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SVIRCO DATA: January to December 2012

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SVIRCO OBSERVATORY AND TERRESTRIAL PHYSICS LABORATORY

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Abstract

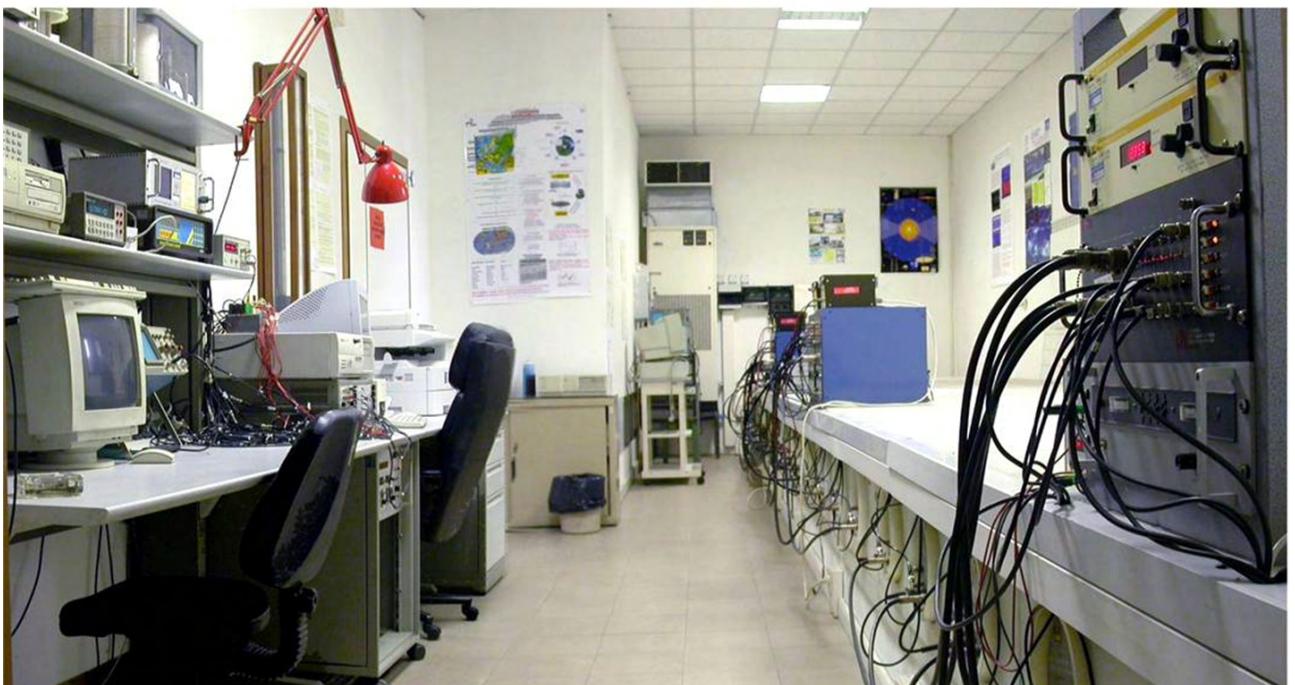
The pressure corrected intensity of the nucleonic component, produced by primary cosmic rays and recorded by the Rome Neutron Monitor, is reported for the period January to December 2012, together with the barometric pressure data, in tabular and graphic form.



S.V.I.R.CO. Observatory

Rome

Italy



SVIRCO OBSERVATORY

During the 1st International Geophysics Year (1957) an international network of "ground-based detectors" for continuous cosmic ray measurements was world-wide established.

The cosmic ray station of Rome joined this network with the purpose to study the time variations of primary cosmic rays (**S**tudio **V**ariazioni **I**ntensità **R**aggi **C**osmici: **S.V.I.R.CO.**) and their modulation in the heliosphere.

From July 1957 to April 1997, the SVIRCO Station (now Observatory) performed uninterrupted measurements at the Physics Department "G. Marconi" of "La Sapienza" University of Rome (41.90° N, 12.52° E, altitude about 60 m a.s.l.)

In May 1997 the neutron monitor was moved into the Physics Department "E. Amaldi" of "Roma Tre" University. Since then it has been continuously running at the new location (41.86° N, 12.47° E, altitude about s.l.).

The SVIRCO Observatory (INAF/IAPS-UNIRomaTre collaboration) is housed in a reserved building provided with a double air-conditioning system. The room temperature is maintained in a range of 23°-28° C, meanwhile the relative humidity is kept below 60%. Either the ambient parameters are continuously checked and recorded by digital sensors. Their time histories have been plotted in this report.

On January 1, 2005 three counters were added to the detector. After this upgrade, from 17 to 20 NM-64, the SVIRCO neutron monitor is still composed by 5 sections, but the arrangement varied as follow: three 3-counter, one 5-counter and one 6-counter units.

The enhancement improved not only the overall counting rate of 15.6 % (January 2005) but, as a result, also the statistical quality of the recorded data.

Each one of the 20 BF₃ proportional counters (BP-28 type) is equipped with a smart amplifier/discriminator circuit including a spectrum stabilizer. This new electronic unit, developed in our laboratory, holds firmly the pulse height spectrum of the amplifier output (within a range of more than 150 volts around the operating voltage), providing the counter with an effective protection against high voltage variations.

Anyway, systematic and exhaustive tests of the counters are regularly performed. The output pulses of the amplifiers, discriminated by the threshold gates, are collected and stored into a multi-channel analyzer. The analysis of the height distribution (spectrum) of the amplifier pulses coinciding with the discriminator ones, is essential to verify the long term efficiency of each counter together with the amplifier gain and the discriminator threshold.

As well as the amplifier/discriminator circuits, a large part of the electronic instrumentation operating in the Observatory was designed and realized in our laboratory together with the software for data acquisition and pre-elaboration.

To minimize the risk of data loss and to improve the overall data reliability, two independent systems perform the data acquisition at the same time. Each system is remotely controlled by a dedicated computer and is timed by a high stability quartz clock and/or a GPS receiver. One equipment (VXI) runs according to a timing of 1 minute and fulfills the acquisition of each single counter. The other one (OLD) records the individual 5-minute counting rate of each detector section in addition to the rates of the overall multiplicity, sorted into separated counting channels (from 1 to greater than 8). The counting rates of the two independent systems are checked each other on hourly base to detect possible measurement errors. The annual time history of the difference between the counting rates of the two systems is comprised in this paper.

A special care is applied to the atmospheric pressure measurements which are carried out by three high-precision barometers. These instruments, achieving a resolution up to 0.01 hPa, are continuously cross-checked for the best measuring accuracy and reliability. Furthermore the barometers are equipped with different types of transducer namely: vibrating cylinder, aneroid and quartz, therefore throughout their different behaviours, it is possible to point out the occurrence of any long-term drift and eventually to re-calibrate the instruments. The yearly check of the barometers is here reported.

More details of the complete acquisition system can be found on the included block diagram.

The overall stability of the neutron monitor is controlled by means of the section ratios. The hourly counting rate of each section, divided by the total rate, is plotted in real time on a daily diagram. Moreover, the daily averages of these ratios are separately plotted, as percentage, in monthly histograms. The annual series of histograms, included in this report, shows the long term stability of each section.

In order to verify the coherence between the variations of the nucleonic intensity recorded by SVIRCO-Rome and by another observatory with similar characteristics, a comparative data analysis has been finally performed with the neutron monitor data of Hermanus (South Africa - 34.42° S, 19.23° E, altitude 26 m a.s.l.). This Observatory was chosen not only for its data availability, but also for its suitable geographic location. With a cut-off energy (4.58 GV) and altitude (26 m a. s.l.) similar to Rome, it is also far enough to avoid correlation between the local pressure changes of the two monitors.

Both data sets have been normalized to their respective annual average and then plotted, together with their ratio, on daily basis and also in a regression form.

We acknowledge the Unit of Space Physics - School of Physics at the North-West University (Potchefstroom-South Africa) for Hermanus Neutron Monitor data. [© North-West University 2009. All rights reserved]

DATA PRESENTATION

The intensity data, of the secondary nucleonic component of cosmic ray, detected in Rome at the SVIRCO Observatory, were corrected for pressure variations at a reference level of 1009.25 hPa with an attenuation coefficient of 0.70% / hPa.

a) Tables:

The hourly corrected data are reported in tabular form for each month together with the daily ratios section R_i . The R_i ratios (%) are computed as the rate of each section (channel i) divided by the total rate. Only $n - 1$ section ratios are provided, being n the number of sections.

The hourly and daily averages (in hPa) of the atmospheric pressure measured at the Observatory, are also presented in monthly tables.

Furthermore, the monthly averages of the values, reported either in the corrected-data tables or in the pressure ones, are shown below them.

b) Graphs

The hourly-corrected data were also multiplied by a suitable normalization factor and plotted in monthly graphs. The normalization was evaluated as percentage of the counting rate average in the period from January to February 1997, when the Monitor operated at the previous location of "La Sapienza" University. The reference counting rate level (100%), computed for such a referential period, is equal to 554946 counts/hour. The set of normalized graphs are provided for long-term analysis.

The monthly graphs of the atmospheric pressure are reported too.

CONDITIONS FOR SVIRCO DATA USE

You are welcome to use SVIRCO neutron monitor data of IFSI/INAF-UNIRomaTre collaboration under the following conditions:

- You agree to acknowledge our financial supports in any published use of the data. Example:
"SVIRCO NM is supported by the INAF - UNIRomaTre collaboration"
- You are kindly requested to send a copy of any published work derived from our data to:

Dr. Stefano Masetti
Head of SVIRCO Observatory and TPL
INAF - Istituto di Astrofisica e Planetologia Spaziali - Area di Ricerca Tor Vergata
Via del Fosso del Cavaliere, 100 00133 Roma - Italy,
e-mail: stefano.masetti@iaps.inaf.it

MEASUREMENT INTERRUPTION

DECEMBER 26, 2011 - JANUARY 2, 2012

During the period 27-31 December 2011 the planned renovation of the Physics Department electrical system was performed. In order to prevent possible serious damages to instrumentation a precautionary suspension of the Observatory activity was arranged. The neutron monitor was switched off on December 26, 2011 at 12.05. It restarted operating on January 2, 2012.

HOURLY RECOVERED DATA - YEAR 2012

When the whole counting rate of the Neutron Monitor was lost for less than a 15 min interval (*) or a section was inoperative (°), the hourly data were recovered as reported in the table.

Month	Day	Time (UT)
08	27	06 - 08 (*)
09	03	01-02 (*) 11-12 (*)

RELEVANT MONITOR AND DATA CHARACTERISTICS FOR 2012

Cosmic Ray Observatory Rome or SVIRCO
Geographic coordinates 12.47°E, 41.86°N
Altitude Sea level
Threshold rigidity (year) 6.27 GV (1995)
Instrument 20 NM - 64 (three 3-counter,
one 5-counter and one 6-counter units)
Scaling factor 1
Pressure coefficient 0.70 % / hPa
Pressure reference level 1009.25 hPa

Rate enhancement
from 17 to 20 counters 15.6% (since January 2005)

