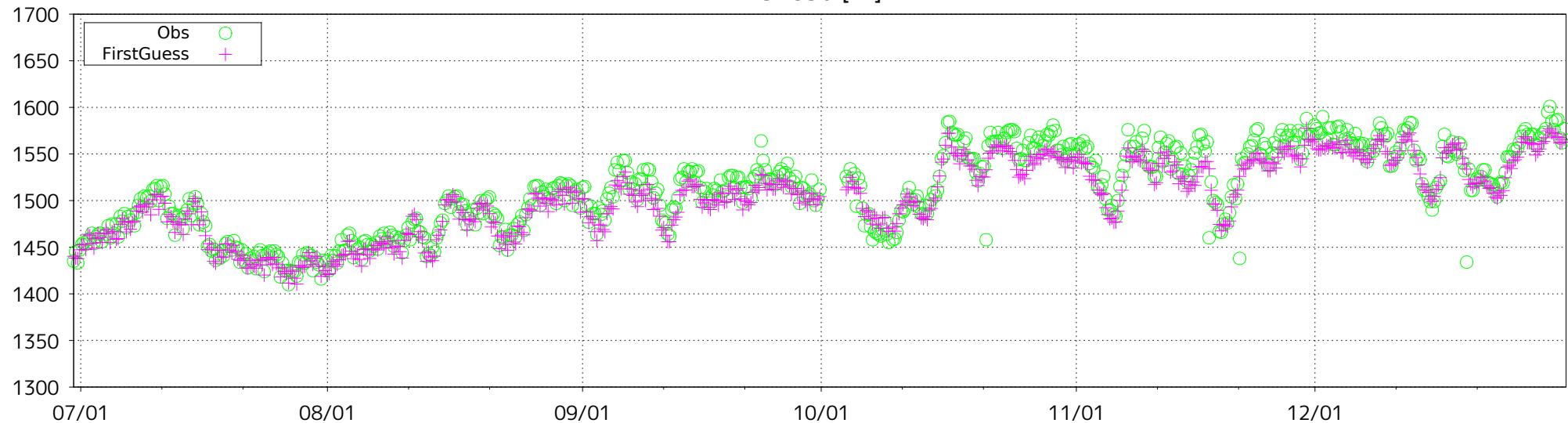


Figure 70(a) Time-series representation of SLP Obs minus FirstGuess for station 48802

ID: 48802 (lat: 22.4N, lon: 103.8E)

GZ850 [m]



GZ850 [m] (Obs-FirstGuess)

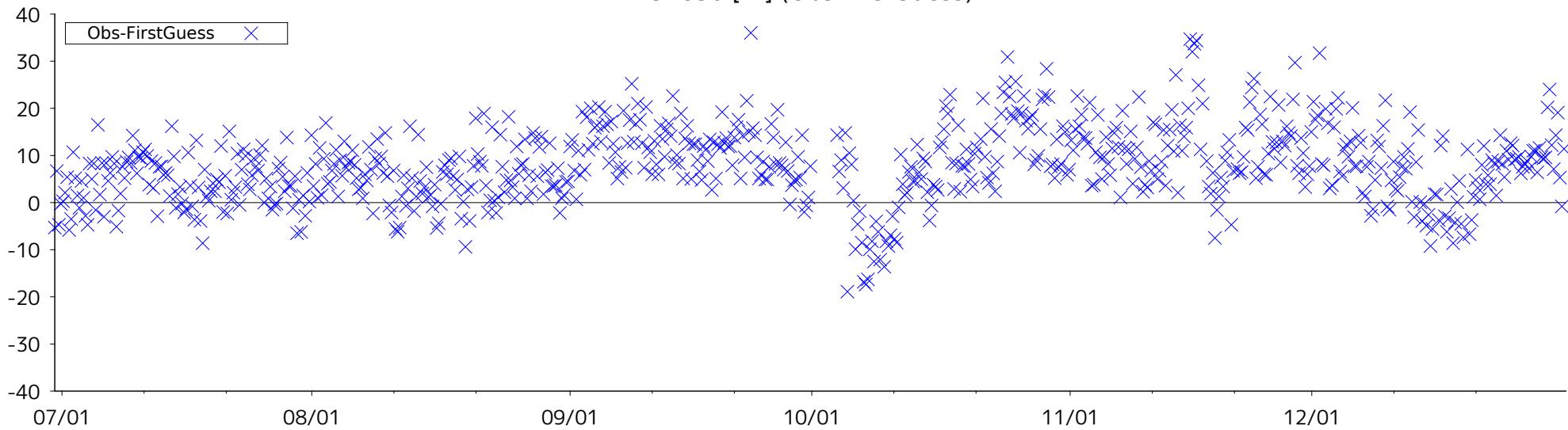
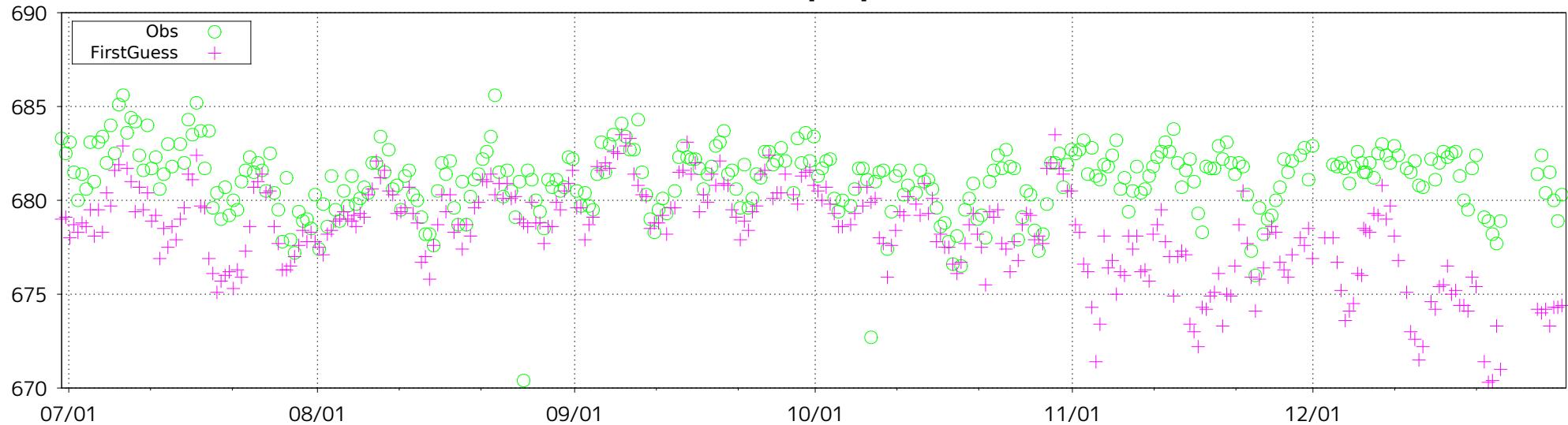


