Subject: MetPak COSMOS Soil Monitoring Program

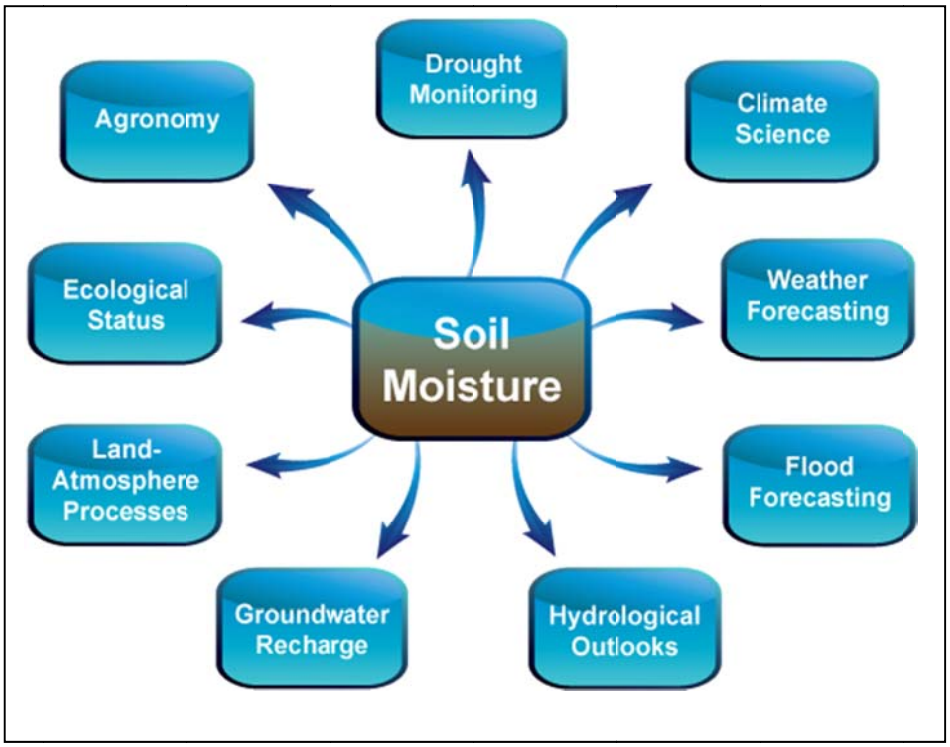
Reference AN0028

MetPak COSMOS Soil Monitoring Program

Introduction

The Centre for Ecology and Hydrology (CEH) is establishing the first UK large area soil moisture network. The network delivers exciting new data showing how soil moisture varies across the country with soil type, climate and vegetation. COSMOS-UK (Cosmic-ray soil moisture monitoring network) stations also measure the weather and other environmental variables.

COSMOS-UK has great potential to transform hydro-meteorological modelling by providing real-time data for assimilation and model validation. Leveraging the new technology of cosmic-ray soil moisture sensing makes the measurements representative of areas up to 700 m in diameter, which averages the inevitable small-scale variability in soils and vegetation.

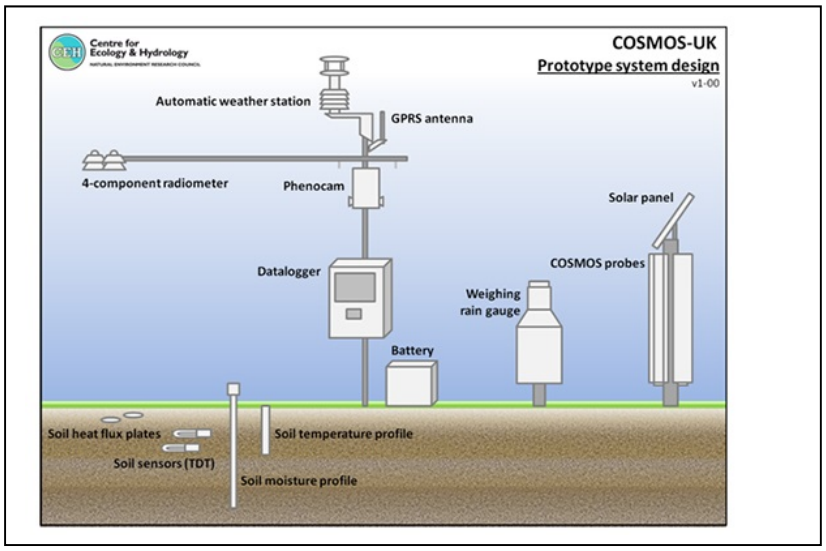


COSMOS-UK is NERC (Natural Environment Research Council) funded as part of the RCUK (Research Council UK) Capital Investment Strategy. This initiative is an innovative development providing “Big Data” in support of UK businesses.

Publically accessible real-time data will empower all kinds of applied environmental research:

- More accurate meteorological models
- Better water resource information and future outlooks
- Improved UK resilience to natural hazards, for example by earlier flood warnings
- It could improve water use efficiency in crop production and give better crop yield forecasts.
- It will enable a step change in fundamental science, particularly, meteorological predictability associated with soil moisture, better models of greenhouse gas emissions from soils.
- COSMOS-UK will allow / open-up other environmental science areas where UK soil moisture data has not been available before, such as applications in ecosystem services.

Example Installation Site



Each COSMOS-UK station is equipped with a range of research-quality meteorological and soil monitoring sensors.

Large-area soil moisture (at a spatial scale of approximately 700 m) is provided by the COSMOS probes. Point measurements of soil moisture are also available from two near-surface TDT (time domain transmissometry) probes and at three depths from a profile probe.

Soil temperature is measured by the near-surface TDT probes and at five depths by a soil temperature profile.

Two soil heat flux plates provide the soil heat flux, an important term in the surface energy balance.

Net radiation is calculated from the four components recorded individually (incoming and outgoing shortwave and longwave radiation).

An automatic weather station provides the following meteorological variables: wind speed and wind direction, atmospheric pressure, air temperature and relative humidity; and precipitation is measured using a weighing rain gauge.

A phenological camera gives a visual record of the land surface (e.g. state of vegetation, snow cover) and atmospheric visibility.

Each station is powered from a battery and solar panel. Data are logged and telemetered to CEH in real-time, where they are processed and made available via the COSMOS-UK web interface.

Detailed soil characterisations arising from a comprehensive calibration programme and standard metadata (land cover, instrument heights, depths and locations) will also be available for each site.

Gill Equipment

Gill Instruments has so far supplied 30 systems between 2014 and 2016.

The Gill system comprises MetPak Base Station and a separate WindMaster with up to 20Hz wind measurement capability.

A further 8 standard MetPaks were supplied through NERC and Campbell Scientific for trial purposes.





Why Gill?

MetPak and WindMaster are chosen as the base meteorological and wind measurements as they use our proven ultrasonic technology, which provides one of the most accurate ways of measuring wind speed and direction. Our solid-state wind sensors are built with no moving parts, are maintenance free and feature a corrosion-free polycarbonate or carbon fibre / aluminium exterior, making them well suited to most applications while the MetPak weather stations provide reference quality, compact. multi-parameter capability without compromising any individual measurement.

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