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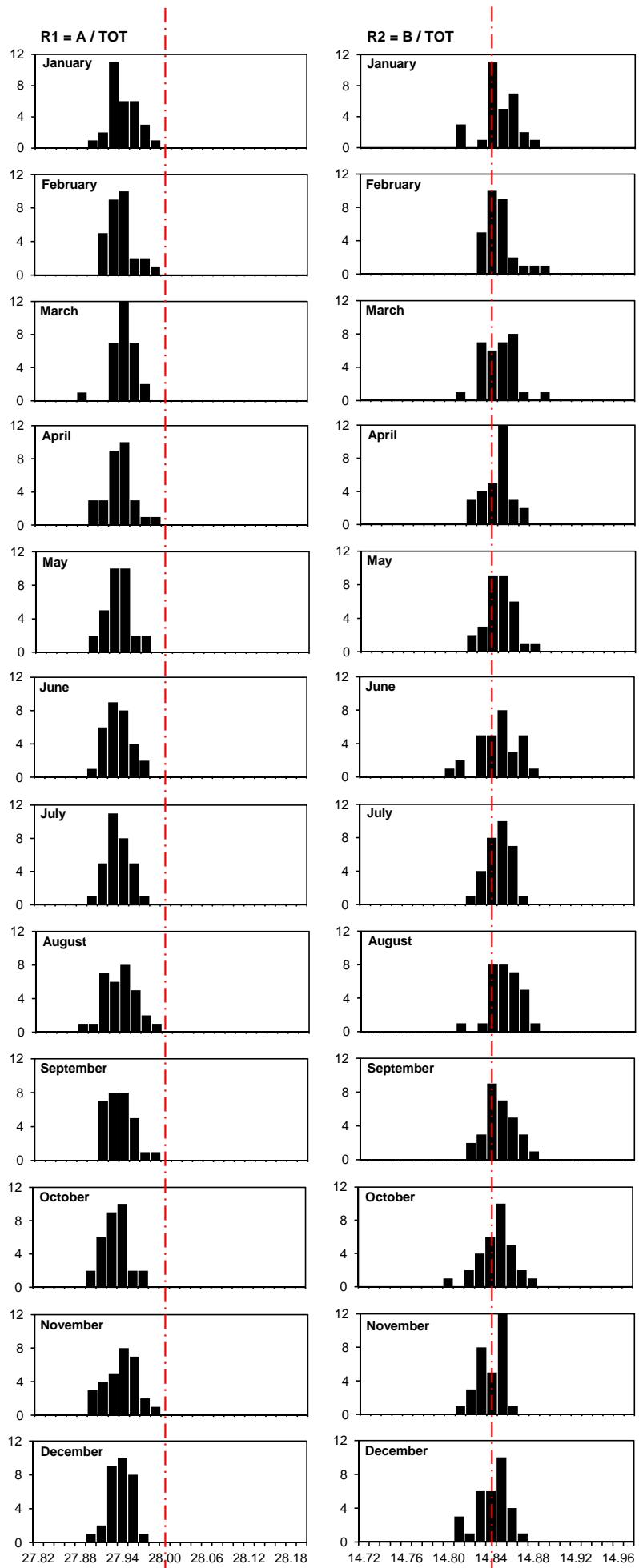
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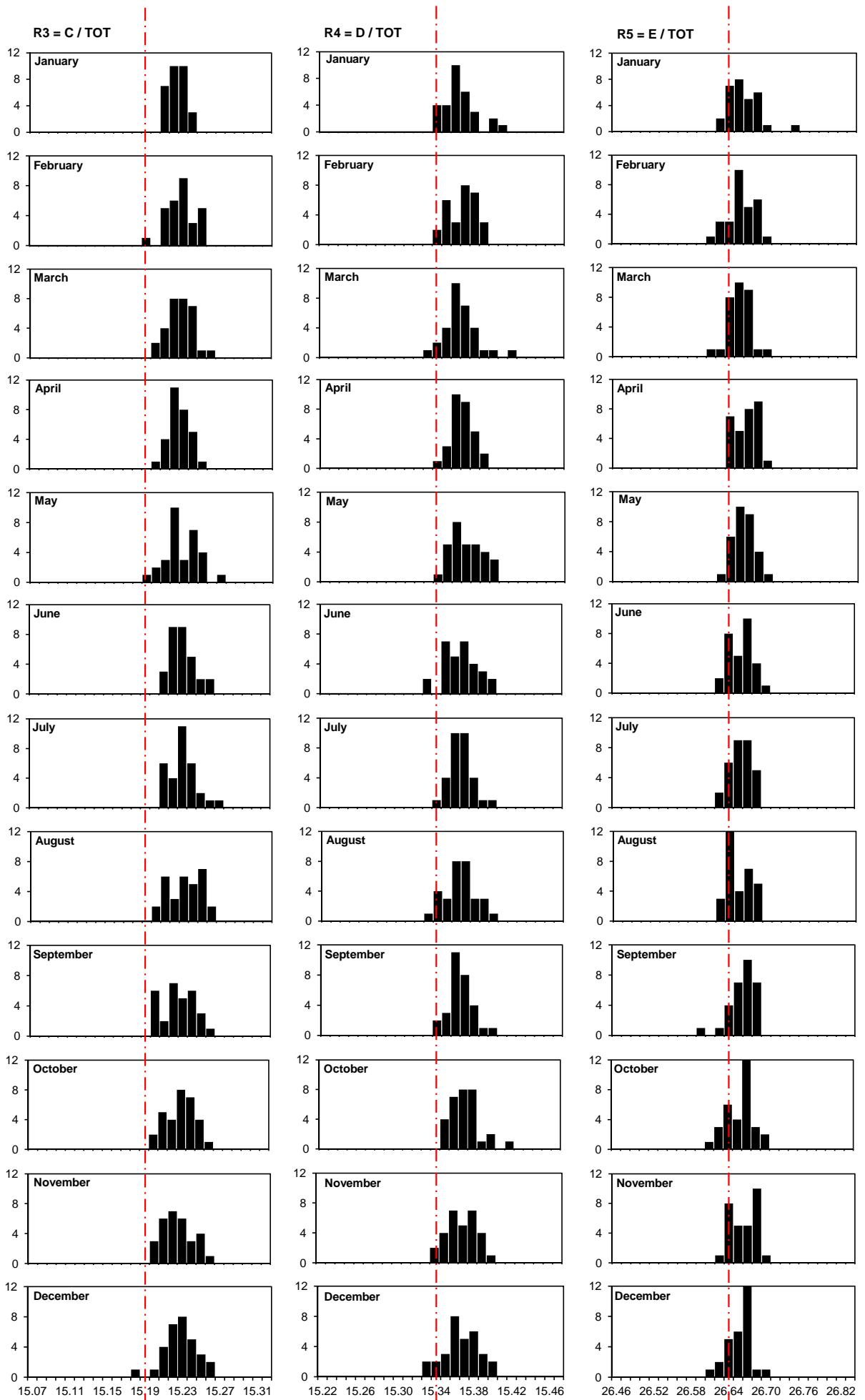
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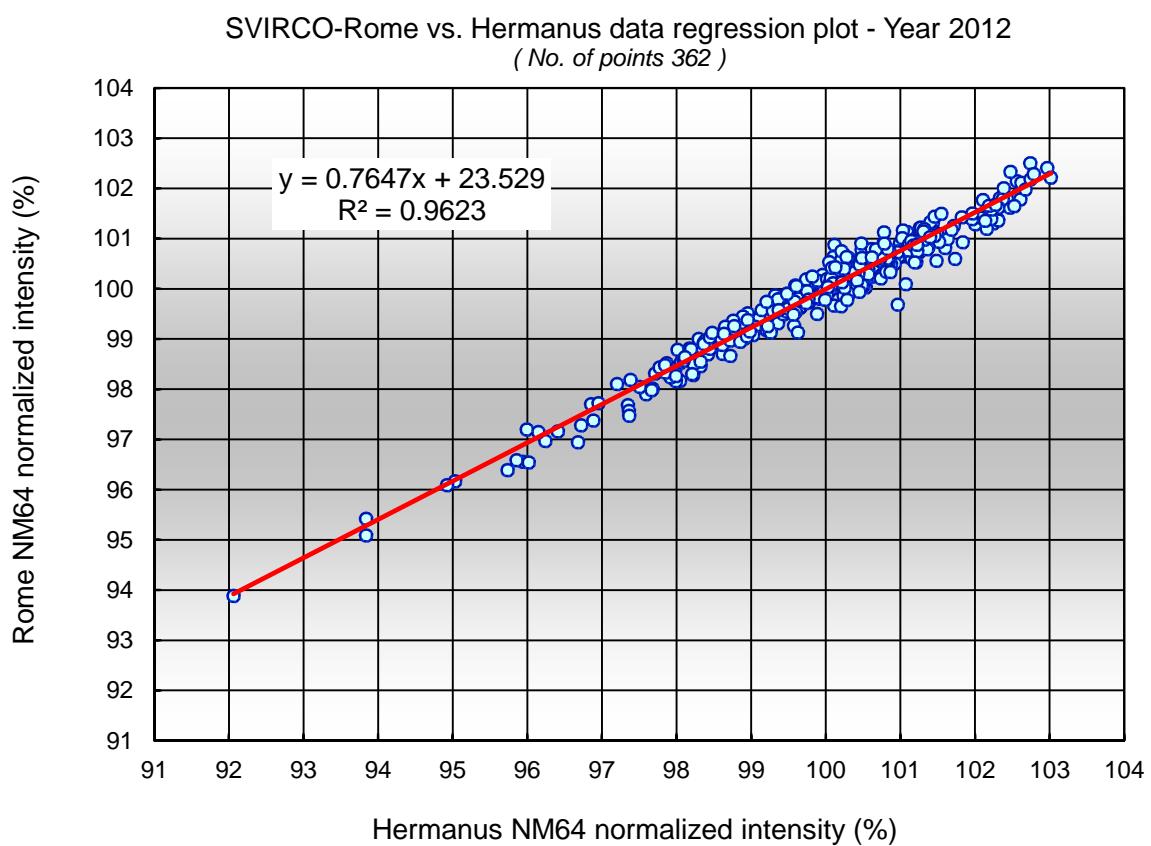
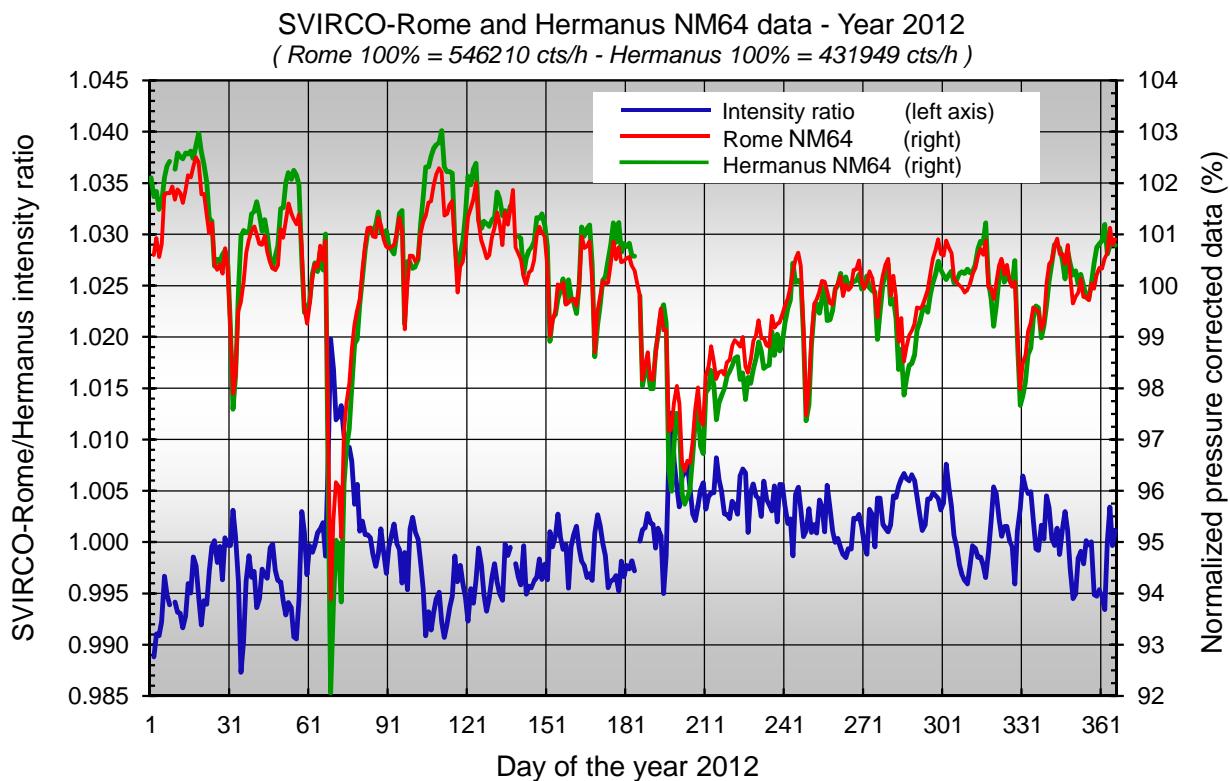
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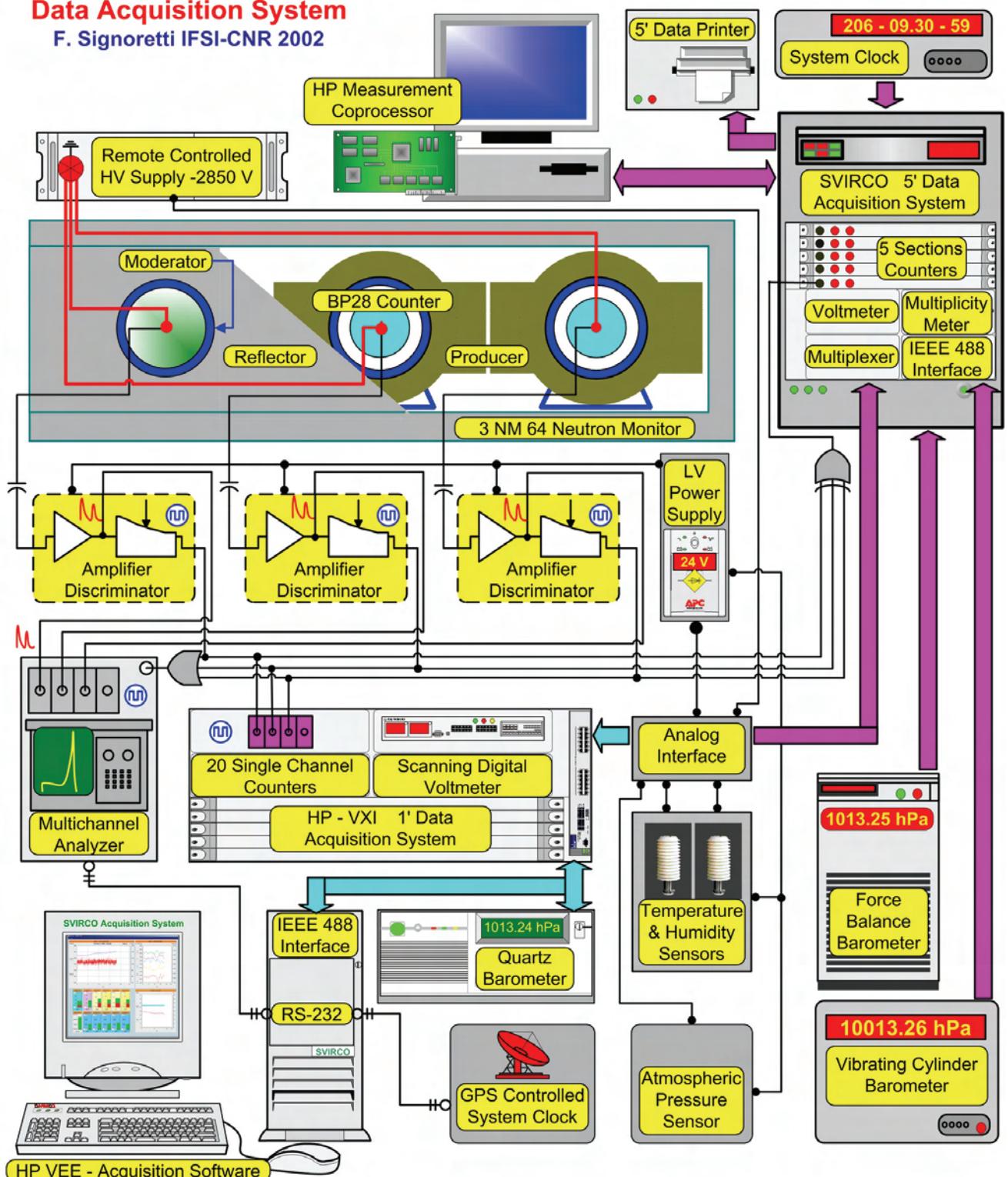
INAF/UNIRomaTre S.V.I.R.CO. Observatory 20 NM-64
Year 2012 - Ratios of Neutron Monitor Units