Figure 70(b) Time-series representation of GZ850 Obs minus FirstGuess for station 48802

ID: 38719 (lat: 39.1N, lon: 68.9E)

SLP [hPa]



SLP [hPa] (Obs-FirstGuess)

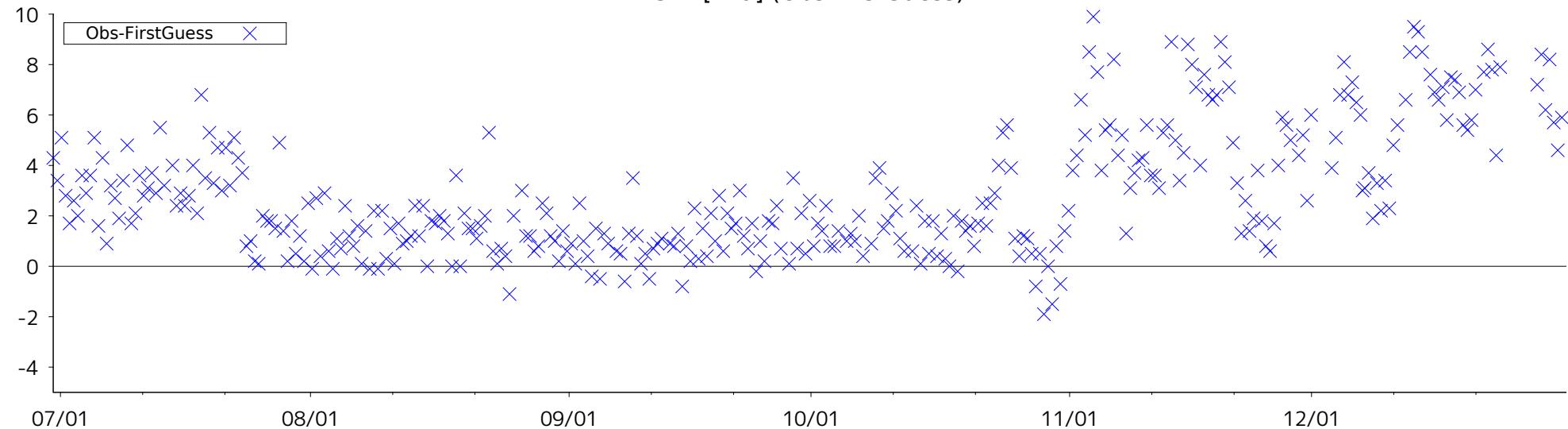


Figure 71 Time-series representation of SLP Obs minus FirstGuess for station 38719