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Midlatitude soil moisture: an experimental and modeling analysis

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Soil moisture has a key role for the internal dynamics of ecohydrological systems and for their relationships with the climate system. At continental midlatitudes, soil moisture was recognized as a key variable in determining the strength of summer droughts (Ferranti and Viterbo, 2006). Lack of observations of soil moisture (and evapotranspiration) has been recognized as a main limitation to further progress, e.g. in the field of land-atmosphere interactions (Seneviratne and Stöckli, 2008). Obtaining soil moisture estimates from indirect observations is therefore very important.

Here we compare direct measurement of soil moisture and different modeling approaches. Soil water data at hourly temporal resolution were collected from 2005 to present in the monitoring station located in Grugliasco, Torino (campus of the Agricultural Faculty of University of Torino, Italy). The station is located in the northwestern part of the Po Valley. The site is equipped with an automatic meteorological station, an automatic TDR station with 160 vertical probes ranging from 150 mm to 2000 mm length, and 80 mercury column tensiometers. The vegetation at the site is composed of grasses and grapevines.

The dataset is compared with the output of a simple punctual model for soil moisture averaged over the active soil layer. The model includes infiltration, evapotranspiration, runoff and leakage. Rainfall, atmospheric pressure and temperature and wind velocity at the site are used as external input of the model. The model allows a detailed temporal description of soil moisture dynamics, with resolution of a few hours, comparable with the temporal resolution of the data. The importance of the various mechanisms of the soil water balance, and the model sensitivity to the different parameters are tested against the data observed.

References:

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