



GuMNet: Guadarrama Monitoring Network

González-Rouco & GuMNet Consortium



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The figure is a detailed map of the Sierra de Guadarrama National Park, showing the locations of GuMNet and AEMet stations. The map includes an inset of the Iberian Peninsula, a legend for station types and park boundaries, and labels for various locations including EG005-Alameda, EG008-Raso del Pino I, EG009-Raso del Pino II, EG007-Dos Hermanas, EG003-Zabala, EG004-Cotos, EG006-Hoyas, EG002-Cabeza Mediana, Navacerrada, Fresno de Cantespino, Pedraza, La Pinilla, Somosierra, Buitrago de Lozoya, Segovia, Pto. León, Colmenar Viejo, Alpedrete, El Goloso, Valdemorillo, Retiro, EG901-Herrería/Portatil, and EG010-Herrería. A scale bar and a north arrow are also present.

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The resulting network consists of the following instrumentation: **10 complete WMO standard meteorological stations distributed over the area, from 900masl up to over 2200masl.** The standard WMO GuMNet station includes: an **alpine wind monitor (DVV)**, an **air temperature and humidity sensor (THR)**, **ultrasonic snow height sensor (SAN)**, a **4 component net radiation sensor (SNR)** and a **rain gauge (PLM)** especially designed for both liquid and solid precipitation.

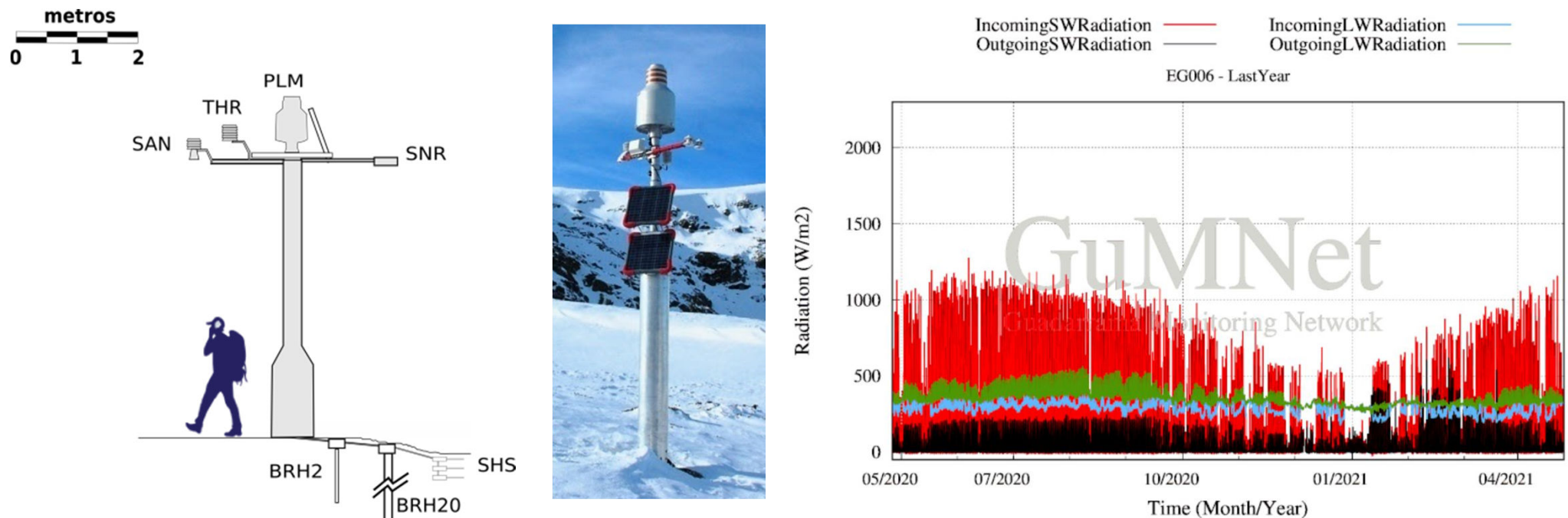


Figure 2. EG006-Hoyas automatic weather station scheme (left) and picture (middle), located in the cirque valley of Peñalara at 2019m.a.s.l. On the right, radiation data during the past year recorded at EG006-Hoyas.

A GPRS connection is established between all the remote stations and a central server in Madrid 3 or 4 times per day. This configuration allows to download the recorded data and to verify the health status of the instrumentation, hence **minimizing the loss of data.**

3. Sub-surface and Soil Observations



The network has also **12 boreholes** for monitoring the **subsurface temperature evolution** (distributed over 6 of the WMO type sites) and **8 trenches** for direct monitoring of **temperature and humidity of the soil** (distributed over 7 stations), which makes this network quite **unique**.

Boreholes are drilled and cylinder-shaped casings are installed to easily place and replace temperature sensors at **16 different depths** at each station, distributed in two monitored boreholes of **2 (BRH2)** and **20 meters depth (BRH20)**, respectively (Figure 6).

Trenches (SHS) are dug in the first layers (1 – 2 m) of sediment to introduce **temperature, humidity and electrical conductivity** sensors. This allows to establish and document the soil horizons at each site (Figure 3).

