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Main Objective

Monitoring of field-scale soil moisture at IITM Pune, a component of COSMOS-INDIA network (Evan J G. 2016), using cosmic-ray soil moisture sensors (CRS; Fig.1). CEH is working in partnership with IISc Bangalore, IITM Pune, IIT Kanpur, UAS Dharwad and NIH Roorkee to develop the COSMOS-India network, and to deliver high temporal frequency observations of soil moisture at the intermediate spatial scale in near real-time.

COSMIC-ray soil moisture sensor (CRS) technology

- Cutting-edge field scale (c. 200 m radius) CRS (Fig. 1) measure average near-surface (to c.25 cm depth) volumetric soil water content (VWC) over heterogeneous soils without contact (non-invasive).
- VWC is inferred by counting fast neutrons which are naturally generated by incoming cosmic-rays, and are slowed or captured by hydrogen atoms contained primarily within water residing in the upper soil profile.
- CRS sensors are calibrated to local site conditions. Data are telemetered over mobile networks and processed by CEH and IITM.



Figure 1. Cosmic-ray soil moisture sensors (CRS) installed at IITM Pune.

COSMOS-IITM:

- This site is operational since January 2017.
- Geographical location 18.5374°N, 73.8054°E
- Elevation – 560 m (1,840 ft)
- Soil properties: Black cotton soil,
- Eco System:- Development of Ecological-park with native Trees Canopy < 12-13 m

Hydro-metrological Sensors :

- Cosmic ray soil moisture observation system (CRS-1000)
- Tipping Bucket Rain gauge
- Radiation sensor to measure Net radiation
- Multiweather component sensors.

Applications

- Water resources, groundwater, irrigation scheduling
- Hydro-meteorological, land surface and ecological studies
- Ground-truth for remotely sensed soil moisture products
- Flood and drought forecasting
- Water use efficiency of crop production

