Geosci. Instrum. Method. Data Syst. Discuss.,
https://doi.org/10.5194/gi-2017-16-AC2, 2017
© Author(s) 2017. This work is distributed under
the Creative Commons Attribution 3.0 License.

Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "One second vector and scalar magnetic measurements at low latitude observatory, CPL" *by* Phani Chandrasekhar Nelapatla et al.

Phani Chandrasekhar Nelapatla et al.

phaninelapatla@gmail.com

Received and published: 22 June 2017

We sincerely thank the reviewer for constructive criticisms and valuable comments, which were of great help in revising the manuscript. Accordingly, the revised manuscript has been systematically improved with new information. Our responses to the referee's comments are given below.

Comment (1): Some acronyms are not explicitly defined in the text (e.g. on page 1 line 28: CSIR; on page 7, line 2: MT, page 12, line 12: OFC ...)

Reply: The acronyms (CSIR, NGRI, MO, OFC, IP, and WINSCP) are defined in the

Printer-friendly version

Discussion paper

text.

CSIR: Council of Scientific and Industrial Research NGRI: National Geophysical Research Institute MO: Magnetic Observatory OFC: Optical Fiber Cable IP: Internet Protocol WINSCP: Windows Secured Copy Protocol We would like to replace the acronym MT with MO in the current version.

Comment (2): Page 1, line 24: I think that the BCMT yearly bulletin, that does not discuss the instruments developments for 1-second acquisitions, is not the more suitable citation here. I suggest to cite instead: Chulliat, A., J. Savary, K. Telali, and X. Lalanne (2009), Acquisition of 1-second data in ipgp magnetic observatories, in Proceedings of the XIIIth IAGA Workshop on Geomagnetic Observatory Instruments, Data Acquisition, and Processing, edited by J. J. Love, Open-File Report 2009–1226, pp. 54 – 59, U.S. Geological Survey.

Reply: Cited the reference in the text and removed Courtillot and Chulliat, 2008 as suggested.

Comment (3): Page 1, line 31: for the GEOMAG-02MO sensor, the manufacturer was indicated, I suggest to do the same for the MAGREC-4B.

Reply: Included the manufacturer for MAGREC-4B in the text as suggested.

Comment (4): Page 2, line 3: I suggest to add INTERMAGNET to the list of keywords.

Reply: Included INTERMAGNET to the list of keywords as suggested.

Comment (5): Page 2, line 8: I suggest to indicate explicitly that the data are Earth magnetic field data

Reply: Included 'Earth's magnetic field' as suggested.

Comment (6): Page 2, lines 9-12: most of the institutes cited operating many observatories they do it in collaboration with other institutes. I suggest to modify this list (for instance USGS, GSC, GFZ, EOST are also contributing with a large number of

CC BY

observatories) or to remove it.

Reply: Included the institutes as mentioned in the text and also producing the data under collaboration program.

Across the world, 200 Magnetic Observatories are in operation, of which 150 are INTERMAGNET Observatories (IMOs) recording high quality 1 minute vector and scalar Earth's magnetic field data. Many of the IMOs started recording and producing 1 sec magnetic field data, prominent ones being 11 Magnetic Observatories operating by Institut De Physique Du Globe De Paris (IPGP) (Courtillot and Chulliat, 2008); 3 Polish observatories maintained by Institute of Geophysics Polish Academy of Sciences (Reda and Neska, 2016); 4 observatories operating by the Japan Meteorological Agency (JMA) (Minamoto, 2013); 8 observatories of British Geological Survey (BGS) (Thompson, 2014), and some others operated by different academic and research institutes under collaboration, for example USGS (United States Geological Survey), GSC (Geological Survey of Canada), GFZ (Geoforschungszentrum) and EOST (Ecole et Observatorie des Sciences de la Terre) (see for more information, http://www.intermagnet.org).

Comment (7): Page 2, line 14: I prefer the use of the word "data" as plural word: I suggest to replace "is" with "are".

Reply: Corrected as suggested. Line: 28, Page: 2

Comment (8): Page 3, figure 1: the upper panel includes axes label indicating latitude and longitude values, but the numbers shown are constant on the small area shown. The lower panel contains many annotations that are written with a small font that is not easily readable on print. I suggest to increase the fonts and use colours that are contrasting with the background image.

Reply: Increased the font size in the figure, as well as the resolution in the revised version of the manuscript.

