VALIDATION OF SOIL MOISTURE AND TEMPERATURE (SENTINEL-1, SENTINEL-3, NOAA-AVHRR)

Katarzyna Dabrowska-Zielinska¹, Jan Musial¹, Wanda Kowalik¹, Wojciech Kyrila¹,
Maciej Bartold¹, Radoslaw Gurdak²

¹Institute of Geodesy and Cartography, Remote Sensing Centre
²University of Warsaw, Faculty of Geography and Regional Studies,
26/28 Krakowski Przedmiescie St., 00-927 Warsaw

Surface temperature from Sentinel-3 and NOAA-AVHRR was analysed over agriculture fields and wetlands in Poland. Sentinel-1 data was used for soil moisture retrieval to give the distribution of different components as a function of surface temperature. The temperatures from Sentinel-3 and NOAA-AVHRR were validated using in-situ measurements for different ranges of soil moisture and latent heat derived from Eddy Covariance. The temperature was used to calculate Sensible Heat, that was further validated by means of Eddy Covariance measurements. The temperature validation was separately performed for wet and dry conditions discriminated using ground measurements.

IN-SITU MEASUREMENTS

The main aim of the Biebrza sentinel-1 (S-1) project is to establish two sites for S-1 and moisture product validation. The secondary goal is to develop an advanced model describing exchange of water, energy and carbon between wetlands and the atmosphere using in-situ and satellite measurements. Project of ESA Contract No. 4400118762/16/I/NFI

Why Biebrza?

It is one of the largest wetland habitats for a number of endangered species (birds) and flora in Europe. In 1993 the Biebrza National Park was established covering area of 600 km². It is also protected under the IASER convention, NATURA 2000, IBA (Important Bird Habitat). The river flows over flat area (~ 0.02 % slope) and floods every spring after the snowmelt. The retention capacity of peat covering Biebrza basin is as high as the largest lakes in Poland. Therefore, it plays a major role in flood prevention.

MARSHLAND AND GRASSLAND SITES OF SOIL MOISTURE VALIDATION AND HEAT FLUX

- Decagon ELP-5G data logger with GPRIS and 3 input ports
- GSP soil moisture, temperature and electrical conductivity probes calibrated to specific soil conditions
- CR-1000 data logger with 8 input ports
- Campbell 003E-L air temperature and relative humidity sensor
- Halogenics NR01 4-component net radiation sensor to analyze short- and longwave downwelling and upwelling radiation
- Halogenics RFP-195C1 heat flux plate to analyze energy flows within a soil
- Vaisala CS101u psychrometric pressure sensor
- Campbell 05103a, wind speed and direction turbine
- Decagon LPF leaf wetness sensor

- Eddy covariance system:
  - Lioir LI-7500A, Eddy Covariance system
  - Gill WindMaster 34 ultrasonic anemometer

Additional technical equipment:
- CFM110, Compact Flash Module expansion to Campbell CR1000 logger to store measurements
- CS-GPS expansion to Campbell CR1000 logger
- GPS on top to Campbell CR1000 logger
- Solar panel for the Campbell CR1000 logger and LI-7500A system
- Gel batteries for the Campbell CR1000 logger and LI-7500A system
- TS-5120WHP100, GPIS camera
- INFEX (Ion Sensitive Field Effect Transistor) probe to analyse soil pH (1 piece)

VALIDATION OF SENTINEL-1 SOIL MOISTURE PRODUCT

\[ q = \frac{C(T, T)}{r + C(T, T)} \]

- \( q \) - air density (g cm⁻³), \( C \) - specific heat of air at constant pressure (cal g⁻¹ °C⁻¹), \( T \) - temperature surface and air, \( r \) - air resistence (s cm⁻¹)

\[ LE = R_n + (H - G) \]

- \( LE \) - latent heat flux (W/m²), \( R_n \) - net radiation (W/m²), \( H \) - soil heat flux (W/m²)

AGRICULTURE SITE

Wielkopolska cronepla (Sentinel-2 image)

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