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Land surface temperature from remote sensing for the validation of a distributed hydrologic model at basin scale

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Land surface temperature (LST) is the key parameter that links the energy fluxes between atmosphere and surface and becomes fundamental in energy balance modelling to estimate net radiation, soil heat flux and sensible and heat flux. The availability of satellite remote sensing information makes easy to retrieve LST in raster format, mainly suited for the use in conjunction to distributed model. However, some uncertainties have to be addressed, such as the choice of the split windows algorithms for LST retrieval.

The aim of this work is to evaluate the use of LST retrieved from satellite images for the validation of a distributed hydrological model as a complementary method to the traditional calibration with discharge measurements.

In particular in this work images from different sensors are acquired: AVHRR (Advanced Very High Resolution Radiometer) onboard NOAA satellites and MODIS (MODerate resolution Imaging Spectroradiometer) onboard TERRA satellite.

Different split windows algorithms for LST retrieval from AVHRR are tested. A comparison is made with daily land surface temperature MODIS product. The AVHRR and MODIS surface temperatures are in good agreement.

Also air temperature from ground measurements is considered and compared to land surface temperature. A strong relationship is found in the whole basin, but particular attention is made for mountain zone, Torino city area and for rice fields.

Comparison is also made with surface temperature measured at Landriano site in Lombardia where a station for micrometeorological measures is located.

A continuous distributed hydrologic model, FEST-WB, which includes the main processes of the hydrological cycle such as evapotranspiration, energy balance, infiltration, flow routing and subsurface flow, is applied at basin scale.

The Upper Po river basin, which includes Piemonte and Lombardia region and Switzerland, is selected as test basin for the period 2000 – 2003.

For hydrograph simulations comparison with observed data demonstrates that the model is able to well predict hydrologic processes.

Simulated land surface temperature is then compared to satellite one and good likeness is found.