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SMOS Level 3 and Level 4 Research Products Provided by the Barcelona Expert Center

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More than three years have passed since the launch, on November 2, 2009, of the European Space Agency's (ESA) Soil Moisture and Ocean Salinity (SMOS) satellite carrying a microwave synthetic aperture radiometer working at 1.4 GHz. The aim of the mission is to provide Sea Surface Salinity and Soil Moisture observations, with a spatial resolution of 30-50 km, and an accuracy suited for climate studies.

From the brightness temperature observations, experimental sea surface salinity (SSS) and Soil Moisture (SM) maps are being developed and distributed at the SMOS Barcelona Expert Center (SMOS-BEC) to take the most out of SMOS observations. Data are distributed in NetCDF format using THREDDS and maps are served through a Web Map Service (ncWMS), both at the SMOS-BEC distribution data website (http://cp34-bec.cmima.csic.es/).

For ocean applications the following SSS products are being served at spatial resolution of 0.25º:

• Level 3 maps by spatial and temporal weighted average of level 2 SSS data. Three- and nine-day averaged maps are produced every 3 days. Monthly, seasonal and annual maps are also computed.
• Level 3 maps from optimal interpolation of level 2 SSS data. Nine-day averaged maps are produced every 3 days, as well as monthly, seasonal and annual maps.
• Level 4 maps from SMOS SSS fused with satellite-derived SST [1]. Similar to Level 3 data, nine-day averaged maps are produces every 3 days, as well as monthly, seasonal and annual maps.
• Singularity Exponents products obtained by applying singularity analysis [1] on OSTIA SST products (http://myocean.eu/) are also served.

Three versions of each product are generated using ascending passes, descending passes, and full orbit passes (i.e. ascending + descending). Both absolute salinity value and its anomaly (difference between the absolute value and climatology data (WOA 2009)) are stored in the product. L3 and L4 maps are validated with near-surface measurements provided by Argo profilers, and their expected accuracy is 0.2-0.4 depending on processing level and the region of interest.

For land applications, SMOS spatial resolution has proved useful for improving our understanding of water and energy fluxes between the atmosphere, the soil surface, and subsurface. Still, it is insufficient for regional applications, such as land and water resources management or drought mitigation, which require a spatial resolution of 1 to 10 km. For this reason, a downscaling algorithm which combines SMOS with MODIS VIS/IR satellite data into 1km SM maps has been implemented at SMOS-BEC [2]. High resolution (1 km) soil moisture maps are derived with this technique over the Iberian Peninsula and are distributed through SMOS-BEC maps server web page in near real time (delay < 6h).

Moreover, soil moisture level 3 products are computed by monthly, seasonal and annual temporal averages of level 2 soil moisture data at 0.25º spatial resolution. They are also distributed at the SMOS-BEC web site.

[1] A. Turiel et al., “The multifractal structure of satellite sea surface temperature maps can be used to obtain global maps of streamlines”, Ocean Science 5, 447-460 (2009)

[2] M. Piles et al.,”Downscaling SMOS-derived Soil Moisture Using MODIS Visible/Infrared Data”, IEEE Trans. Geosc. and Remote Sens., vol 49, pag.352-374 (2011)