CC BY

Comment (9): Page 3 line 19: I suggest to revise the sentence to make it more straightforward: “The CPL observatory is located 60 km: : : and was developed : : :”.

Reply: Corrected the text as suggested. Lines: 11-12, Page: 4.

Comment (10): Page 3, lines 20-23: I suggest to revise the description of the observatory setup to give some more information aimed at readers not familiar with magnetic observatories.

Reply:The detailed information about the observatory setup was already discussed in Arora et al. 2016.

Comment (11): Page 4, lines 4-14: I think it would improve clarity to describe the history of CPL instrumentations, indicating briefly the reasons behind the installation of additional instruments etc.

Reply: The CPL Magnetic Observatory consists of Tri-axial Digital Fluxgate Magnetometer (DTU, Denmark) and GSM90-F1 Overhauser as primary variometer setup. MAG-01H theodolite was used for performing absolute observations since the day Observatory was established. The Observatory grade 1 second GEOMAG-02MO was also installed as a secondary Magnetometer with another GSM90-F1 Overhauser in the same Observatory campus. The idea of installing the secondary magnetometer is to provide back up to the primary variometer system, in case of any issues.

Comment (12): Page 5, figure 2: correct “Lightning” on the figure description. I again suggest to increase the fonts and make text more easy to read.

Reply: Corrected the spelling of ’Lightning’ in the Figure and also modified the font size in the figures.

Comment (13): Page 5, line 28: ‘Y’ component indicates the East (geographic) component of the magnetic field. I think here the recorded component should be indicated either as E or D.

CC BY

Reply: Included Declination (D) as suggested. Lines: 13-14, Page: 6.

Comment (14): Page 6, figure 3b: The graph contains many details, but there is no indication about the GPS receivers used for time stamping. It could be useful to add this information.

Reply: Included the label 'GPS' in Figure 2 and provided details of GPS receivers in the revised version. Lines: 5-6, Page:6.

Comment (15): Page 6, line 18: I suggest to add the INTERMAGNET technical note in the Reference list, removing its title from this sentence.

Reply: Included the citation of INTERMAGNET technical note in the reference list and removed the title from the text.

Turbitt, C., Benoit St-Louis, Jean Rasson, Jurgen Matzka, Duff Stewart, Danish Technical University, Xavier Lalanne, Gerhard Schwarz, Tom Shanahan., INTERMAGNET Definitive One-second Data Standard, Document number: TN6 , Version number: v1.0, 2014.

Comment (16): Page 6, line 19: I suggest to use the word "issues", instead of "problems".

Reply: Replaced the word 'issues' in the text as suggested.

Comment (17): Page 7, figure 4: an indication about the experimental conditions when these graphs were computed could be useful. Did they were acquired at CPL? How long was the acquisition?

Reply: Figure 4 represents the basic frequency-noise response of the new FGE sensor, generated at controlled conditions at manufacturing location. The manuscript includes the description of the noise characteristics. The data was not acquired from CPL but the acquisition was made few months ago before the shipment of sensor to Hyderabad, India.

CC BY

Comment (18): Page 7, line 6: the text within brackets is reproduced form INTERMAGNET technical note, but it not easily understandable by a reader: I suggest to write “Phase response, maximum group delay”).

Reply: Corrected the text as suggested.

Comment (19): Page 10, line 9: I suggest to indicate the manufacturer of Magrec-4B.

Reply: Included the manufacturer of Magrec-4B in the text as suggested.

Comment (20): Page 10, line 26: I would suggest to use a different expression than “raw GPS data”, since the position solution is not a raw GPS measurement. Raw GPS data would be the pseudorange and phase values of each satellite acquired, before computing a position solution.

Reply: In the current version the raw GPS data was replaced by GPS data.

Comment (21): Page 11, figure 6: this figure contains too many screen-shots that are rendered in a small space. I suggest to reorganize it to have more readable panels. I do not think all 9 panels are necessary for the publication.

Reply: The last panel was removed from the Figure. The new Figure is attached for reference. The appropriate text was also rearranged in the manuscript.

Comment (22): Page 12, line 10: I would suggest to use a different word than “establishment”, e.g. “institute” or “campus”.

Reply: Replaced the word "establishment" with "Institute" in the revised version.

Comment (23): Page 12, line 14: since it was already indicated that the Hyderabad computer is a Windows machine, there is no need to repeat it.

Reply: Removed "Windows machine" in the text as suggested.