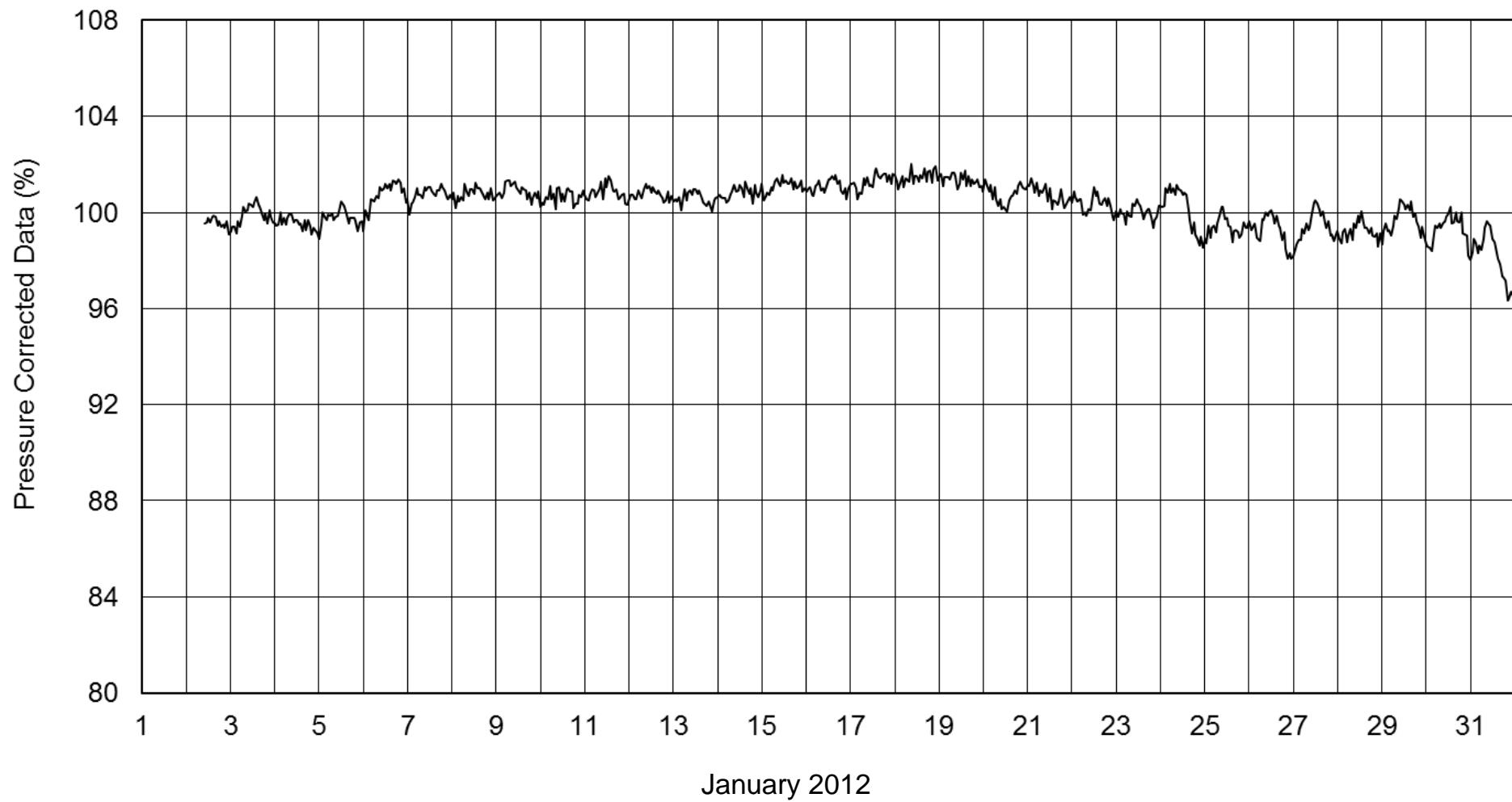
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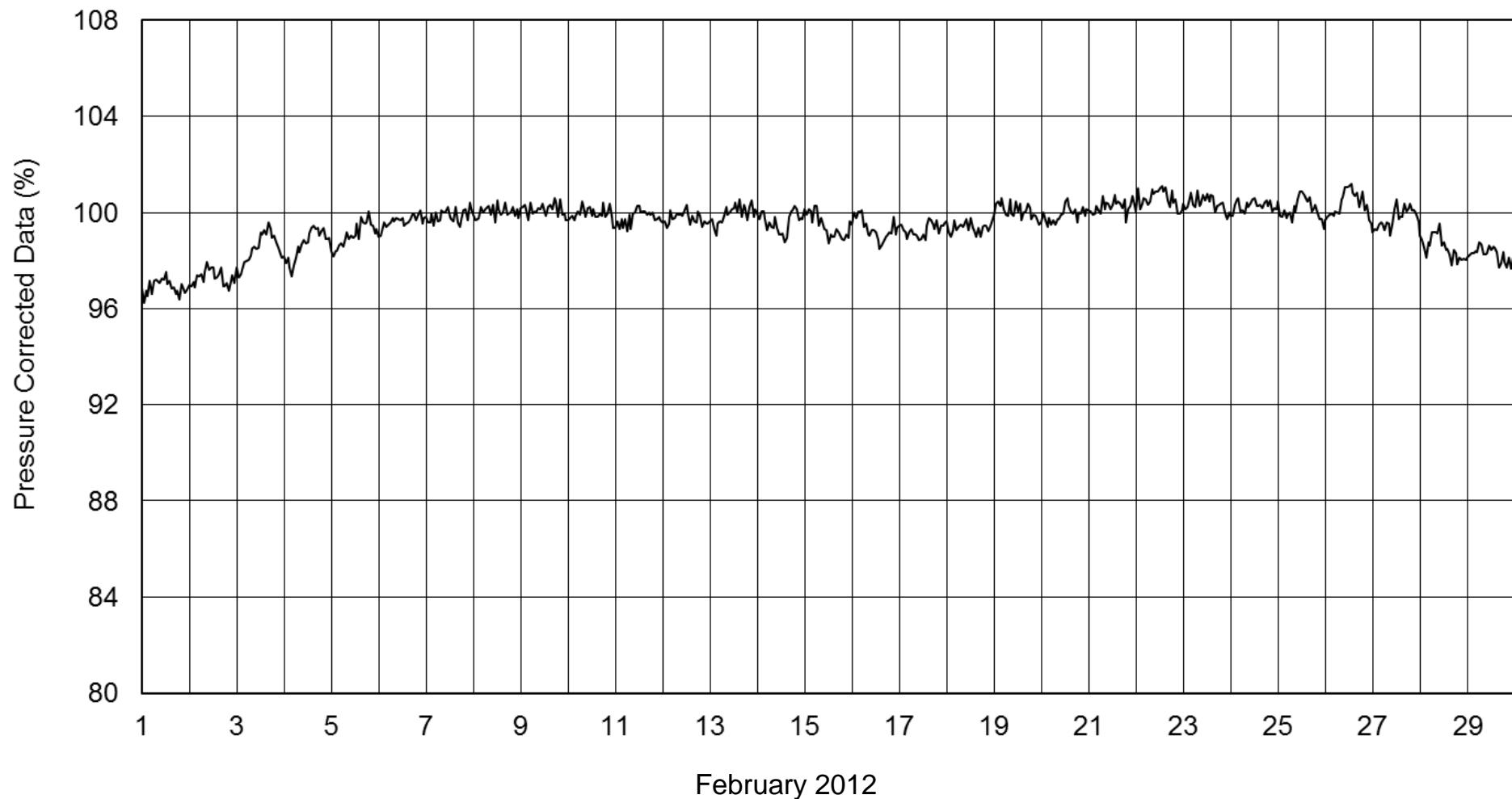
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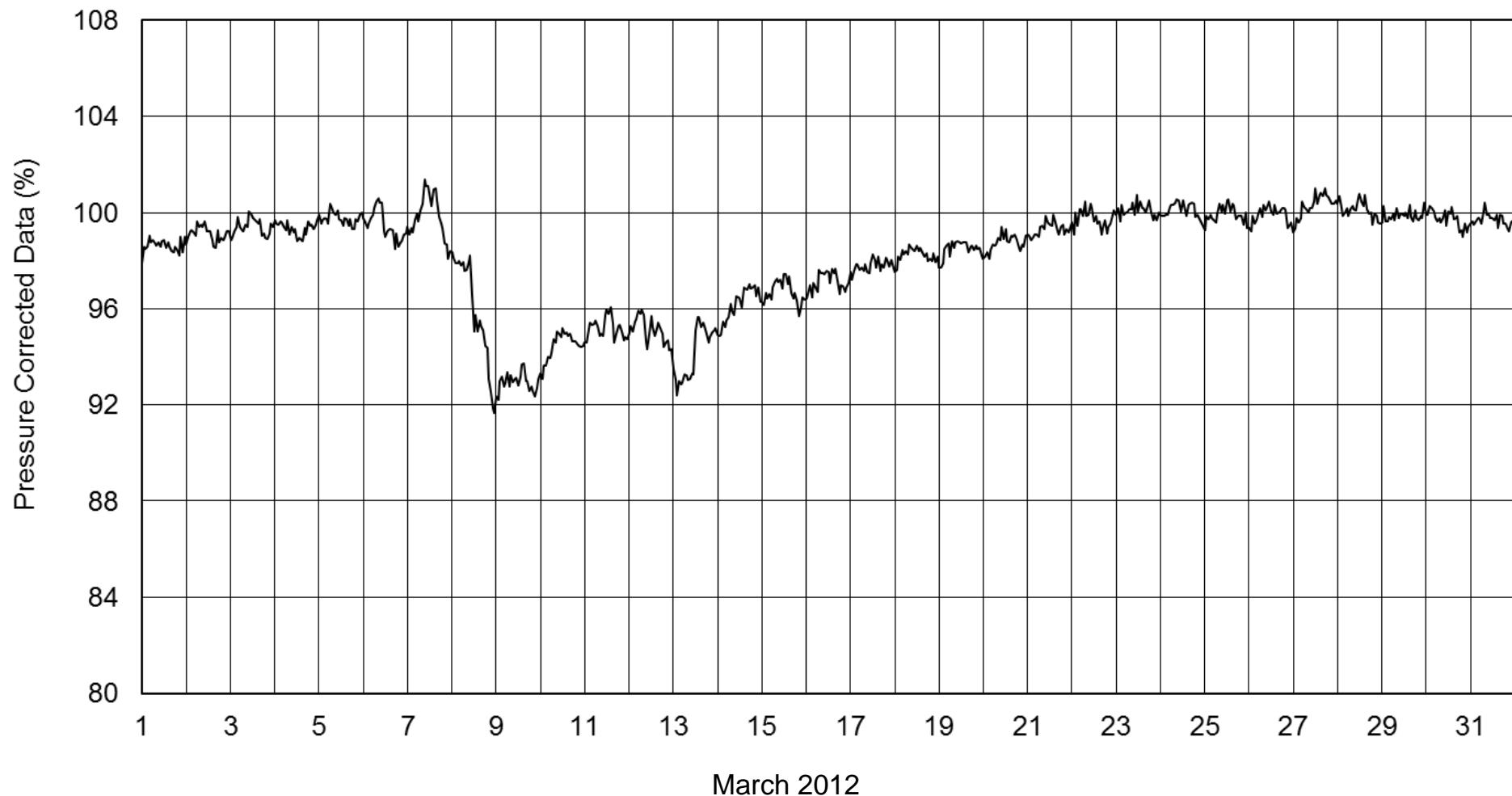
SVIRCO OBSERVATORY - Pressure corrected data



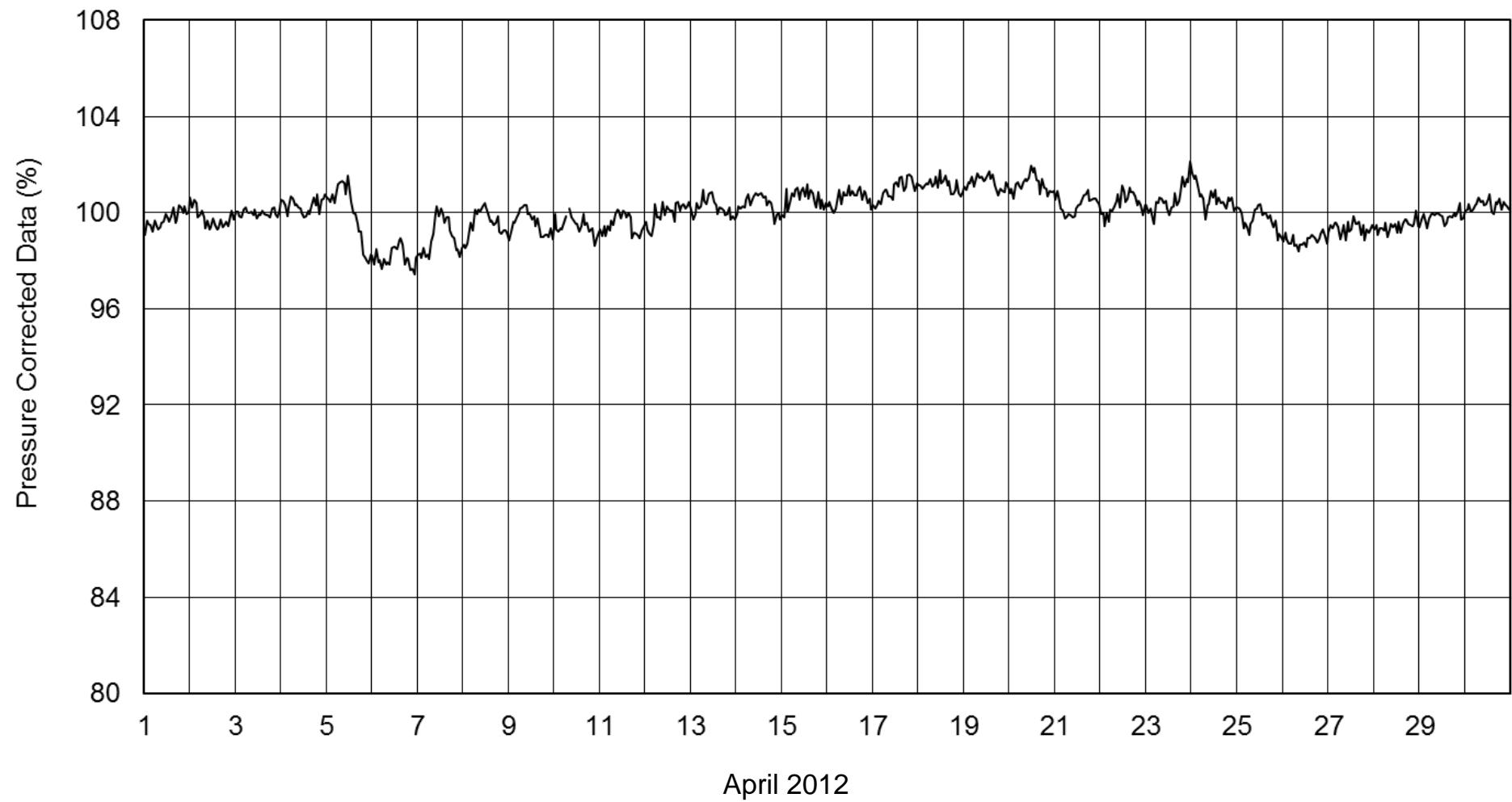
SVIRCO OBSERVATORY - Pressure corrected data



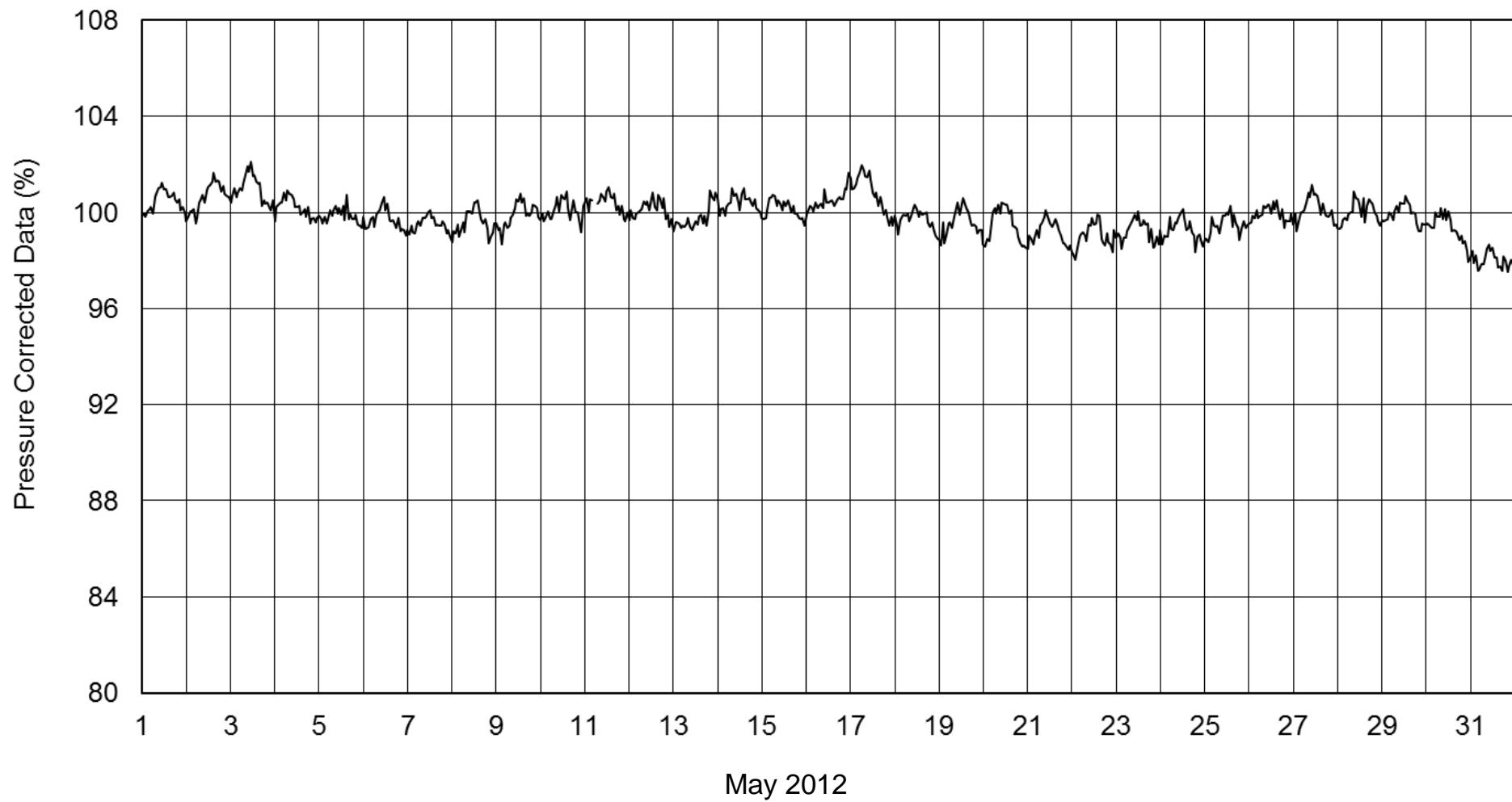
SVIRCO OBSERVATORY - Pressure corrected data



