GuMNet : A new long-term monitoring initiative in the Guadarrama Mountains, Madrid (Spain)

GuMNet Team Members *

Summary

We are announcing a new monitoring network in the Guadarrama Mountains north of Madrid, which **is planned to be operational during 2015.** GuMNet (Guadarrama Monitoring Network) integrates atmospheric measurements as well as subsurface observations. It aims at improving the characterization of atmosphere-ground interactions in mountainous terrain, the hydrometeorology of the region, climate change regional/local impacts, and related research lines. It will also provide the meteorological and climate data that constitute the necessary background information for biological, agricultural and hydrological investigations in this area. Currently, the initiative is supported by research groups from the Complutense and Polytechnical Universities of Madrid (UCM and UPM), the Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT), the Spanish National Meteorological Agency (AEMET), and finally the Parque Nacional de la Sierra de Guadarrama (PNG). This network will increase the coverage of high mountain instrumentation in southern Europe. This will be a source of high quality data for research groups that need meteorological and/or climatological atmospheric and subsurface information.

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Temporary web page: http://tifon.fis.ucm.es/~gumnet

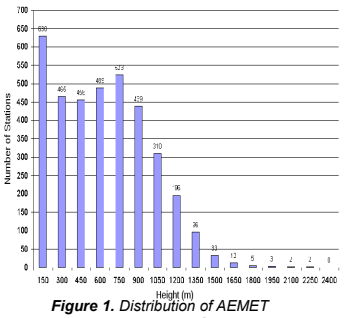
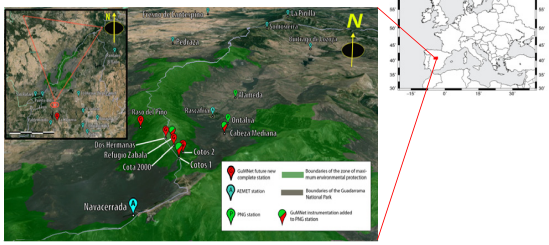


Figure 1. *Distribution of AEMET meteorological stations in Spain in 1999 with respect to altitude, (Duran et al., 2003). Note the small number of high altitude observation sites in mountain areas.*

Location of hydro-meteorological sites

Figure 2. *Distribution of the final GuMNet sites, including the new instrumentation (red symbols) and the existing PNG (green) and AEMET (blue) sites.*



New instrumentation will be installed at 8 high-altitude locations that belong to highly protected National Park area (see light green area in Fig 2). At three of these sites, the new instrumentation will replace and/or expand already existing sensors operated by PNG. Additional instrumentation are planned at two sites at lower altitudes (<1500m asl). These sites are complemented with locations contributed by AEMET, thus providing information about the regional meteorological state in the vicinity of the Guadarrama massif. This heterogeneous distribution of observational sites will allow monitoring of physical phenomena at various spatial and temporal scales, and will make this network a multidisciplinary focus for developing synergies between diverse research groups from a wide range of disciplines .

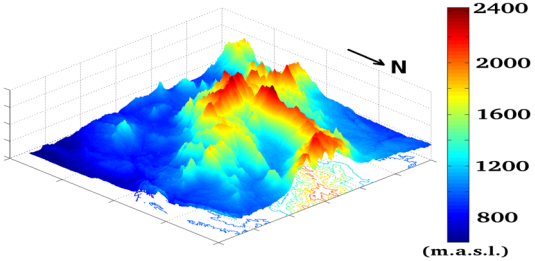


Figure 3. *Topography of the Guadarrama massif, the color scale covers the range of heights between 800 and 2400 m asl.*

Instrumentation

The starting setup is as follows: A group of WMO-compatible meteorological stations in the central area of the massif will be installed, which include also a subsurface component of boreholes (≈20 m depth), where temperature and moisture will be measured. This core group is complemented by other sites in the surrounding as La Herreria (including a fixed and a mobile tower for micrometeorological investigations, CO2 and water vapor fluxes). This setup is embedded in a network of meteorological stations run partly by AEMET and partly by the PNG, which will provide the information necessary for the characterization of regional meteorology and climate of the area.

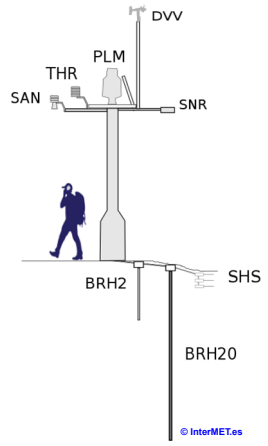


Figure 4. *Schematic representation of a full hydro-meteorological and subsurface station designed to minimize environmental impact and to withstand high snow covered periods.*

Hydro-meteorological sensors

Figure 5. *Seven complete stations following the WMO criteria are planned, including a four-component net radiation sensor **(SNR)**, an ultrasonic snow height sensor **(SAN)**, a pluviometer specialized for snow capture **(PLM)**, air temperature and humidity sensors **(THR)**, and wind speed/direction sensor **(DVV)**. All instrumentation is designed to avoid the effects of icing for minimize loss of data.*

Subsurface boreholes

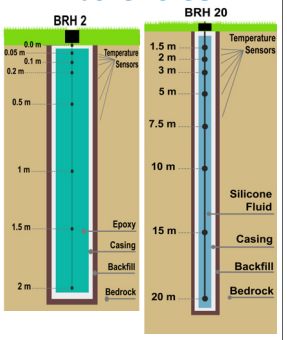


Figure 6. *The network will include 6 locations with 20 m boreholes **(BRH20)**, complemented by shallow boreholes **(BRH2)**, which will cover the shallow subsurface. At several sites direct measures from trench of temperature and humidity **(SHS)** will be installed. In order to avoid freezing effects and convection silicone fluid will be used to fill the boreholes.*

Anemometry / CO2 flux towers

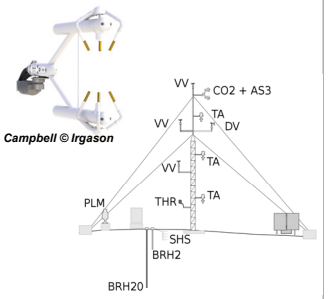


Figure 7. *A tower (10 m), will be installed, including an integrated gas analyser and sonic anemometer **(CO2+AS3)**, air temperature **(TA)**, wind speed **(VV)** and direction **(DV)** at different heights, air humidity/temperature **(THR)**, precipitation **(PLM)**, and a complete set of subsurface measurements **(BRH20, BRH2, SHS)** (two boreholes and trench sensors). An additional mobile tower (4m) with similar instruments is available for investigating differing types of land use or vegetation.*

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