Comment (24): Page 13, lines 1-17: I think that this description provides too many operational details that are not needed for this publication.

CC BY

Reply: We wish to keep the description which might provide inputs to the new users, with regard to the data transmission from a remote location.

Comment (25): Page 15, figure 9, page 16, figure 10 and relevant text in the manuscript: I think that using low pass filter to despike the data is not the best approach, since it filters out also many other geophysical signals. It would be preferable to flag the data points that are affected by unwanted noise and remove them when producing quasi-definitive data by substituting their values with the “missing value” used in INTERMAGNET.

Reply: So far we are flagging the data points that are unwanted noise and removing them during the preparation of quasi-definitive data by substituting their values with the “missing value" to INTERMAGNET. We are not planning to despike the data by using the LPF software. The idea is to provide information about the filter software with two examples as shown in the Figures 09a and 09b and 10 .

Reply: The cutoff frequency of 0.005 Hz is not the part of INTERMAGNET 1 second standard. But we made an attempt to see the differences in the noise removed in the data after applying the INTERMAGNET 1 second standard cutoff frequency of 0.2 Hz (Figure 09a) and 0.005 Hz (Figure 09b) for CPL Observatory. It is evident from Figure 09a that the noise in the Z component (last bottom panel) was not completely removed with cutoff frequency 0.2 Hz and still shows the clear signatures of noise in the data set. With the cutoff frequency of 0.005 Hz (Figure 09b, last bottom panel), the noise in the Z component was completely removed. An example showing various cutoff frequencies is illustrated in Figure 10. For low-latitude Observatories especially in India, the influence of temperature, increase in industrialization and habitation are the critical constraints for recording the good quality noise free data, for which more stringent filtering may be required. Our intention is to investigate the optimum filter required for our data based on our processing efforts with various filters. The occasional noise in the data will be removed by applying different cutoff frequencies or flagging the data by removing the data and substituting their values with the “missing value" to

CC BY

INTERMAGNET.

Comment (26): Page 20, lines 4-12: I suggest to add some additional information to recall the upgrades of CPL observatory presented in the article.

Reply: Hyderabad Magnetic Observatory, HYB (1964-present) and Choutuppal Geoelectric Observatory, CPL (1967-1991) were established with the intention of studying low-latitude magnetic phenomena at all frequency ranges. Operations at CPL were discontinued due to increased noise in electrical measurements. With rapid urbanization and introduction of Hyderabad Metro Rail project in the vicinity of IMO-HYB, it was necessary to re-look at possibilities of making noise free magnetic measurements in the erstwhile Geoelectric observatory at Choutuppal. Preliminary observations in 2012 and continuing observations thereafter, have led to recognition of Choutuppal (CPL) as a Magnetic Observatory by International Association of Geomagnetism and Aeronomy (IAGA). The quieter magnetic environment of the CPL campus with minimal human footprint along with carefully designed constructions to minimize effects of temperature fluctuations have led to improving qualities of data and baselines. CPL at present is under consideration of INTERMAGNET status. We have included these points in the revised version of manuscript.

It has been possible now to generate 1 second data in typical low-latitude conditions with a combination of new instrumentation, from the Observatory grade 1 second magnetometer and upgraded version of GSM-90 F1 together with established 3-component Fluxgate Magnetometer and Overhauser, software (Matlab based data processing) and acquisition techniques.

Comment (27): Page 21, line 27: the complete citation of Turbitt et al., 2012 should be: Turbitt, C.; Matzka, J.; Rasson, J.; St-Louis, B.; Stewart, D., An instrument performance and data quality standard for INTERMAGNET one-second data exchange. [Poster] In: XVth IAGA Workshop on Geomagnetic Observatory Instruments and Data Processing, Cadiz, Spain, 4-14 June 2012.

CC BY

Reply: Included the complete citation in the reference list.

**** Figures 9, 10, 12 and 13 of earlier version were now modified and in the revised version the figures are attached for your kind reference and continues with the same figure numbers.

**** For your kind perusal, pdf is attached herewith as a supplementary which contains both text and figures together.

Please also note the supplement to this comment:
http://www.geosci-instrum-method-data-syst-discuss.net/gi-2017-16/gi-2017-16-AC2-supplement.pdf

---

Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., https://doi.org/10.5194/gi-2017-16, 2017.