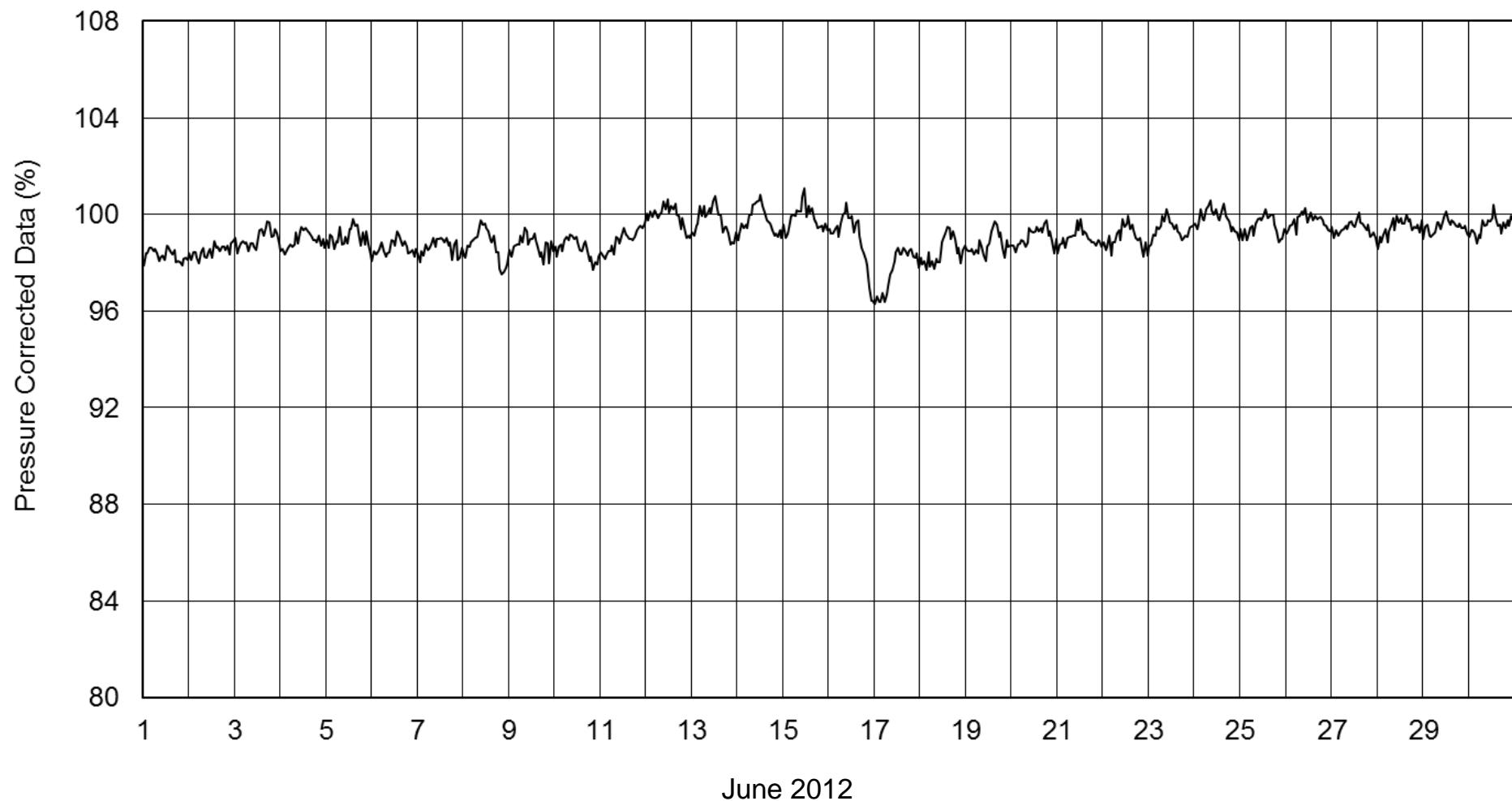
SVIRCO OBSERVATORY - Pressure corrected data



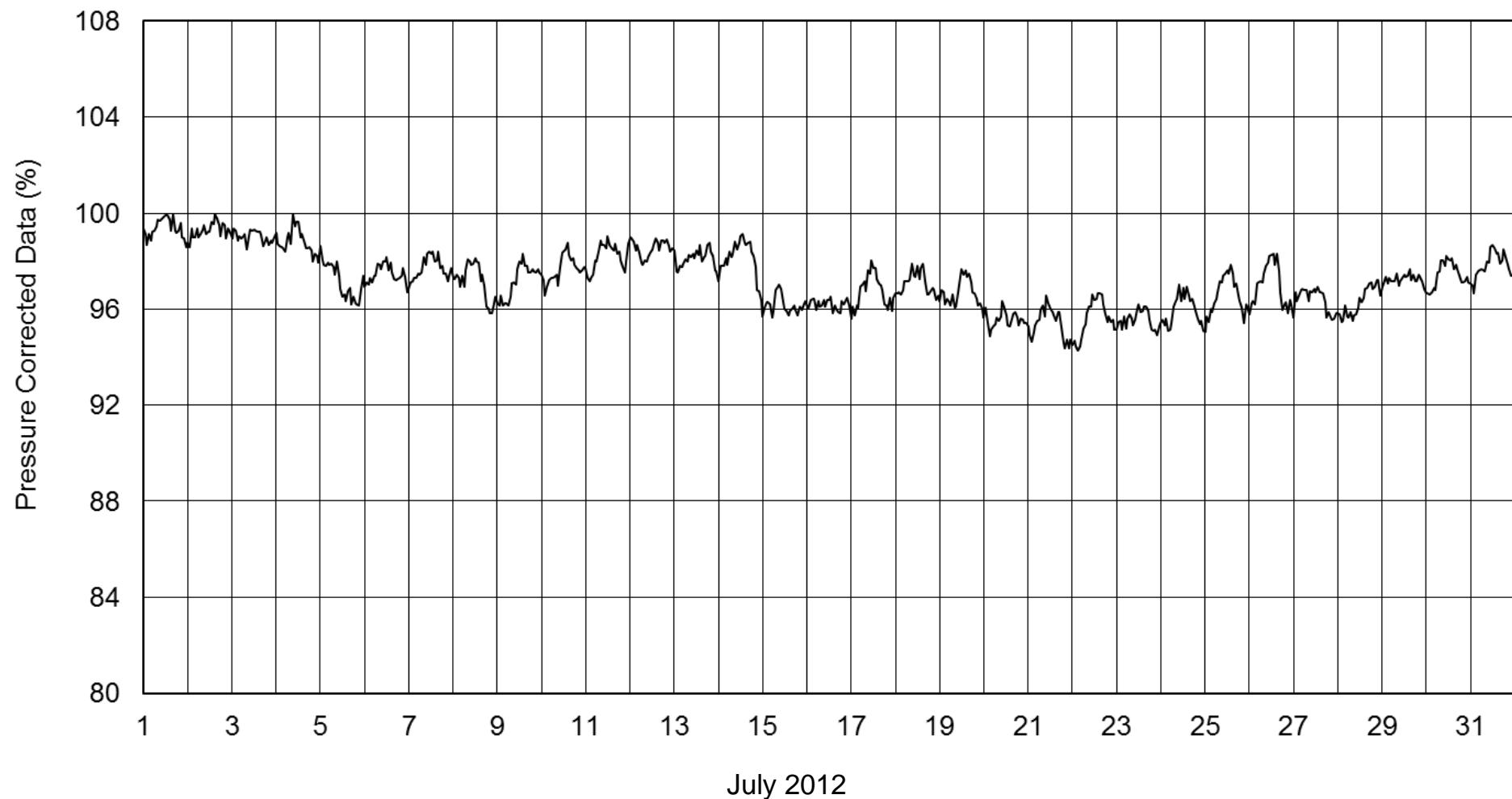
SVIRCO OBSERVATORY - Pressure corrected data



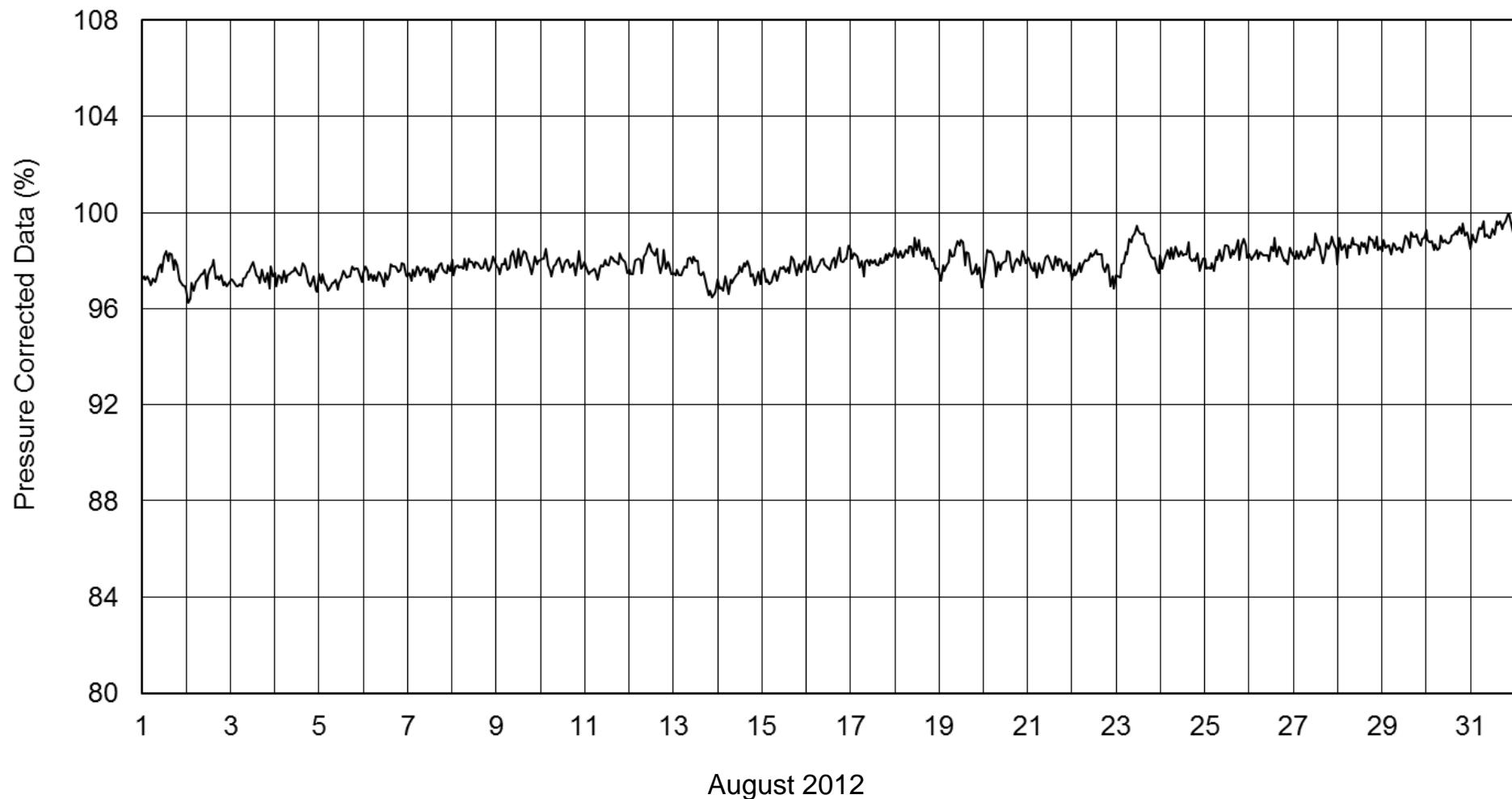
SVIRCO OBSERVATORY - Pressure corrected data



