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Assessing the options for the operational mapping of the soil moisture content in the European Alps

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Soil Moisture (SM) is one of the key observable variables of the hydrological cycle and therefore of high importance for many disciplines, from meteorology to agriculture. This contribution presents a comparison of different products for the mapping of SM. The aim was to identify the best available solution for the operational monitoring of SM as a drought indicator for the entire area of the European Alps, to be applied in the context of the Interreg Alpine Space project, the Alpine Drought Observatory.

The following datasets were considered: Soil Water Index (SWI) of the Copernicus Global Land Service [1]; ERA5 [2]; ERA5-Land [3]; UERRA MESCAN-SURFEX land-surface component [4]. All four datasets offer a different set of advantages and disadvantages related to their spatial resolution, update frequency and latency. As a reference, modelled SM time-series for 307 catchments in Switzerland were used [5]. Switzerland is well suited as a test case for the Alps, due to its different landscapes, from lowlands to high mountain.

The intercomparison was based on a correlation analysis of daily absolute SM values and the daily anomalies. Furthermore, the probability to detect certain events, such as persistent dry conditions, was evaluated for each of the SM datasets. First results showed that the temporal dynamics (both in terms of absolute values as well as anomalies) of the re-analysis datasets show a high correlation to the reference. A clear gradient, from the lowlands in the north to the high mountains in the south, with decreasing correlation is evident. The SWI data showed weak correlations to the temporal dynamics of the reference in general. Especially, during spring and the first part of the summer SM is significantly underestimated. This might be related to the influence of snowmelt, which is not taken into account in the two-layer water balance model used to model SM for deeper soil layers. Low coverage in the high mountain areas hampered a thorough comparison with the reference in these areas.

The results presented here are the foundation for selecting a suitable source for the operational mapping of SM for the Alpine Drought Observatory. The next steps will be to test the potential of MESCAN-SURFEX and ERA5-Land for the downscaling of ERA5 to take advantage of the low latency of ERA5 and the improved spatial detail of the other two datasets.

Literature:

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