CC BY

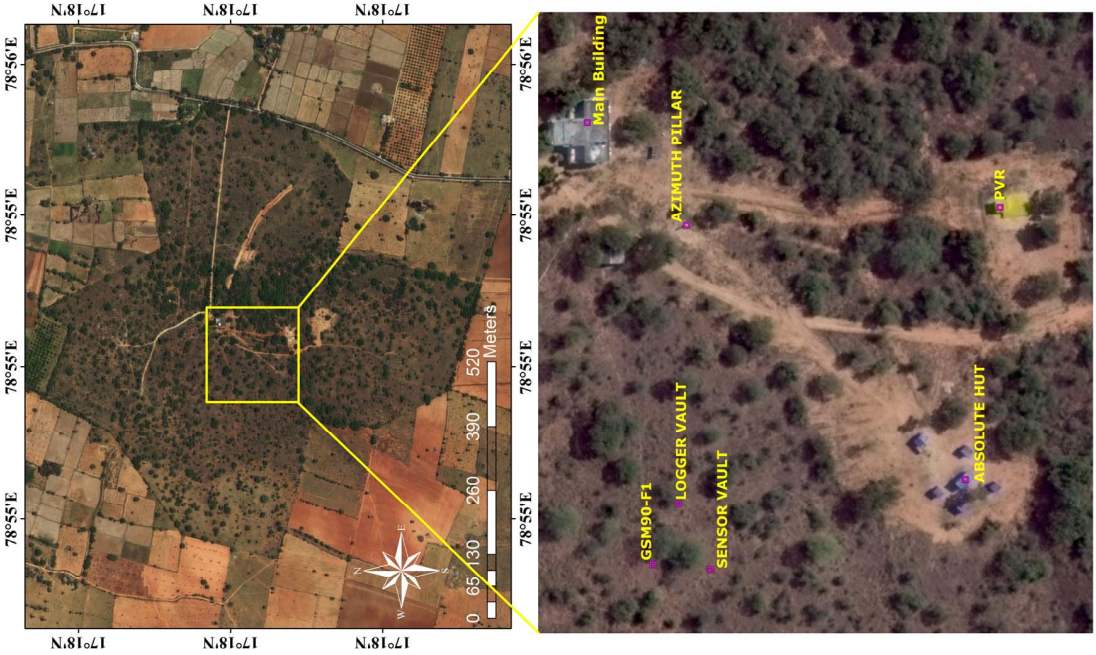


Fig. 1. Figure 01. Bird's eye view of Choutuppal campus of CSIR-National Geophysical Research Institute (top panel) and the highlighted text box show the location of variometer vaults, Azimuth pillar, Absolut

Printer-friendly version

Discussion paper

CC BY

Fig. 2. Figure 02. Thermally insulated new variometer vaults using Extruded Polystyrene (EPS) foam sheets for good temperature control and the location of sensor and logger vaults.

CC BY

Fig. 3. Figure 06. Details of data logging and real-time plotting tools of MAGREC-4B data acquisition system