SVIRCO OBSERVATORY - Pressure corrected data

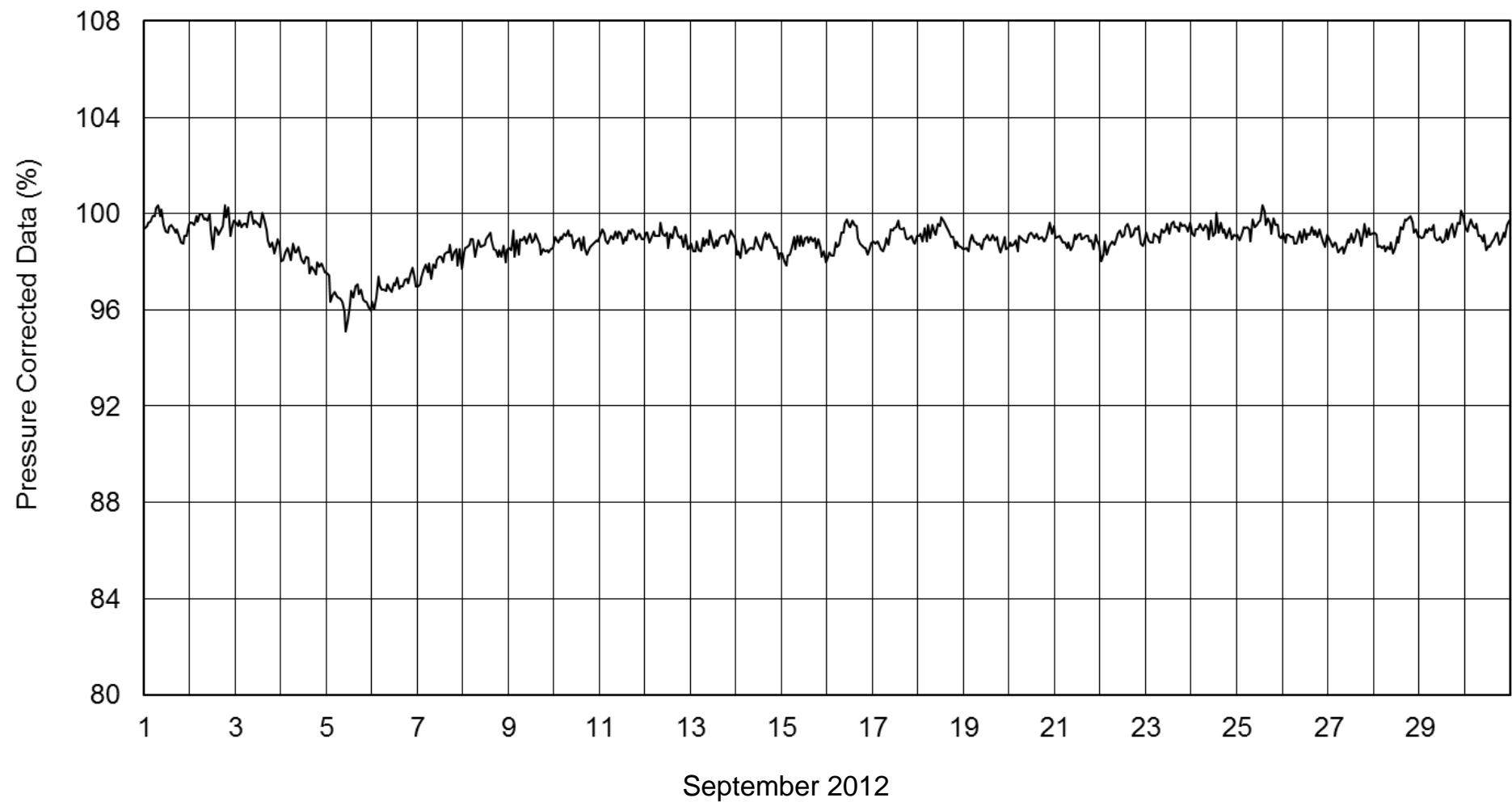


SVIRCO OBSERVATORY - Pressure corrected data

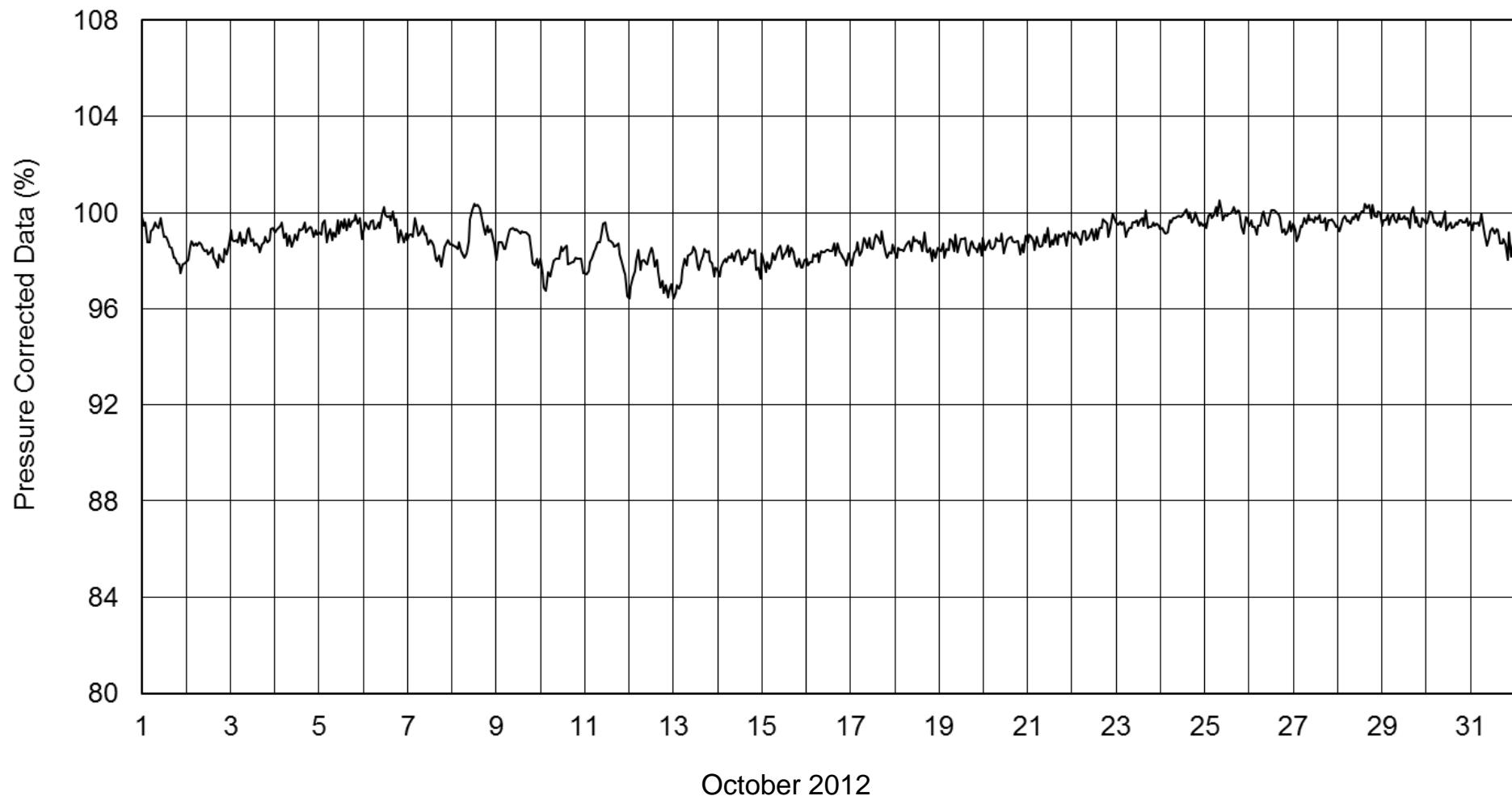


August 2012

SVIRCO OBSERVATORY - Pressure corrected data

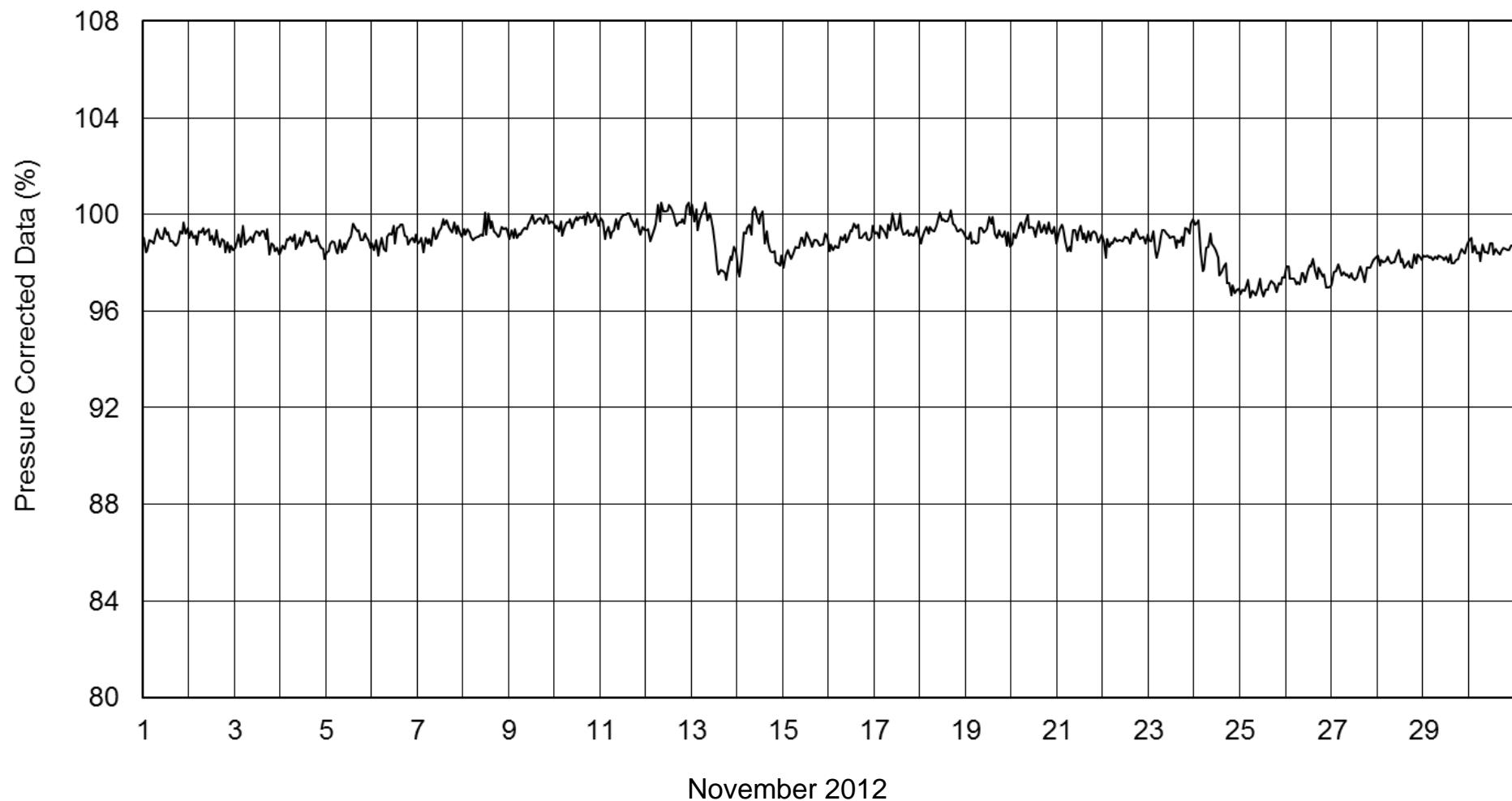


SVIRCO OBSERVATORY - Pressure corrected data

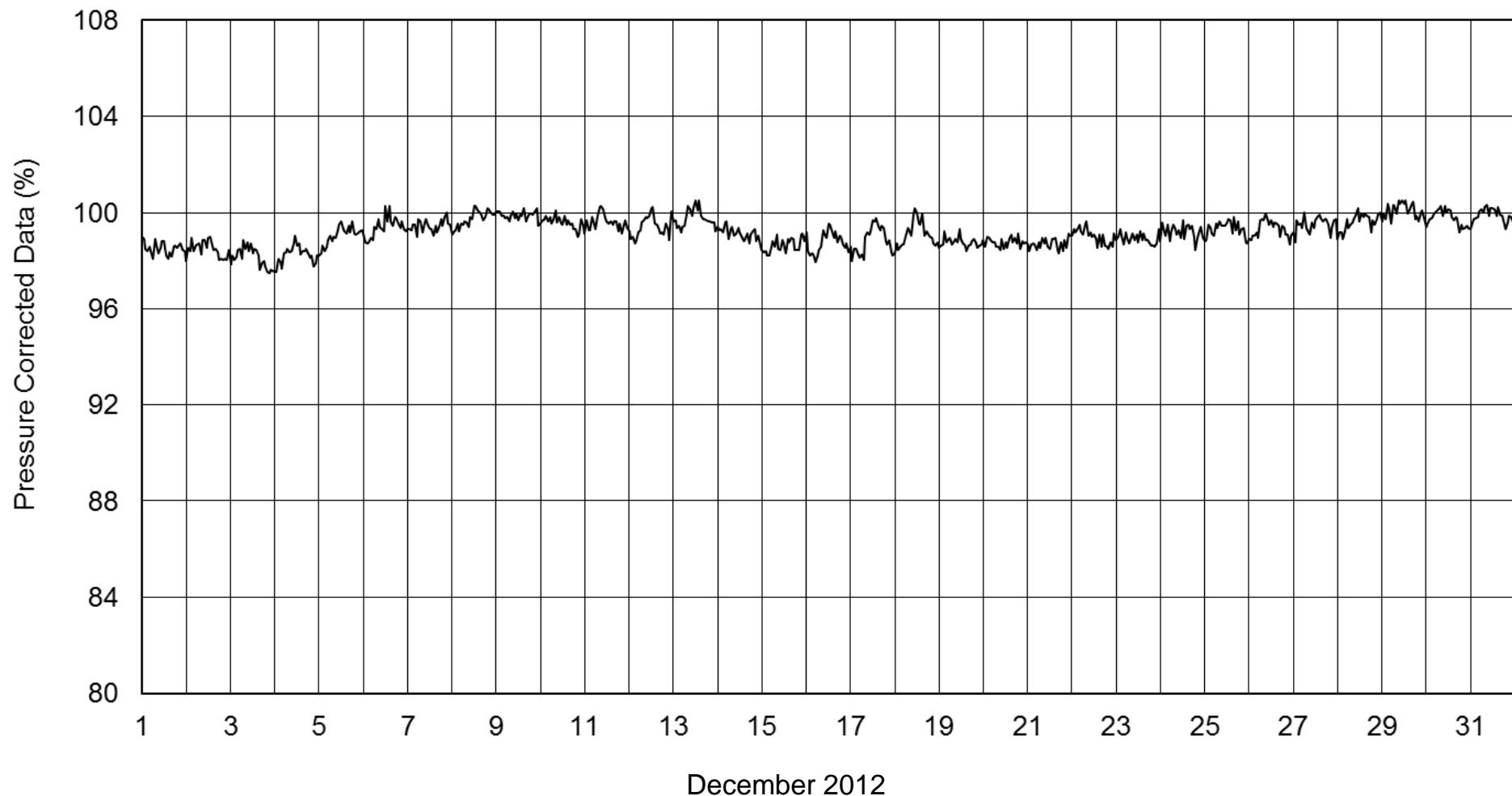


October 2012

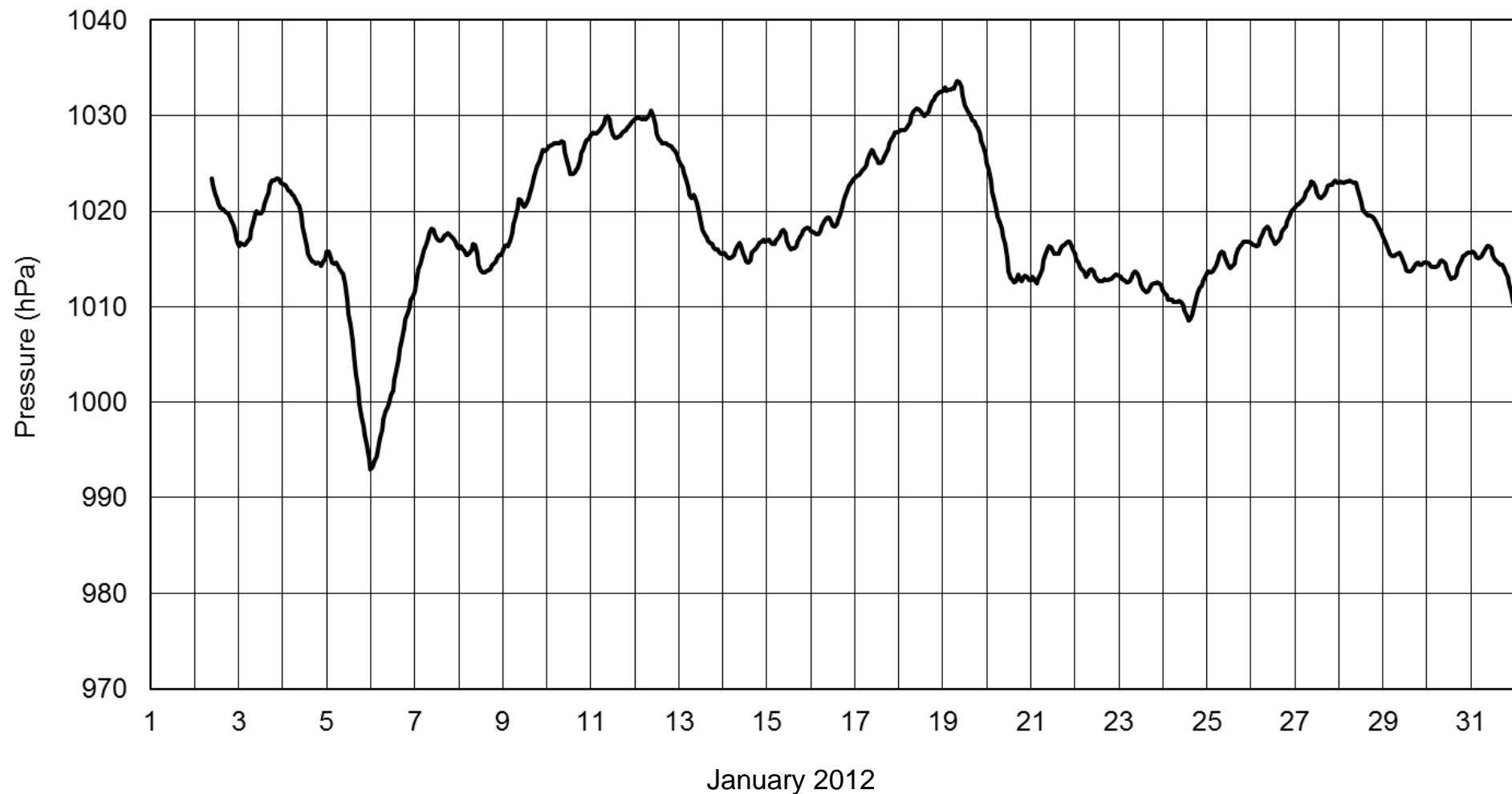
SVIRCO OBSERVATORY - Pressure corrected data



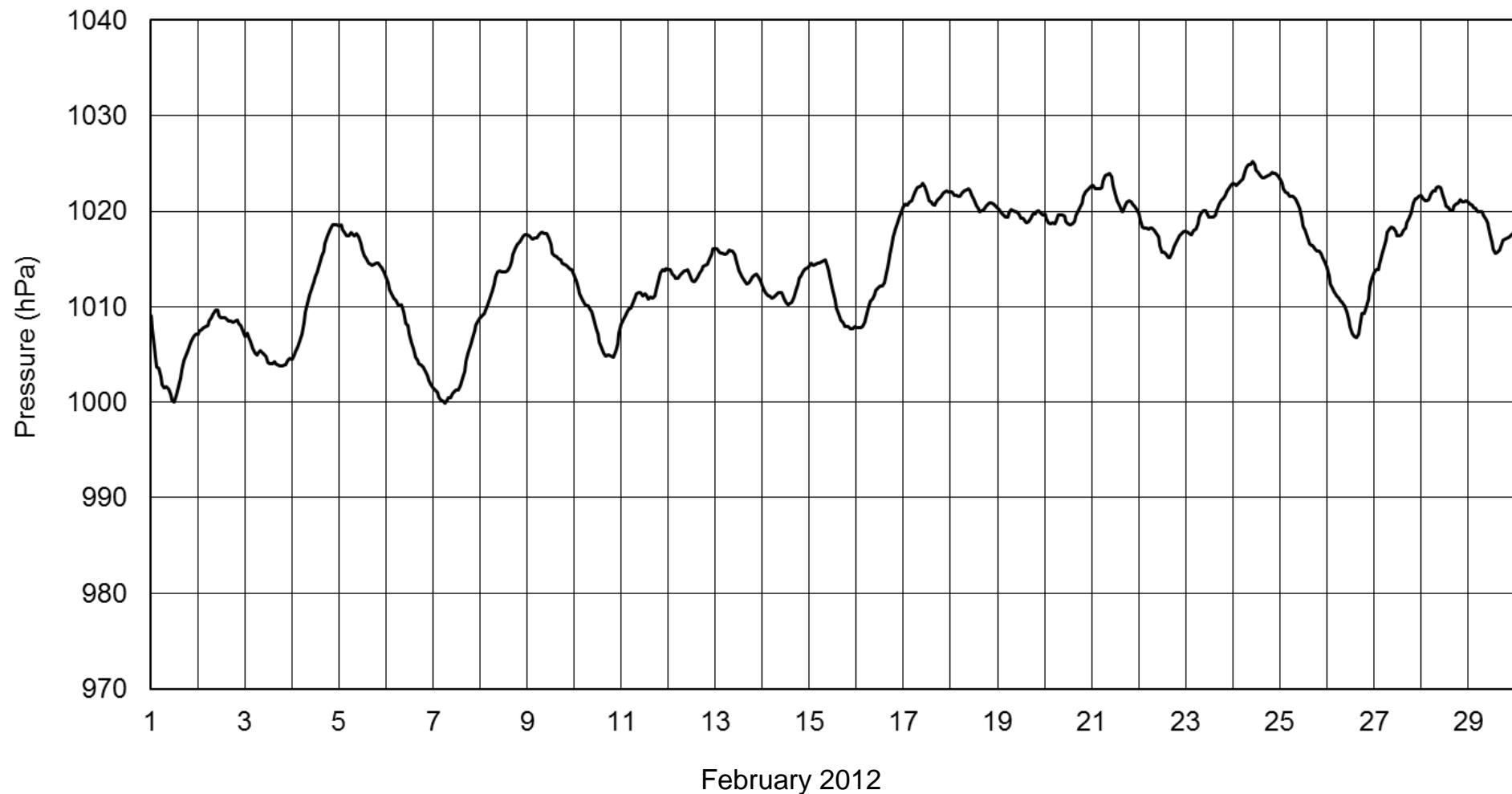
SVIRCO OBSERVATORY - Pressure corrected data

