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Testing the three axis magnetometer and gradiometer MOURA and data comparison on San Pablo de los Montes Observatory.

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A magnetometer and gradiometer named MOURA has been developed with the objective to measure the magnetic field on Mars in the frame of Mars MetNet Precursor Mission (MMPM) [1]. MOURA is a compact, miniaturized, intelligent and low cost instrument, based on two sets of triaxial magnetometers separated one centimeter from each other to do gradiometry studies. It has a resolution of 2.2 nT, and a field range of $\pm$ 65μT, which can be extended to $\pm$130 μT when sensors are saturated. [2]

These sensor heads are Anisotropic MagnetoResistances (AMR) Commercial-Off-The-Shelf (COTS) by Honeywell, specifically HMC1043, which has been selected due to their relative low consumption, weight and size, factors very important for the mission with very limited mass and power budget (shared 150 g for three full payloads). Also, this technology has been previously successfully employed on board Unmanned Aerial Vehicles (UAV) to perform geomagnetic surveys in extreme conditions areas [3], and in several space missions for different applications. [4]

After the development of the MOURA Engineering Qualification Model (EQM) in November 2011, an exhaustive set of tests have been performed to validate and fully characterize the instrument. Compensation equations have been derived for the temperature corrections in the operation range (between -135 ºC and 30 ºC) in controlled environments. These compensation equations have been applied to field data, which have shown to follow the daily Earth´s magnetic field variations as registered by San Pablo Geomagnetic Observatory (IAGA code: SPT) (available at www.ign.es and www.intermagnet.org) with deviations lower than 40 nT. These deviations were attributed to several error factors as the different locations between MOURA and SPT and other possible different geomagnetic conditions.

Due to the above, a measurement campaign on SPT installations are been done. The main objective is to compare MOURA measurements on a relevant environment, with data obtained by SPT magnetometers. This is considered the last step prior to Mars in situ measurements.

SPT employs for geomagnetic observations a fluxgate magnetometer FGE-Danish Meteorological Institute and a fluxgate vector magnetometer Geomag M390, both equipped with Overhauser effect magnetometers GSM90. The conditions into the rooms that contain these instruments are controlled. The equipments are situated on several pillars fixed strategically at Earth surface avoiding vibrations and other Earth movement that could affect measurement due to changes on the sensor position, the region is magnetically clean and the temperature variation is very low. Magnetic measurements are performed by MOURA for several days located on one of these pillars. These measurements are compared with SPT reference instrumentation with the aim to obtain a direct and very accurate evaluation of MOURA facing reference instrumentation.

1. http://metnet.fmi.fi/index.php

2. Development of miniaturized instrumentation for Planetary Exploration and its application to the Mars MetNet Precursor Mission. H. Guerrero et al. EGU General Assembly 2010, held 2-7 May, 2010 in Vienna, Austria, p.13330

3. Funaki, M.; Hirasawa, N.; and the Ant-Plane Group. Outline of a small unmanned aerial vehicle (Ant-Plane) designed for Antartic research. Polar Science 2008, 2, 129-142.

4. M. Diaz-Michelena Sensors 2009, 9(4), 2271-2288