



Assessing the possibilities of Sentinel products for qualifying and quantifying soil water status of agricultural systems in southern France

Claude Doussan¹, **Urcel Kalenga Tshingomba**¹, Nicolas Baghdadi², Fabrice Flamain¹, Arnaud Chapelet¹, Guillaume Pouget¹, and Dominique Courault¹

¹INRAE - UMR EMMAH - INRAE/Avignon Université - Avignon - France (claude.doussan@inra.fr)

²UMR TETIS, INRAE, Montpellier, France

Water management poses a pervasive challenge in southern France, exacerbated by increasing summer droughts linked to global warming. Water use during spring and summer increases and gets more variable in term of quantity used for crops. Agricultural water use is highly influenced by the diversity in irrigation practices and technics (sprinkler irrigation, drip irrigation, flooding, etc.); and can lead to tensions among water users. It is thus essential to estimate field water use at basin scale, as well as crop water status, in order to further optimize water delivered for irrigation. Advances in remote sensing, particularly with Sentinel 1 (S1) and 2 (S2) data, facilitated the development of soil moisture products (SMP) with improved spatial and temporal resolution to characterize soil water in agricultural plots. These SMP products are accessible through the Theia French public platform and suitable for main crops, with NDVI below 0.75 or surfaces with moderate roughness. These specifications can be met for a variety of crop conditions in the south of France. Yet, the validity of the SMP products under various agricultural plot conditions, considering slope, orientation, roughness, and soil moisture, remains to be assessed over extended time periods. From another point of view, such SMP products do not presently apply to orchards plots, which are however, an essential but overlooked component of water use in irrigation and deserve further examination with S1 and S2 data. The objective of our study is twofold: (i) to test SMP products for field crops in different settings and among years, (ii) to preliminary test if S1 data, combined to S2 data, may be linked to soil moisture in orchard plots. Results reveal for (i) that differences can appear between SMP products and soil moisture in various monitored plots, primarily due to variability within farming systems. Beyond a specific slope and vegetation threshold, the correlation does not improve significantly. For (ii), in orchards plots, using a time smoothing of data, S1 VV-retrodifusion data and NDVI from S2 seem to correlate with soil moisture measurements, with an RMSE < 0.05 cm³/cm³ and enable detection of irrigation events. This study shows that S1 and S2 data are valuable in estimating soil moisture of agricultural plots, giving however some limits in their use, and gives some hope in their further use for orchards water management.