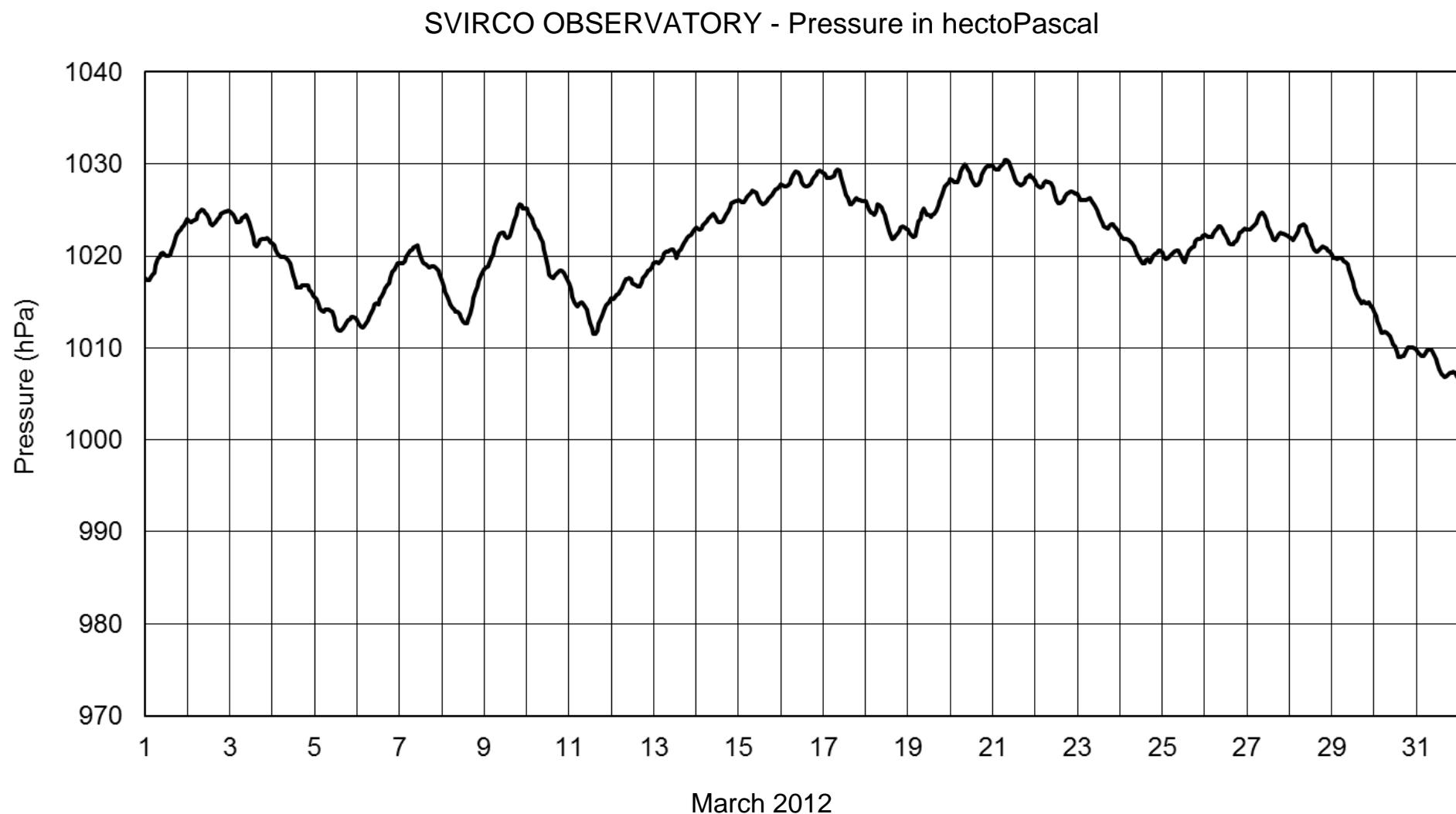


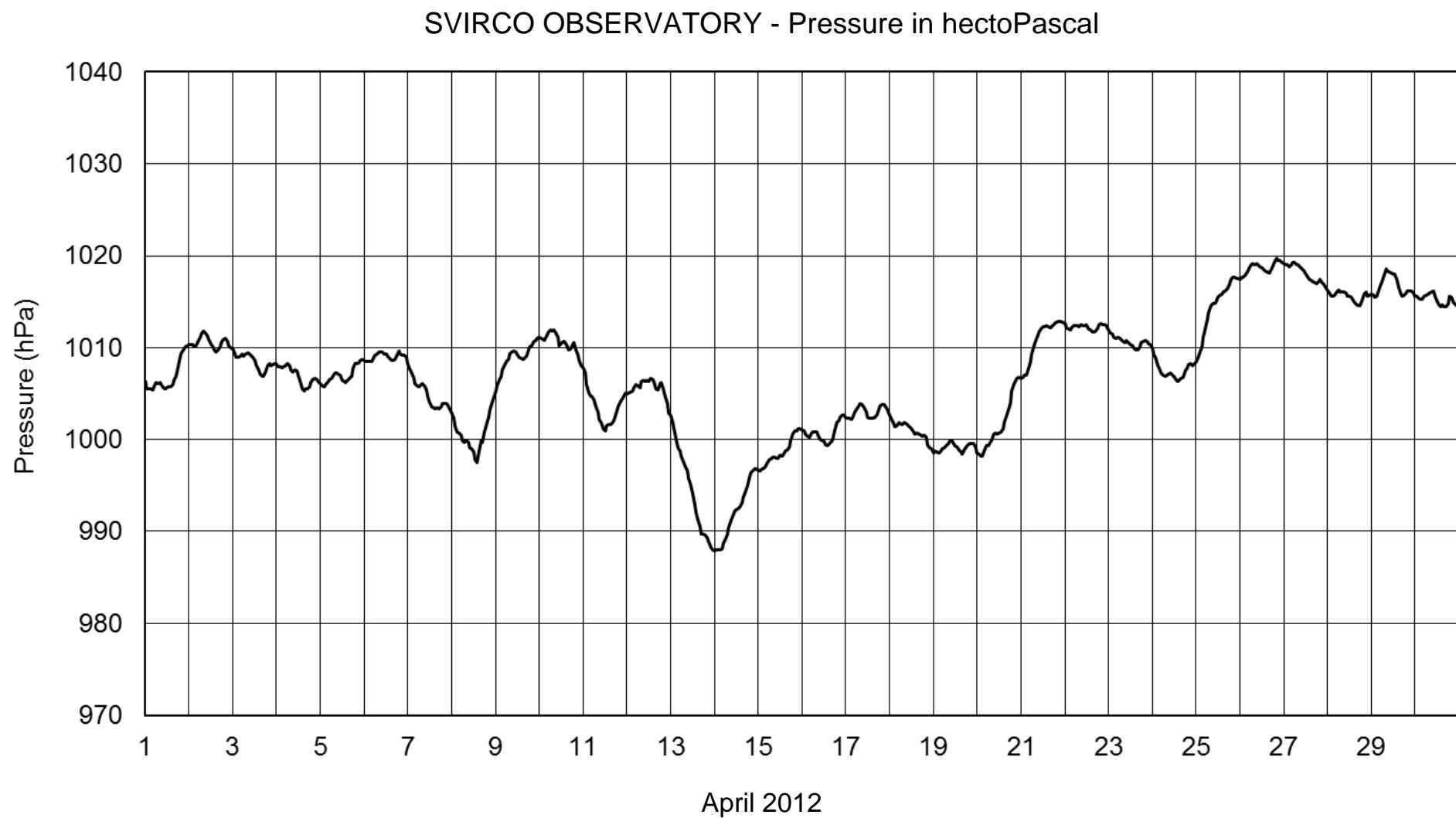
SVIRCO OBSERVATORY - Pressure in hectoPascal



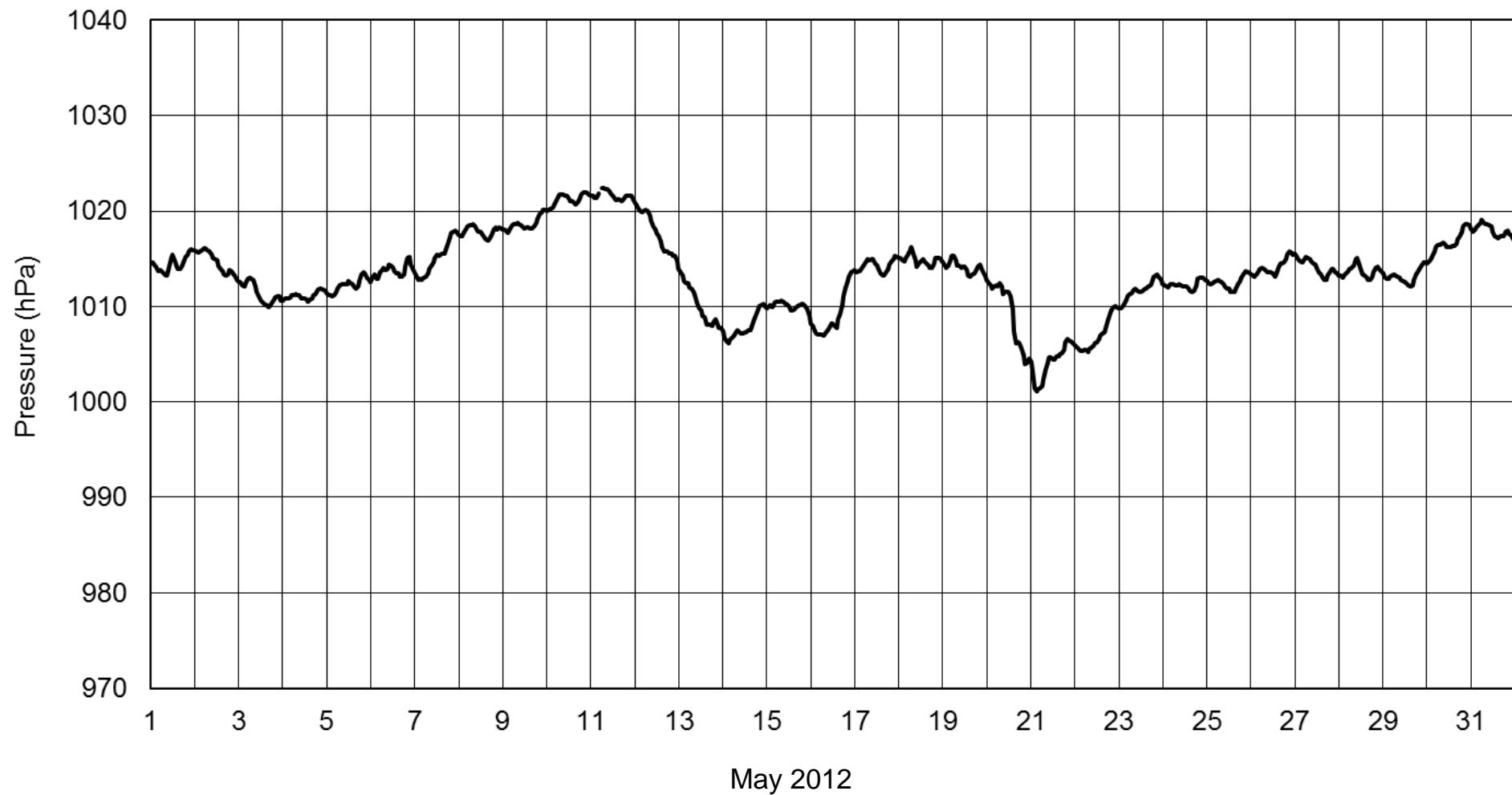
SVIRCO OBSERVATORY - Pressure in hectoPascal