CC BY

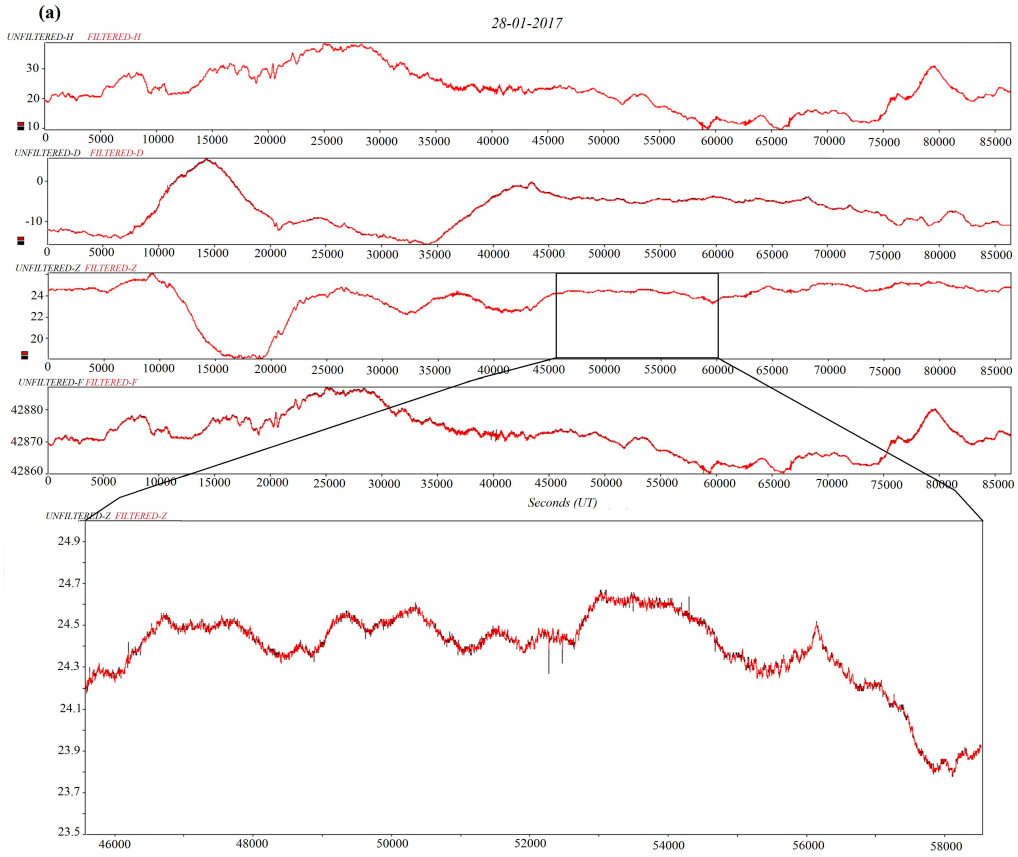
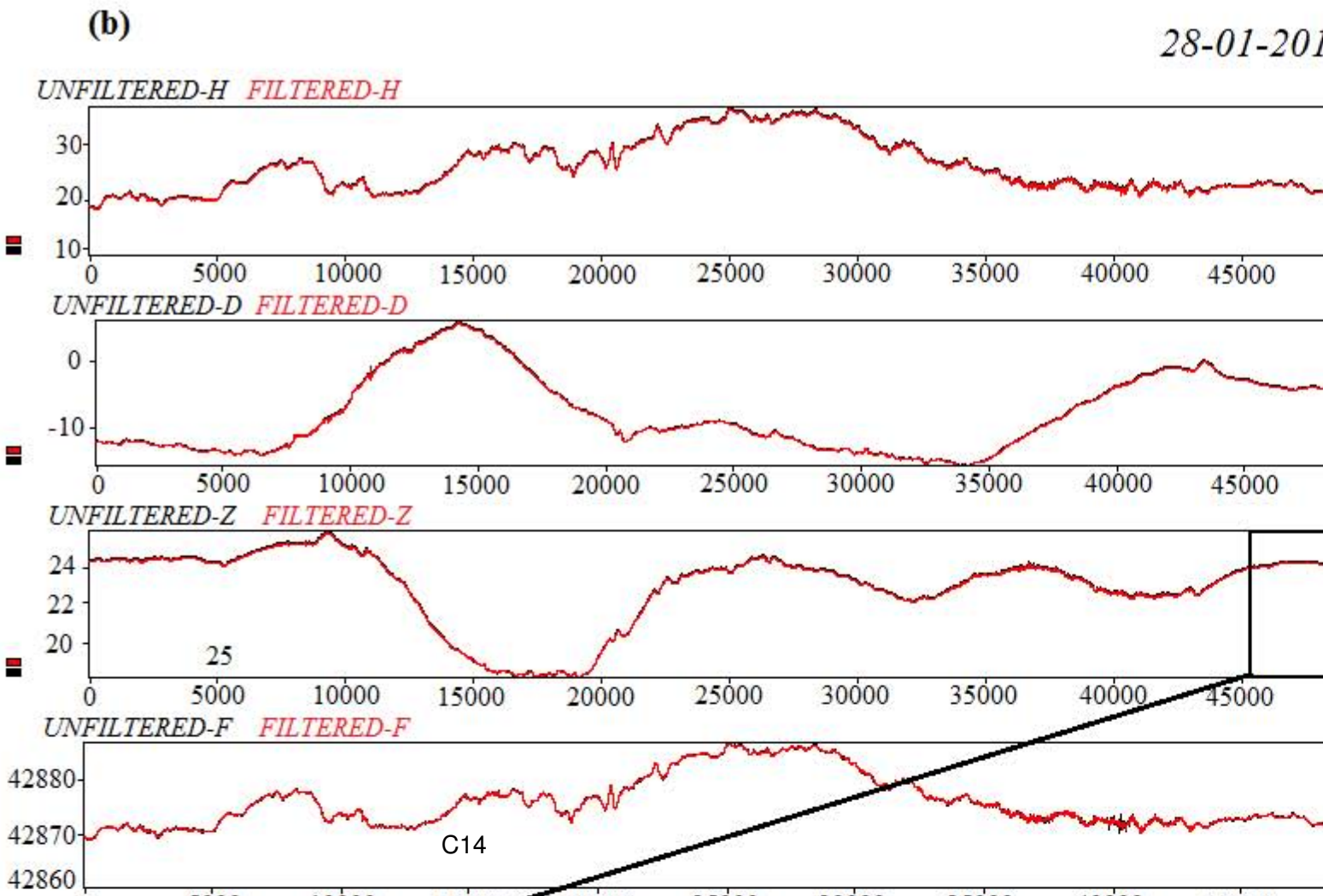


