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Developing a synergy algorithm for land surface temperature: the SEN4LST project

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Land surface Temperature (LST) is one of the key parameters in the physics of land-surface processes on regional and global scales, combining the results of all surface-atmosphere interactions and energy fluxes between the surface and the atmosphere. An adequate characterization of LST distribution and its temporal evolution requires measurements with detailed spatial and temporal frequencies. With the advent of the Sentinel 2 (S2) and 3 (S3) series of satellites a unique opportunity exists to go beyond the current state of the art of single instrument algorithms. The Synergistic Use of The Sentinel Missions For Estimating And Monitoring Land Surface Temperature (SEN4LST) project aims at developing techniques to fully utilize synergy between S2 and S3 instruments in order to improve LST retrievals. In the framework of the SEN4LST project, three LST retrieval algorithms were proposed using the thermal infrared bands of the Sea and Land Surface Temperature Retrieval (SLSTR) instrument on board the S3 platform: split-window (SW), dual-angle (DA) and a combined algorithm using both split-window and dual-angle techniques (SW-DA). One of the objectives of the project is to select the best algorithm to generate LST products from the synergy between S2/S3 instruments. In this sense, validation is a critical step in the selection process for the best performing candidate algorithm. A unique match-up database constructed at University of Leicester (UoL) of in situ observations from over twenty ground stations and corresponding brightness temperature (BT) and LST match-ups from multi-sensor overpasses is utilised for validating the candidate algorithms. Furthermore, their performance is also evaluated against the standard ESA LST product and the enhanced offline UoL LST product. In addition, a simulation dataset is constructed using 17 synthetic images of LST and the radiative transfer model MODTRAN carried under 66 different atmospheric conditions. Each candidate LST retrieval algorithm is evaluated with respect to the difference between the LST input to generate the simulations and the retrieved LST from the simulated BTs and atmospheric water vapour profiles. Preliminary analysis finds the SW algorithm to perform well across most sites, with the DA and combined SW-DA algorithms performing well at sites that are more homogeneous.