Soil moisture in the meso-scale: geostatistical approach

In classical statistical approach an assumption exists, that the analysed variables are independent. Since the majority of the processes observed on the Earth are continuous in space and time, this statement introduces a significant limitation for understanding the examined phenomena. However, there is a branch of statistics, called geostatistics, which is the study of random variables taking into account the space and/or time where they occur. A common example of such "regionalized variable" is soil moisture. Thanks to the geostatistical methods, by employing semivariance analysis, it is possible to get information about the nature of soil moisture and its spatial dependences. Despite existence of many well-developed measurement techniques, the study of soil moisture is still a challenge because of large diversity of factors that drives hydrological processes i.e. soil type, vegetation cover, precipitation distribution, temperature, climate etc. The basic and referential method to determine water content in soil is a gravimetric method, which is accurate, but slow, therefore suitable only for small spatial scales. Indirect methods (TDRs, radars, radiometers etc.) are faster, thus more effective in meso- (medium-size) and global scales, but always need to be validated. Thanks to the geostatistical approach, the mentioned techniques can be merged, what provide complementary information that helps to verify diversity of models and assumptions.

In proposed research soil moisture data from different, across-scales sources will be employed:

1. Soil Moisture and Ocean Salinity (SMOS) satellite mission. Launched on 2 November 2009, SMOS is the second Earth Explorer Opportunity, developed as part of European Space Agency's Living Planet Programme. It is L-band radiometer (1.4 GHz) with 40 km spatial resolution.

2. Sentinel-1 satellites. Sentinel-1A was launched on 3 April 2014 and Sentinel-1B on 25 April 2016. Both are C-band Synthetic Aperture Radars built by European Space Agency in the frame of Copernicus programme.

3. Ten SWEX_Poland soil moisture stations (ISMN), localized in Eastern Poland since 2007.

4. ELBARA III (European Space Agency L-band radiometer). Fabricated by Gamma Remote Sensing and mounted on tower on Bubnow Wetland in Poland (December 2015)

5. Meteorological and soil moisture stations localized at ELBARA III test-site.

5. In-situ data collected around ELBARA's tower: soil moisture, vegetation, roughness, thermal properties and texture of soil. The dataset will be extended by planned field campaigns.

Supervisor: prof. dr hab. B. Usowicz, opiekun pomocniczy: dr M. Łukowski

Profile of the candidate:

We are seeking highly motivated candidates with a strong academic record holding a MSc or equivalent in relevant subjects, with preference of Physics, Mathematics or Computer Science

- a strong motivation for research work
- ability to analyse and write up data
- manual skills
- good written and spoken English (min B2 level)

- IT skills (at least MS Office)
- ability to work independently and in a team
- conscientiousness