Fig. 4. Figure 9a. Sample plots of 1 second raw (black colour line) and filtered data (red colour line) with cut-off frequency 0.2 Hz from the CPL Magnetic Observatory.

Printer-friendly version

Discussion paper

CC BY


(b)
28-01-201
UNFILTERED-H FILTERED-H
30
20
10
0 5000 10000 15000 20000 25000 30000 35000 40000 45000
UNFILTERED-D FILTERED-D
0
-10
0 5000 10000 15000 20000 25000 30000 35000 40000 45000
UNFILTERED-Z FILTERED-Z
24
22
20
25
0 5000 10000 15000 20000 25000 30000 35000 40000 45000
UNFILTERED-F FILTERED-F
42880
42870
42860
C14

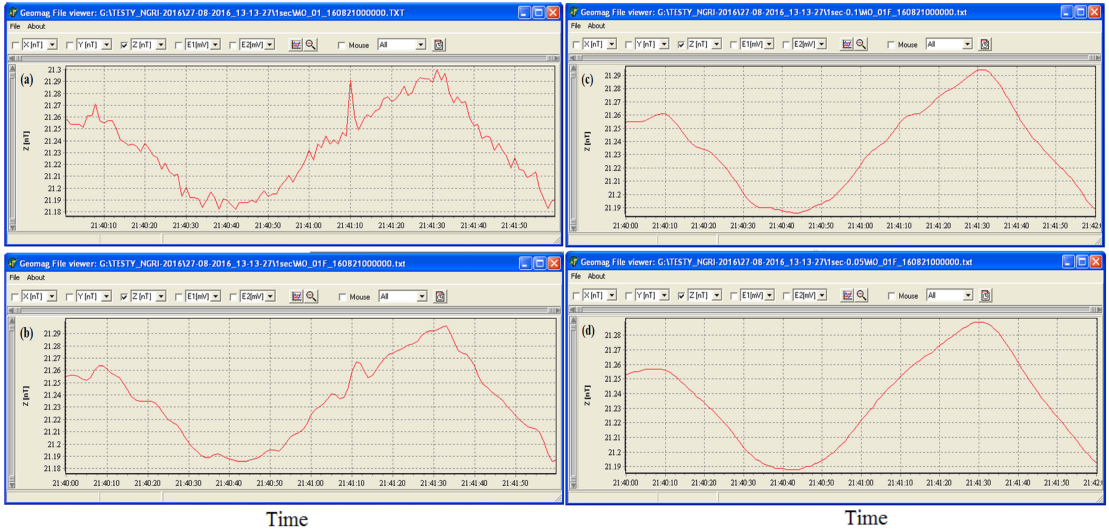


Fig. 6. Figure 10. Despiking of data using Low Pass Filter GEOMAG software with different cut-off frequencies.

