

Comparison of satellite based solar surface radiation estimates and CS model performance in Finland

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Accurate estimates of the Solar Surface Radiation (SSR), as well as increasingly forecasts, are needed for various climate and energy applications. With high spatial coverage, satellite imagery combined with a Clear Sky (CS) model can produce good estimates and forecasts for short time scales, whilst for longer time scales the SSR forecasts made by Numerical Weather Prediction (NWP) models have higher accuracy. Various satellite based applications to estimate SSR have been made, however, few of these are available or have been validated for the challenging high latitude area of Finland.

We are currently making a hybrid satellite – NWP SSR estimation system, using a satellite component for the beginning of the forecast and a NWP component for the longer time scales, with an optimised transition in between. The satellite component uses a CS model to provide the estimate for a CS case, to which the impact of clouds is added based on the Heliosat method and satellite imagery. Aiming to improve the performance of the satellite component the estimates from CS models McClear, SPECMAGIC, pvlb Solis and pvlb Ineichen, with varying aerosol and water vapour input have been compared and validated. The CS estimates have been validated against SSR measurements from five FMI SOLAR stations in southern Finland.

The Pvlb Ineichen and McClear model estimates have the lowest errors, as well as Pvlb Solis estimates depending on the given atmospheric input. These models are used as part of the satellite component to produce estimates for all sky situations. A further comparative validation for the same region is made for these satellite component versions.