# Geomagnetic field observations at a new Antarctic site, within the AIMNet project

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**ABSTRACT**

During the 2007-2008 antarctic campaign, the Italian PNRA installed a Low Power Magnetometer within the framework of the AIMNet (Antarctic International Magnetometer Network) project, proposed and coordinated by BAS. The magnetometer is situated at Talos Dome, around 300 km from Mario Zucchelli Station (MZS), and approximately at the same geomagnetic latitude as MZS. In this work we present a preliminary analysis of the geomagnetic field 1-min data, and a comparison with simultaneous data from different Antarctic stations.

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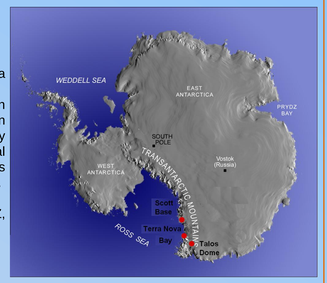
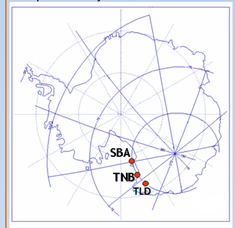
## INTRODUCTION

In this study we show a preliminary analysis of geomagnetic field data recorded at Talos Dome (TLD) from 18 January to 14 March, 2008.
The availability of simultaneous measurements from Mario Zucchelli Station (TNB, formerly Terra Nova Bay) and Scott Base (SBA), allows to make an interesting comparison in that the three stations are located approximately at the same geomagnetic latitude (~ 80°S), with approximately 2 hours total displacement in magnetic local time (MLT; see Table 1). This location is particularly useful to study the signal propagation in the azimuthal direction.

Italian stations TNB and TLD are run by INGV; SBA data, run by IGNSL NZ, are provided by INTERMAGNET database.




The geographic and corrected geomagnetic coordinate systems are indicated, as dashed and solid lines, respectively.

Location of the three Antarctic sites TNB, SBA and TLD.

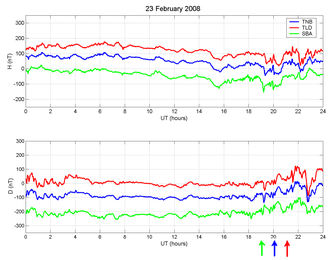
| Station | Geographic Coord. | Corr. Geom. Coord. | MLT Noon (UT) |
|---|---|---|---|
| TNB | 74.7S 164.1E | 80.0S 306.7E | 20:13 |
| SBA | 77.8S 166.8E | 79.9S 326.1E | 19:03 |
| TLD | 72.8S 159.0E | 80.4S 292.4E | 21:06 |

**Table1**
Geographic coordinates, IGRF08 corrected geomagnetic coordinates and times in UT of the geomagnetic local noon for the 3 stations.

## TLD GEOMAGNETIC FIELD DATA

The pictures show the installation of the LPM magnetometer at TLD during the 2007-2008 Antarctic campaign. The system, with rechargeable batteries powered by a solar panel and a wind generator, has minimal power requirements.

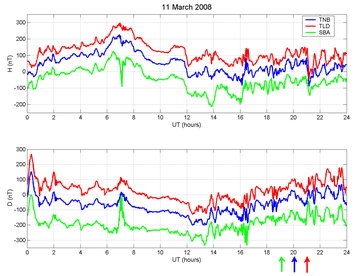
The TLD dataset consists of 1-min averages, from 1-sec original sampling rate, of the three geomagnetic field components H, D and Z recorded from 18 January to 14 March, 2008.




*February, 23* (top) is a quiet day, with sum(Kp)=10.
The plots show that the geomagnetic signals increase in the last hours of the day, when the stations are closer to local geomagnetic noon (indicated by the arrows).