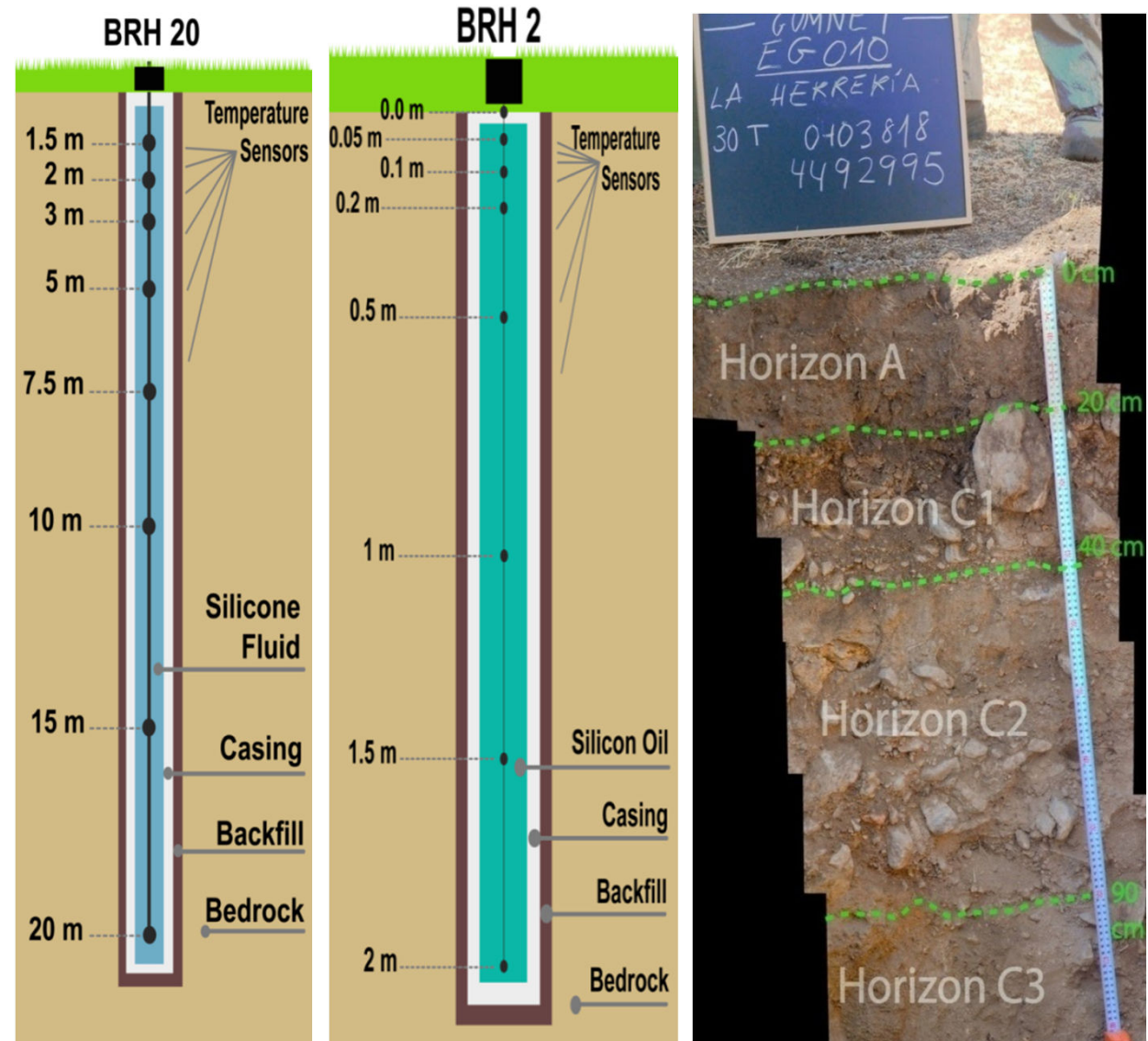


Figure 3. Scheme of the 20m (BRH20, left) and 2m (BRH2, middle) boreholes showing the casing of PVC and silicone oil filling where 8 temperature sensors are immersed at different depths in each borehole. On the right, soil horizons in one of the trenches located at EG010-La Herrería station.