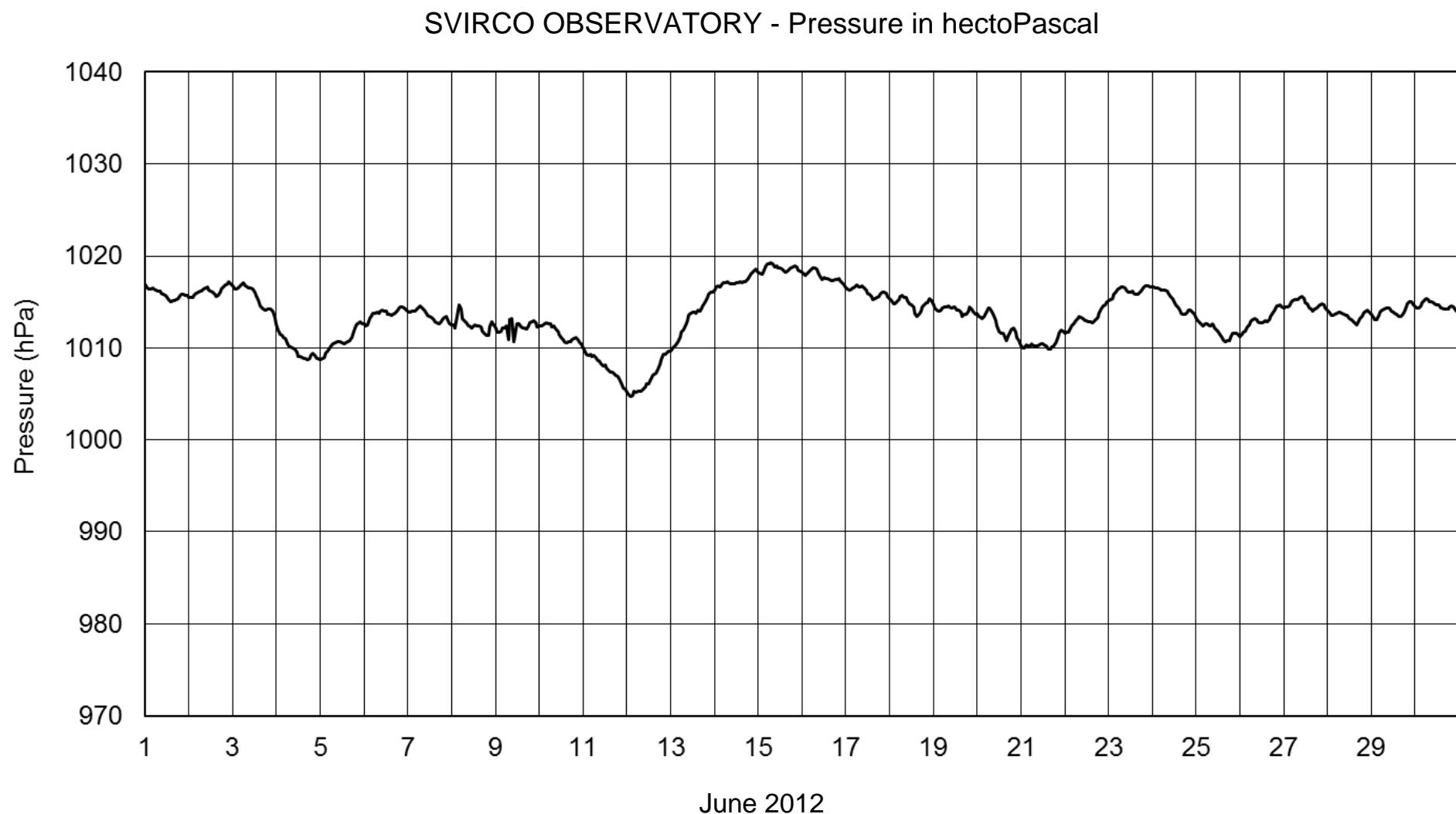


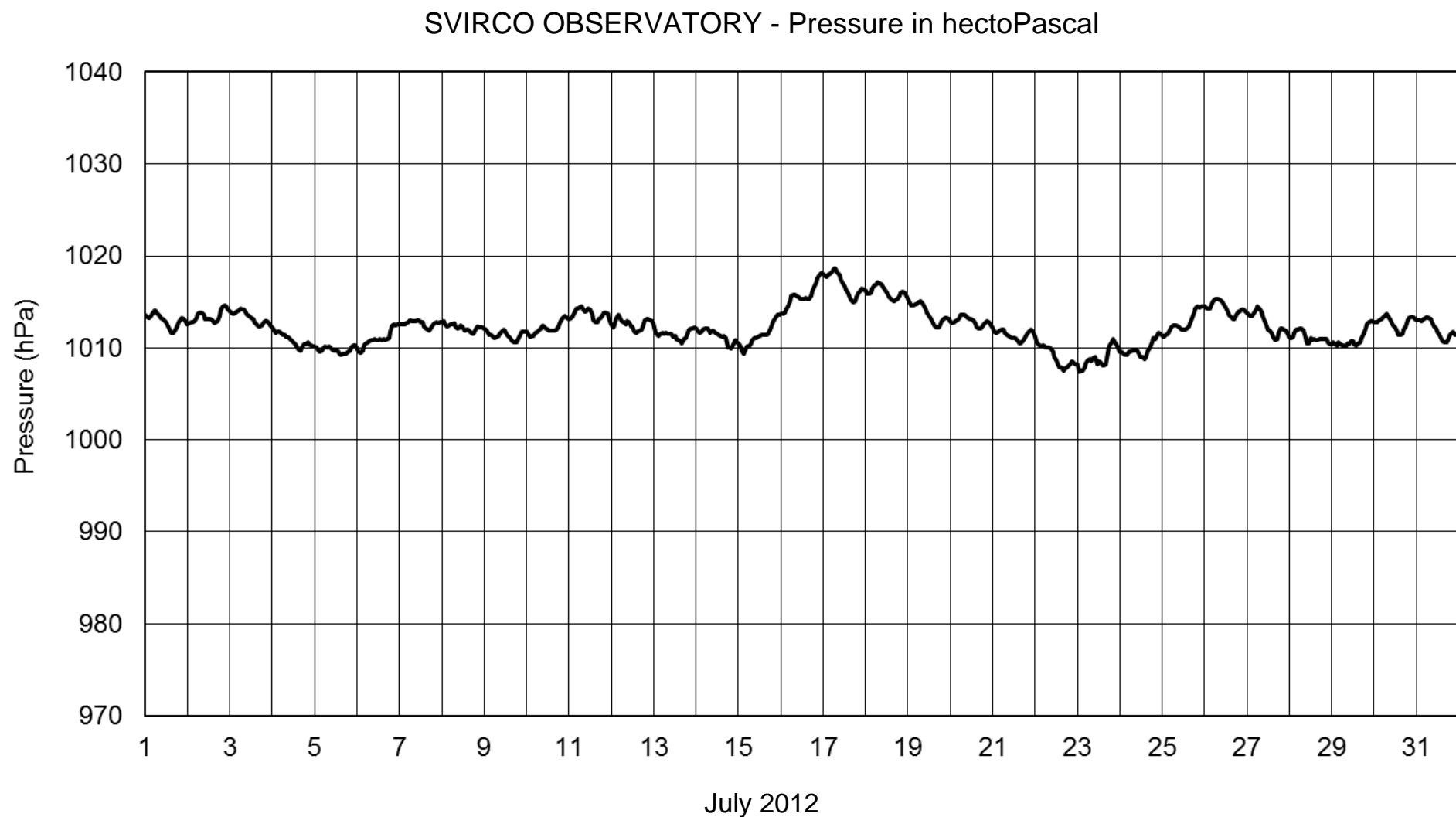


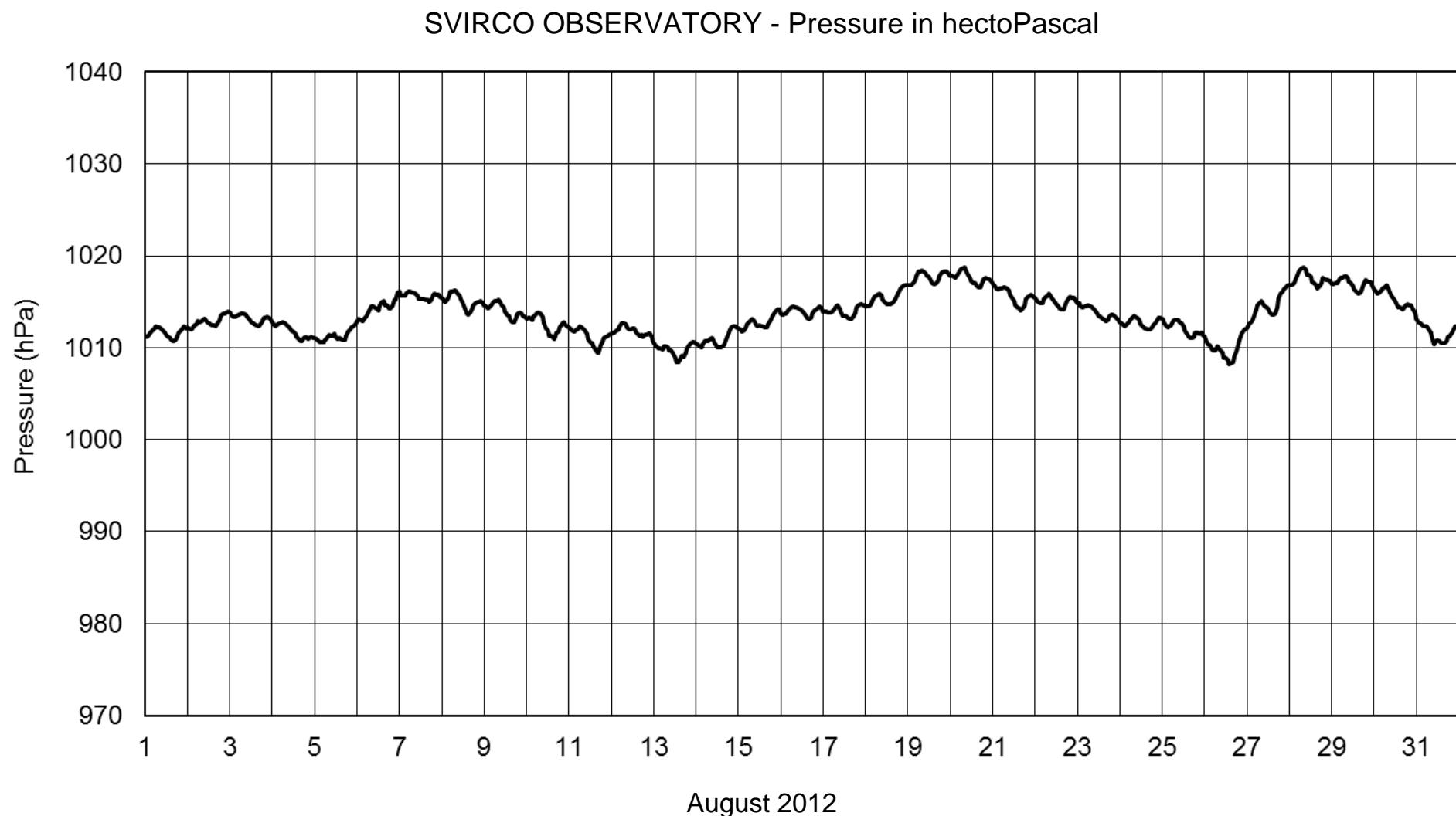


SVIRCO OBSERVATORY - Pressure in hectoPascal

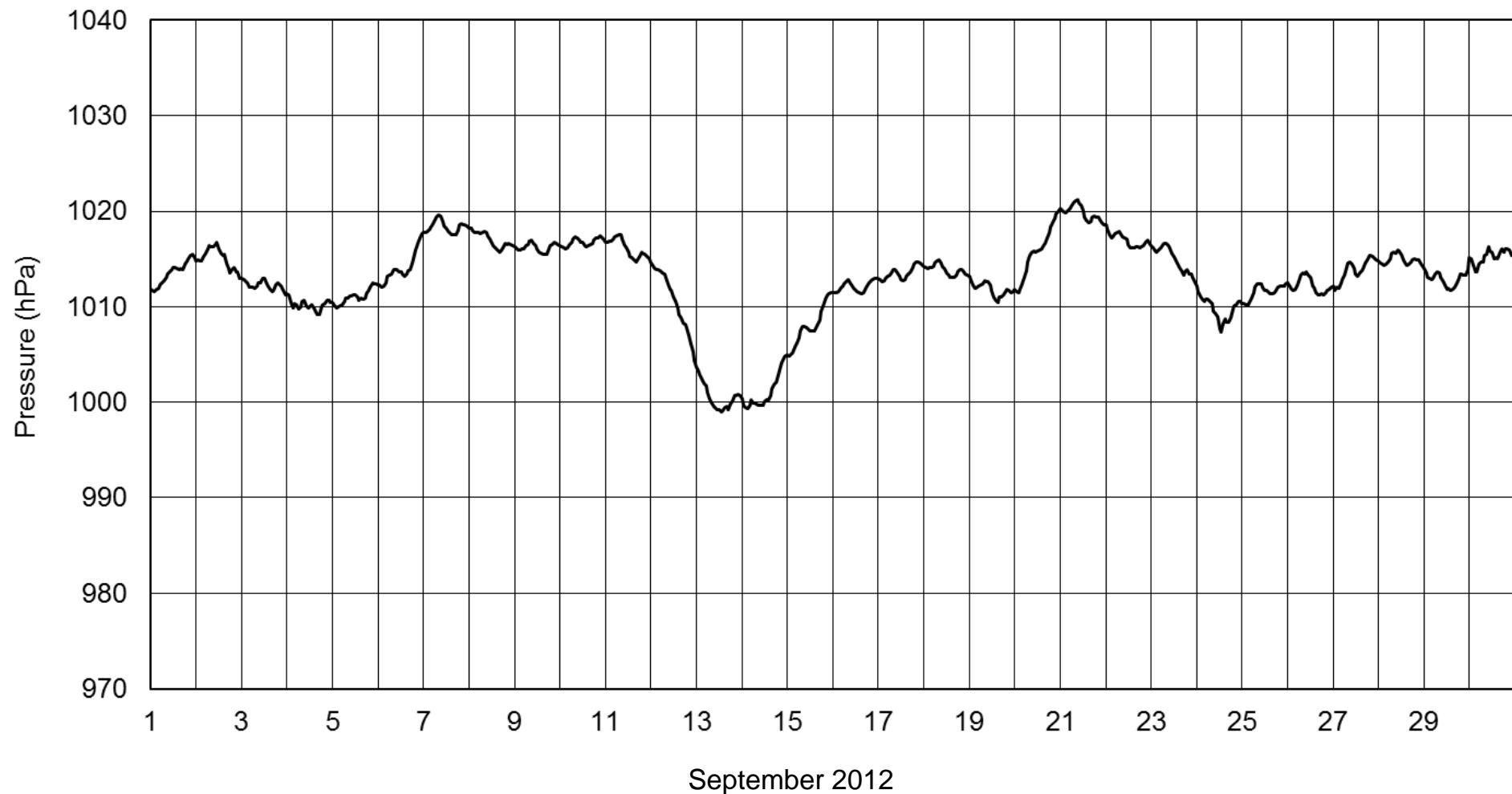


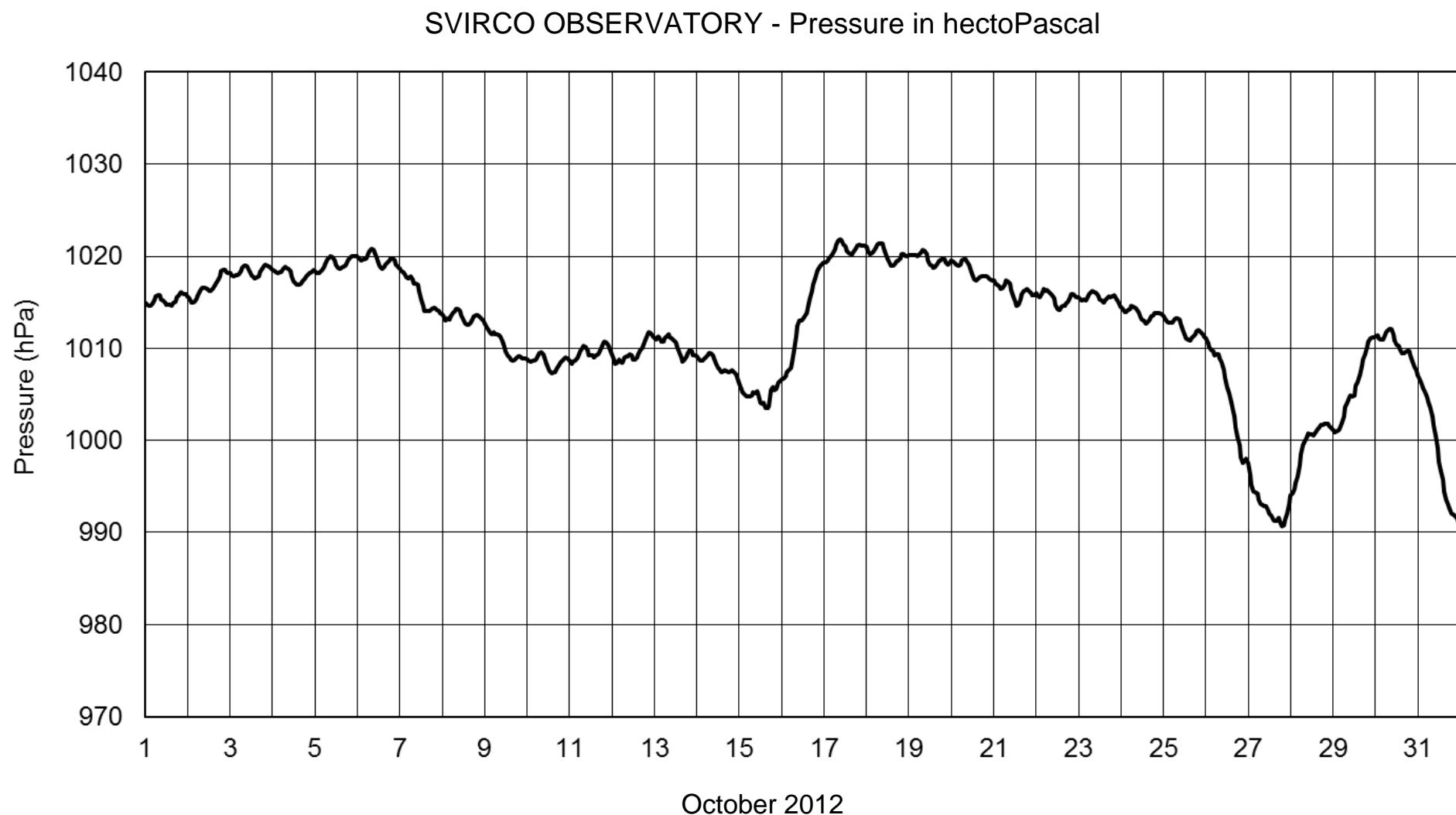


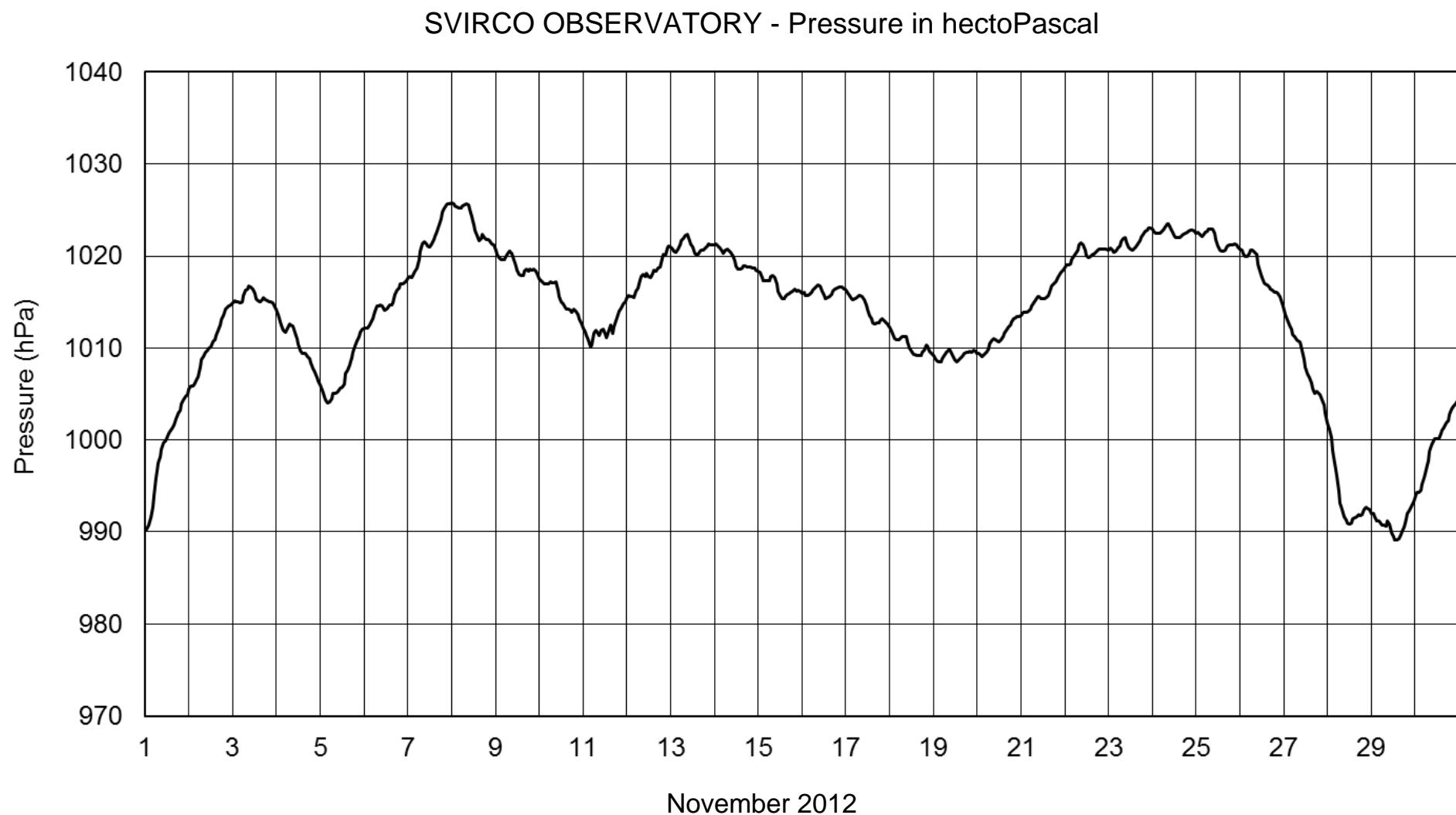


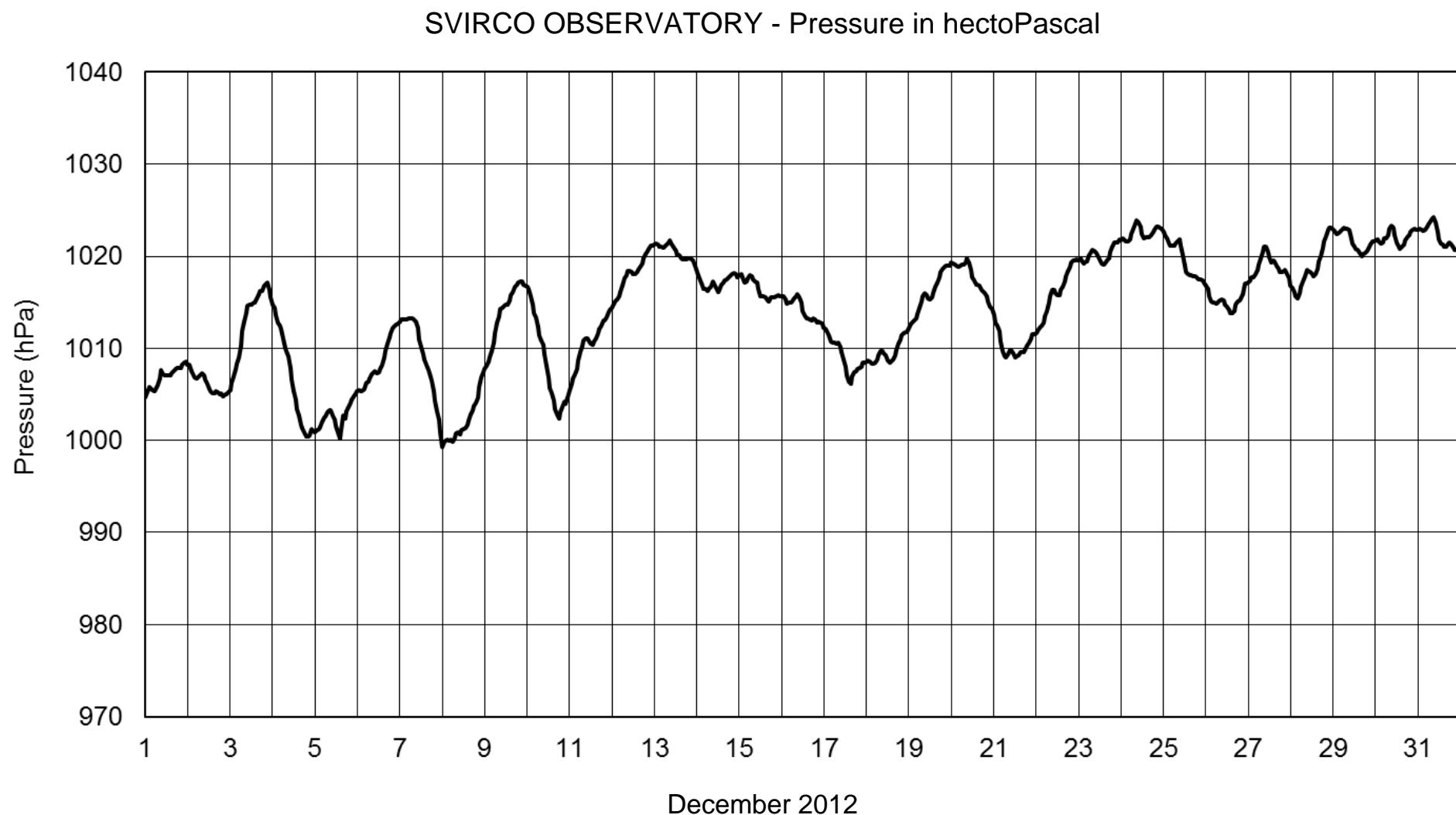


SVIRCO OBSERVATORY - Pressure in hectoPascal

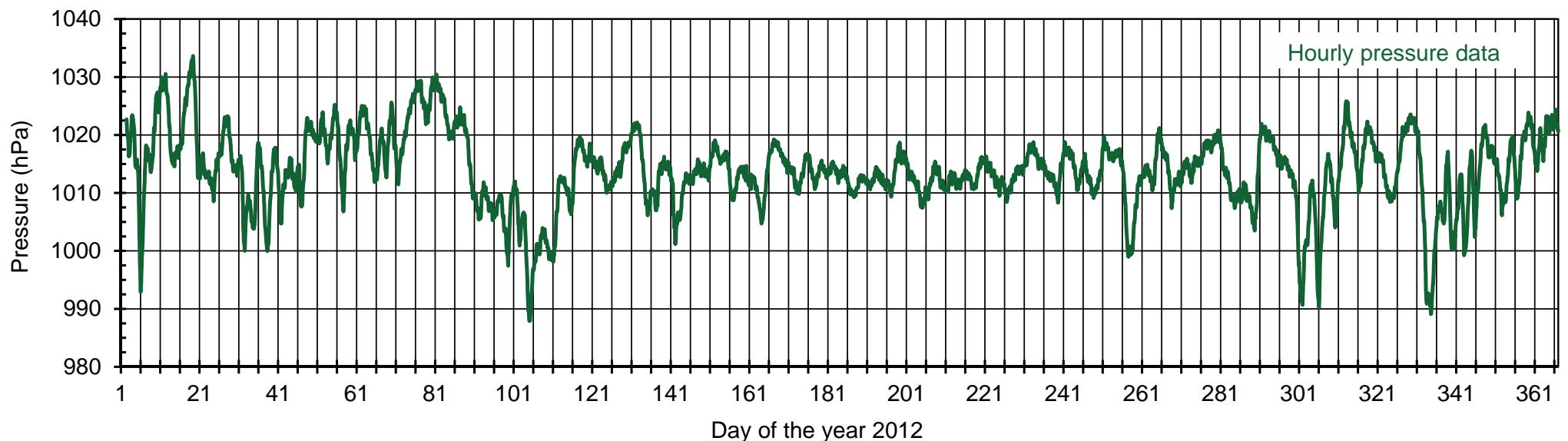
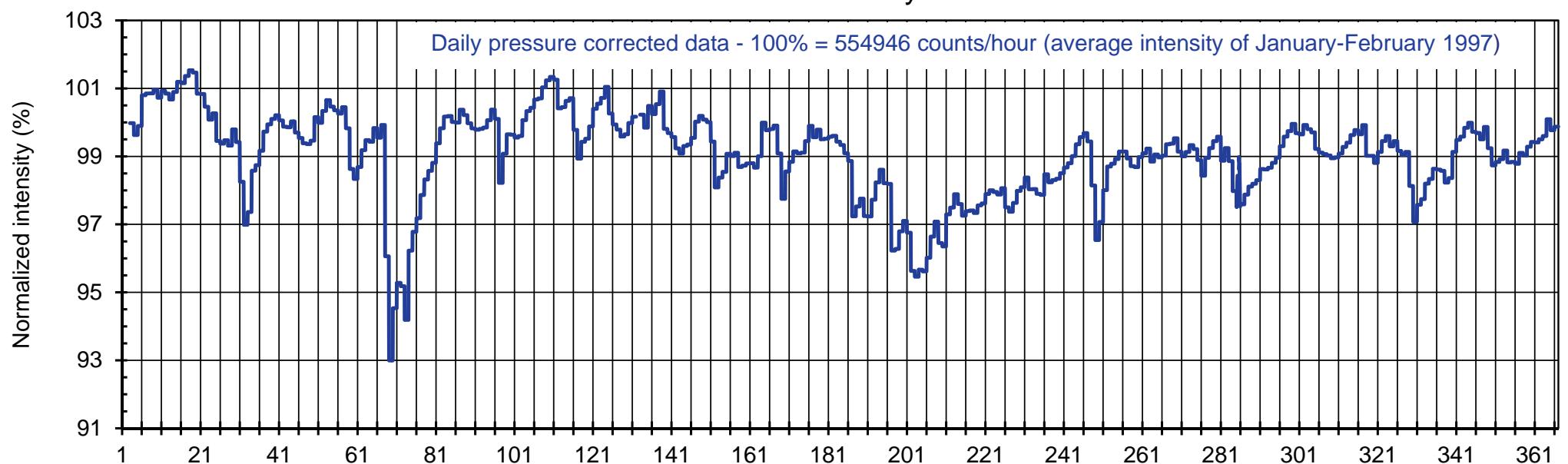