**EXAMPLES OF DAILY MAGNETOGRAMS AT SBA, TNB AND TLD.**

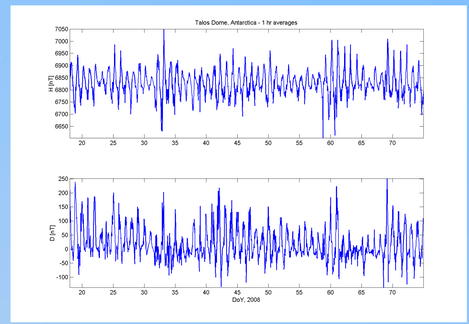
It is evident that the observations at the three stations are very similar, although some differences can be found.

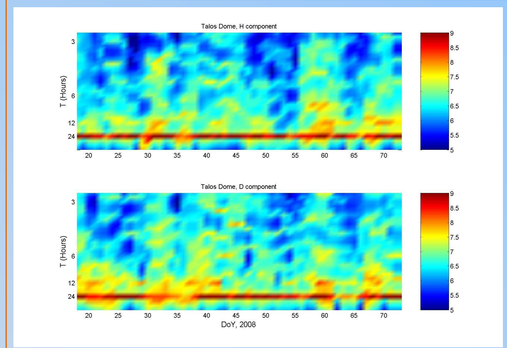



*March, 11* (left) is a more disturbed day, with sum(Kp)=23.
In the dayside MLT sector (from ~13 UT), there is an evident geomagnetic activity.
We note also the interesting signal around 7 UT, whose amplitude maximizes at SBA, which at that moment is exactly at MLT midnight.
The arrows indicate MLT noon at the three stations.

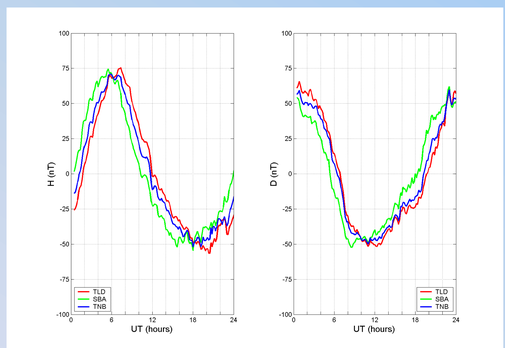
## DIURNAL VARIATION

On the right the hourly values of the horizontal H (northward) and D (eastward) component variations are shown.
The presence of a quite regular 24-hr variation, whose amplitude strongly varies from day to day, is clearly evident.




The dynamic spectrum on the left shows a sharp, persistent power peak in correspondence of 24-hr period. Sometimes also a 12-hr peak emerges.




Daily distribution of the average 10-min values of the two horizontal geomagnetic field components at SBA, TNB and TLD. Each point represents the variation at a fixed 10-min interval, averaged over the whole 57-days analyzed time period.

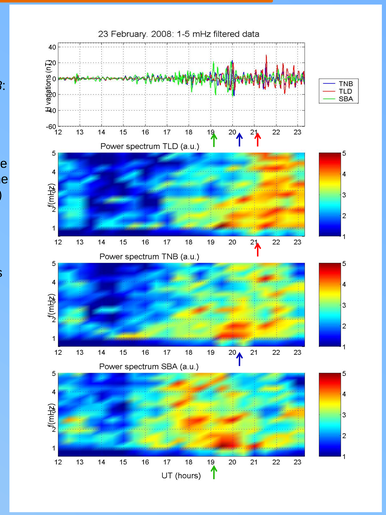
It is evident that the diurnal variation is very similar at the three stations.

There is a clear time shift between the stations, corresponding to the difference in MLT (see Table 1): SBA is leading ~1 hr with respect to TNB and ~2 hrs with respect to TLD.