Printer-friendly version

Discussion paper

CC BY

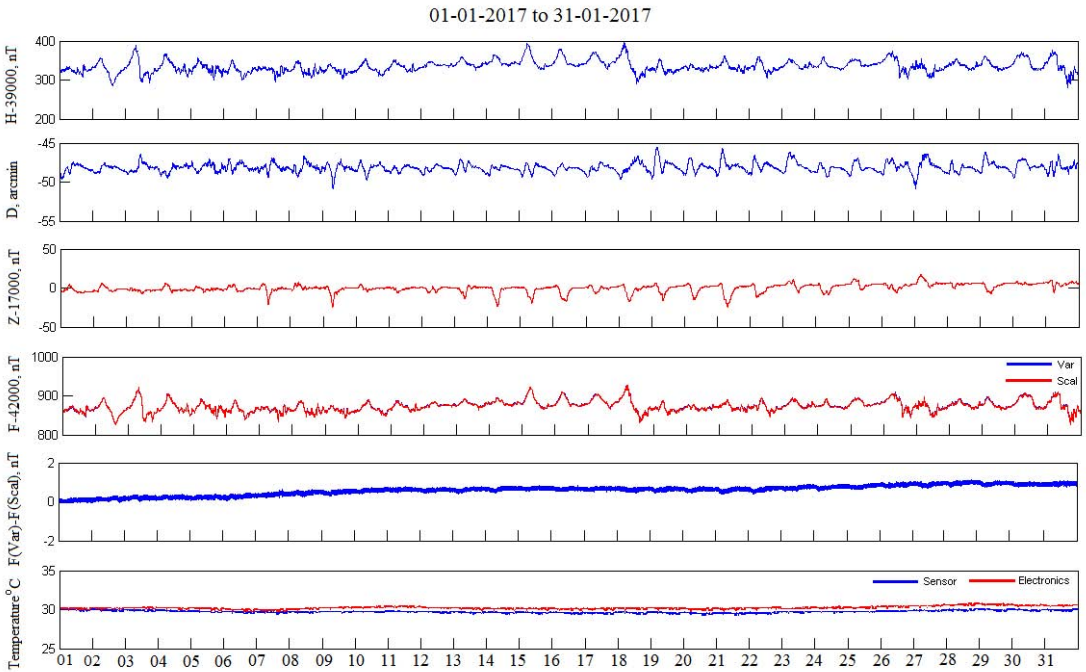


Fig. 7. Figure 12. One complete month (i.e. January 2017) of observed variations and the temperature stability of the enclosure design of CPL Magnetic Observatory

Printer-friendly version

Discussion paper

CC BY

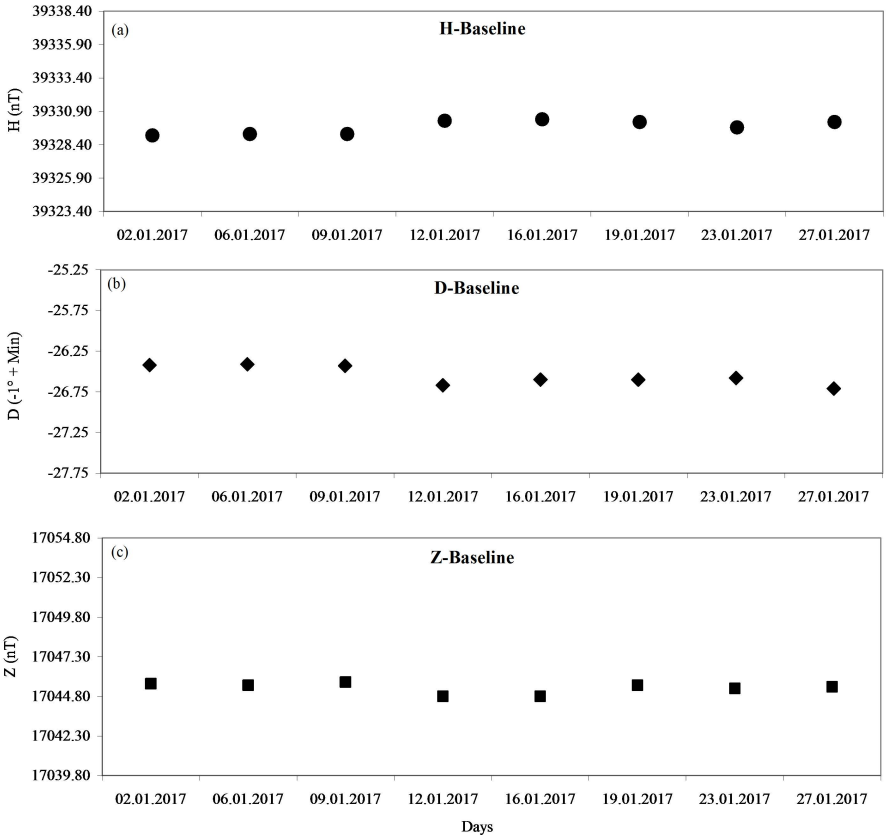


Fig. 8. Figure 13. Computed baselines of H, D and Z components of GEOMAG-2MO for January-2017

CC BY