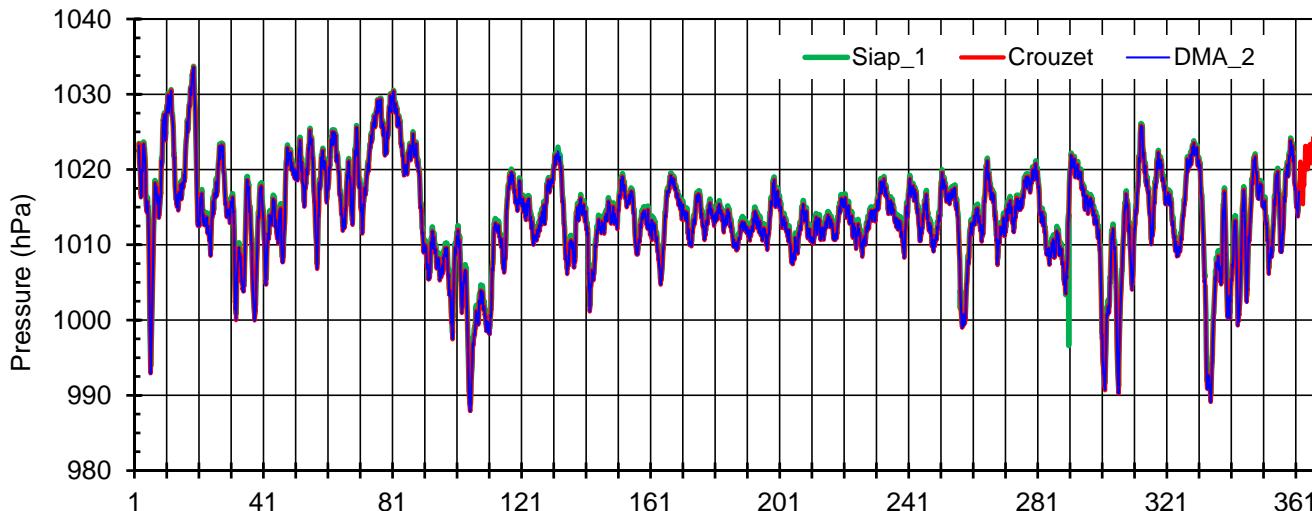
SVIRCO Observatory - Rome



Day of the year 2012

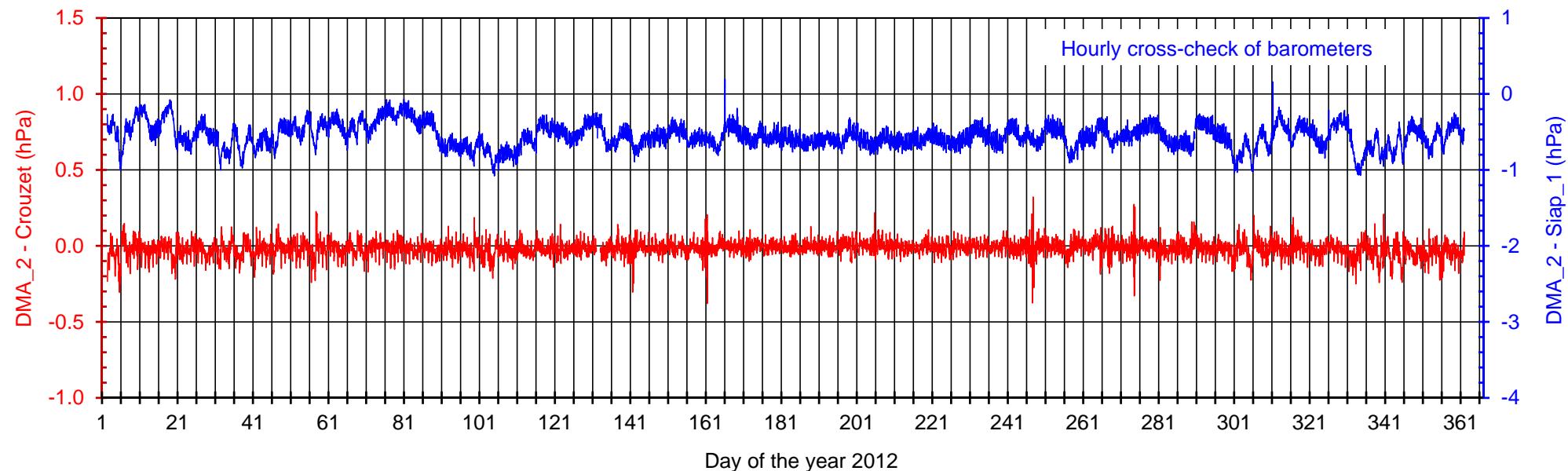
SVIRCO Observatory - Rome

Atmospheric pressure measurements and check of barometers (hourly data)



Barometers operating at SVIRCO - Rome

Instrument	Transducer	Resolution	Accuracy
DMA_1	vibrating cylinder	0.01 hPa	0.04 hPa
DMA_2	vibrating cylinder	0.01 hPa	0.05 hPa
Crouzet	quartz	0.01 hPa	0.08 hPa
Siap_1	aneroid	0.1 hPa	0.5 hPa
Siap_2	quartz	0.1 hPa	1 hPa



SVIRCO Observatory - Rome