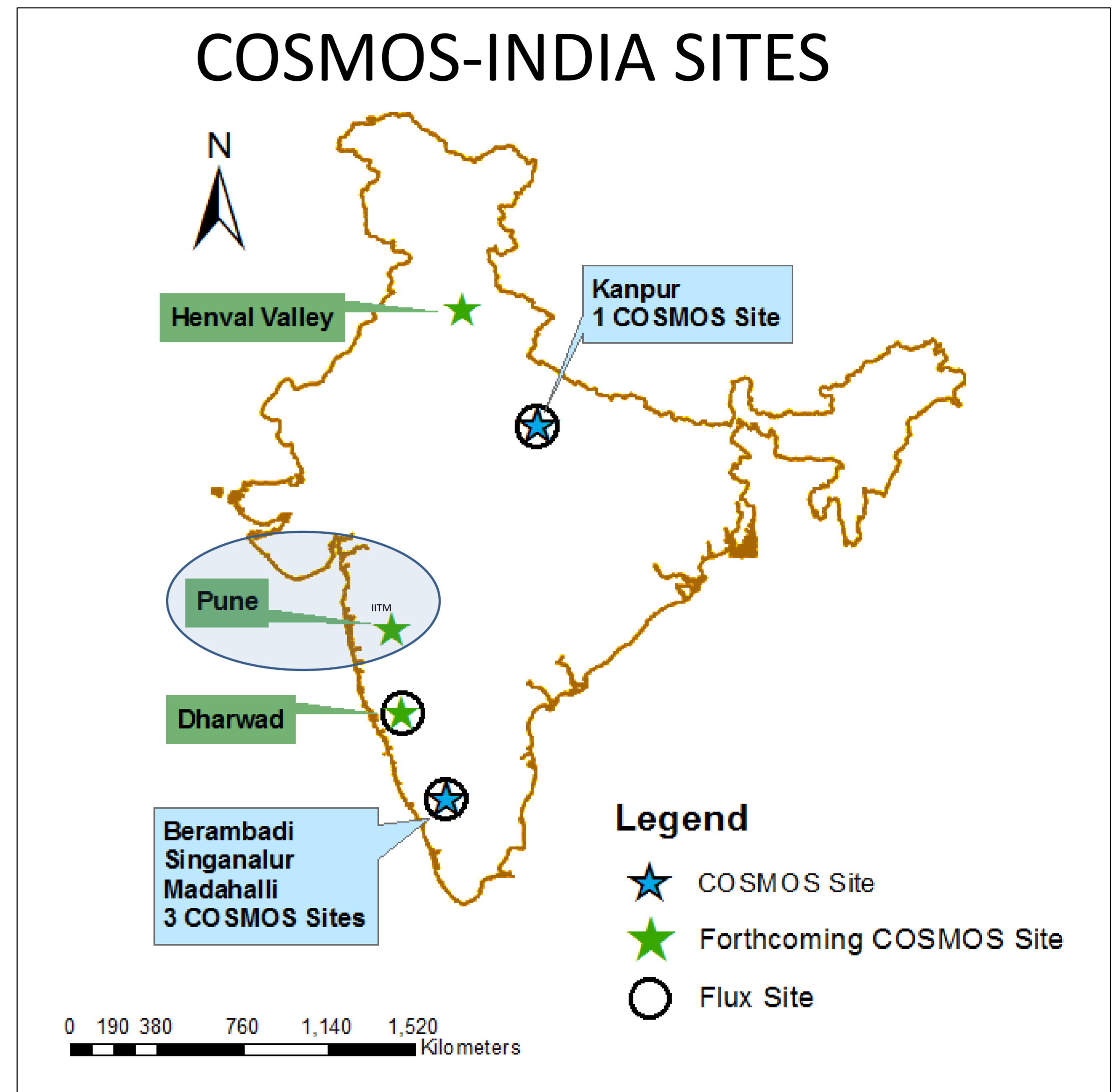


Figure 2. Map showing current and forthcoming COSMOS-India sites.

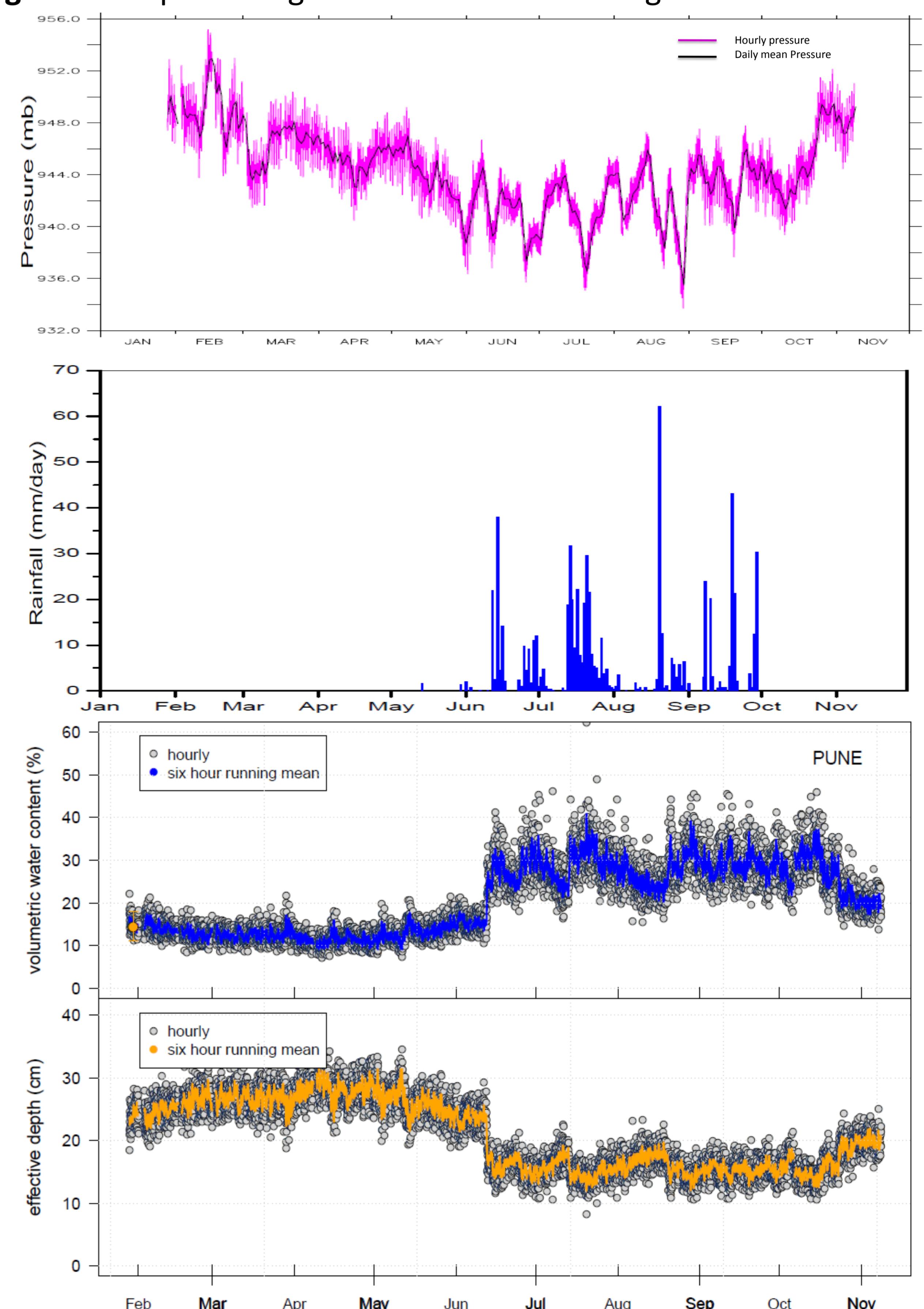


Figure 3. Examples of co-located measurements of Pressure, Precipitation, COSMOS VWC and Effective Depth at IITM Pune, Maharashtra. Note that a provisional calibration procedure was used to estimate COSMOS VWC from fast neutron counts.