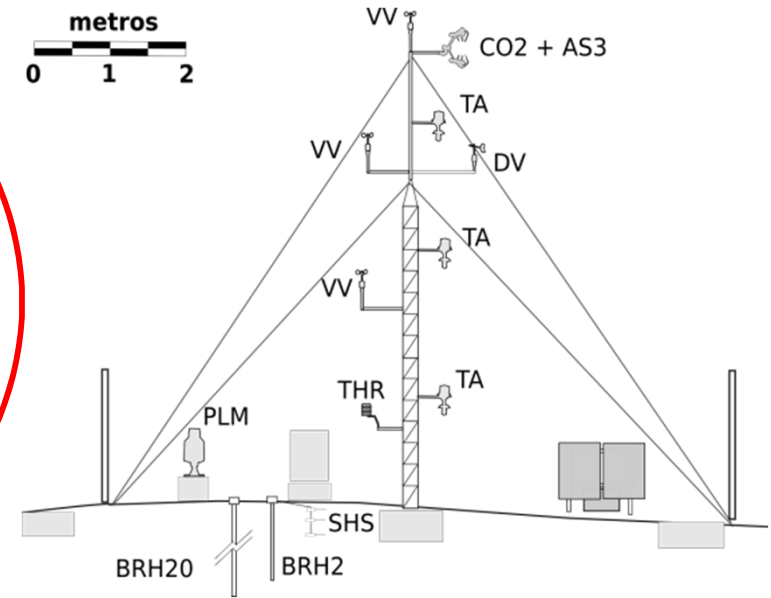
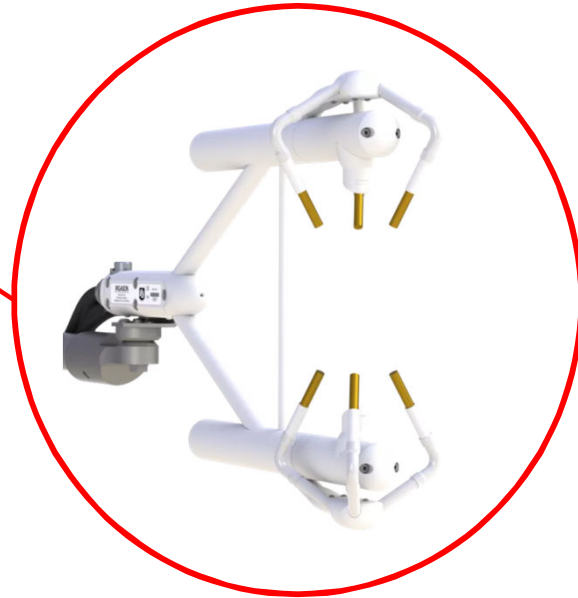


Figure 4. Station scheme (right) and a picture (left) of our at station EG010-La Herrería automatic weather station, located in the municipality of El Escorial at 920m.a.s.l. In the middle, enlargement of the 3D sonic anemometer, Irgason. Atmospheric instrumentation have been design to study boundary layer evolution and CO₂ fluxes.

Two of the stations include **anemometric instrumentation**, as well as **CO₂ and H₂O vapor flux trace analyzers** and **eddy covariance measurements**. **EG010-La Herrería** (Figure 4) is a **fixed anemometric tower** with wind speed (VV) and air temperature (TA) sensors at three different heights. This configuration is complemented with an in-situ **open-path mid-infrared absorption gas analyzer** integrated with a three dimensional **sonic anemometer** (CO₂+AS3). Likewise, the station includes the standard WMO meteorological sensors, two boreholes (BRH20, BRH2) and two trenches (SHS).

A complementary **twin portable station**, **EG901-La Herrería/Portátil** is also operational for comparison purposes at this site or for use in intensive measurement campaigns elsewhere.

- The importance of a network like GuMNet lies in the value that the data brings to an area that serves as the main support for large cities, such as Madrid, and hundreds of surrounding towns. Sierra de Guadarrama is also an environment in which all kinds of activities are carried out, whether research, academic, sports or leisure.
- GuMNet was built as a laboratory in high mountains environments and as a support network for other networks that did not reach so far upstream.
- It promotes collaboration between different institutions, either for outreach activities or research purposes.
- Any researcher is welcome to request GuMNet data by visiting this website: <https://www.ucm.es/gumnet/data-service>



Photo by: Hamid Yammine

Figure 5. Participants, organizers and collaborators at the EIT Climate-KIC 2019 Summer School Journey at La Herrería Forest on a visit to EG010-La Herrería station.

- Should you want to contact us, you can do it through our website:

www.ucm.es/gumnet

- Or via email to any of the following addresses:

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- Related EGU Abstracts:

[*EGU21-6358: An Assessment of Observed and Simulated Temperature Variability in Sierra de Guadarrama \(Spain\)*](#)

[*EGU21-10379: An Assessment of the subsurface thermal diffusion regime at some sites in the Sierra de Guadarrama*](#)

- **PaIMA** (UCM), *Paleoclimate Modeling and Analysis*.
- **MicroVAR** (UCM), *Micrometeorology and climate Variability*.
- **GFAM** (UCM), *Geografía Física de Alta Montaña*.
- **CEI** (UCM, UPM), *Campus de Excelencia Internacional*.
- **PDC** (UCM), *Plataforma de Divulgación Científica*.
- **CPD** (UCM), *Centro de Procesamiento de Datos*.
- **CEIGRAM** (UPM), *Centro de Estudios e Investigación para la*
Gestión de Riesgos Agrarios y Medioambientales.
- *Departamento **Energías Renovables** (CIEMAT).*
- *Departamento **Medio Ambiente** (CIEMAT).*
- **IGEO** (UCM-CSIC), *Instituto de Geociencias*.
- **AEMET**, *Agencia Estatal de Meteorología*.
- **PNSG**, *Parque Nacional Sierra de Guadarrama*.
- **PN**, *Patrimonio Nacional*.



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