## SINGLE EVENTS

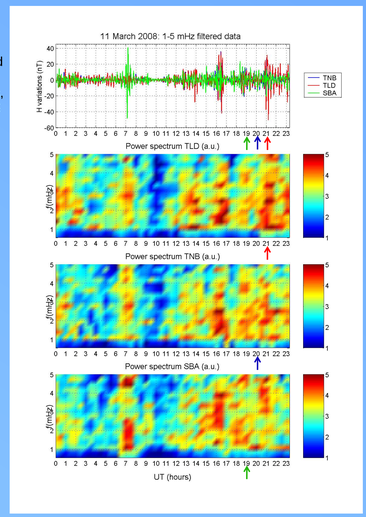
We show two single events, for which a comparison between the geomagnetic signals at the three stations gives interesting results (see the corresponding magnetograms, previously shown in the left bottom part of the poster).

The event occurring on *23 February, 2008*: the wave activity arises from ~ 17 UT. As evident both from the filtered data and the power spectra, the signal amplitude in the first hours (17-19 UT) is greater at SBA; around 20 UT it is greater at TNB and from 21 UT at TLD. This feature indicates an increasing amplitude approaching local geomagnetic noon (indicated by the arrows).



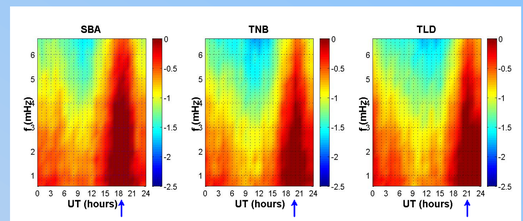

*Top panel*: variations of the geomagnetic field H component at the three stations, filtered in the 1-5 mHz frequency range.

*hree bottom panels*: dynamic power spectra at the three stations.

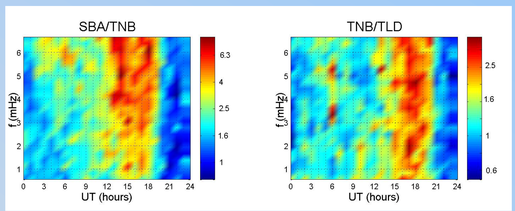



The event occurring on *11 March*, 2008: there is a sustained wave activity in the dayside MLT sector, from ~13 UT, simultaneously at the three stations. Moreover, there is a burst of activity around 7 UT, with a definitely greater amplitude and lower, broader frequency, at SBA, i.e. the station that at 07:03 UT is at MLT midnight (Table 1). The arrows indicate MLT noon at the three stations.

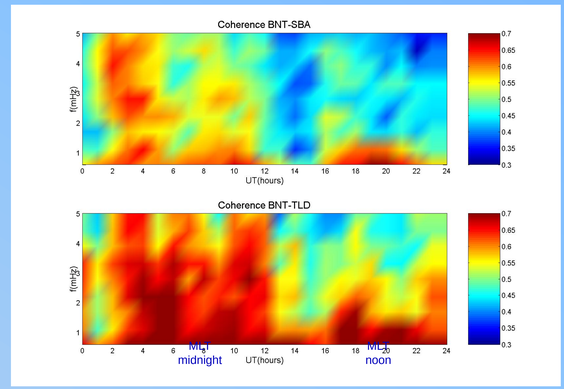
## AVERAGE COHERENCE AND POWER SPECTRA




Average dynamic power spectra (a.u.) of the H component at the three stations. The power at each station clearly maximizes around MLT noon (indicated by the arrows).




Average ratio between dynamic power spectrum at TNB-SBA and TNB-TLD. The ratio shows a bipolar variation, varying from maximum to minimum values around the MLT noon at each couple of stations.




Daily distribution of the average coherence between H-component fluctuations at TNB-SBA and TNB-TLD. The coherence is higher for the two stations TNB-TLD, which are a little closer than TNB-SBA (Table 1).
During the day, the coherence is higher in the MLT night sector (2-12 UT), when the stations are well within the polar cap, far from the cusp, and also just before MLT noon (17-21 UT). The coherence generally decreases for increasing frequency, expecially in the daytime sector.