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Comparison between snow albedo obtained from Landsat imagery and Copernicus/GMES albedo product in a Mediterranean site

Rafael Pimentel (1), Cristina Aguilar (2), Javier Herrero (2), María José Pérez-Palazón (1), and María José Polo (1)

(1) Fluvial Dynamics and Hydrology Research Group. Andalusian Institute for Earth System Research. University of Cordoba, (2) Fluvial Dynamics and Hydrology Research Group. Andalusian Institute for Earth System Research. University of Granada

Albedo plays an important role in physical snow modeling, directly affecting the shortwave radiative flux (0.3-2.5 μm), and quantifying the amount of solar radiation absorbed and reflected by the snowpack. Moreover, it is one of the main factors involved in the melt season due to the dominant role of radiation during these periods. Also, measuring and monitoring snow albedo, especially over large areas, constitute a problem, which increase in semiarid region due to the heterogeneous snow distribution. In these situations, traditional in-situ measurements techniques, such as snow surveys at a fixed location, are not enough to capture the heterogeneity of the snow. Instead, the use of satellite remote sensing is the most extended technique to determine the variability of snow albedo in the three domains: time, space and frequency.

This work presents the evaluation of snow albedo obtained from 1) Landsat images (16-day images with 30mx30m cell size) and 2) Copernicus/GMES albedo products (10-day with a 1kmx 1km) in a Mediterranean site. Thus, WiMMed (Watershed Integrated Management in Mediterranean Environment) hydrological model was applied with albedo input data from these two different sources. This evaluation was performed during two hydrological years: 2011-2012 and 2012-2013 in Guadalfeo river watershed, southern Spain, where the combination of semiarid Mediterranean and alpine climate conditions produces a complex mountainous terrain with variable hydrological behavior.

The results showed similar albedo trends in both data sources. In spite of this, albedo values, (0.30-0.55) from Copernicus/GMES and (0.4-0.75) from Landsat imagery are lower than those available in the literature, which range from 0.4 for dirty old snow to 0.9 to clean fresh snow. This underestimation is mainly due to the grid size selection, which introduces the effects of mixed pixels composed by snow and snow-free areas. This difference between data sources produces variations in the snow variables simulated. In terms of a snow water equivalent a mean reduction of 15 mm, approximately 20% of the total, appears in the simulation with the Copernicus/GMES albedo product. This divergence was higher during the melting periods, in which the evaporation and melting fluxes are more relevant. Therefore, the selection of one or other albedo product in these areas, where snow evaporation plays a very important role and the presence of snow-free patches is very frequent, can condition the final snow simulated variables mainly due to their spatial resolution.