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Handling of subpixel structures in the application of satellite derived irradiance data for solar energy system analysis – a review

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With the increasing availability of satellite derived irradiance information, this type of data set is more and more in use for the design and operation of solar energy systems, most notably PV- and CSP-systems. By this, the need for data measured on-site is reduced. However, due to basic limitations of the satellite-derived data, several requirements put by the intended application cannot be coped with this data type directly. The raw satellite information has to be enhanced in both space and time resolution by additional information to be fully applicable for all aspects of the modelling od solar energy systems.
To cope with this problem, several individual and collaborative projects had been performed in the recent years or are ongoing. Approaches are on one hand based on pasting synthesized high-resolution data into the low-resolution original sets. Pre-requite is an appropriate model, validated against real world data. For the case of irradiance data, these models can be extracted either directly from ground measured data sets or from data referring to the cloud situation as gained from the images of sky cameras or from Monte-Carlo initialized physical models. The current models refer to the spatial structure of the cloud fields. Dynamics are imposed by moving the cloud structures according to a large scale cloud motion vector, either extracted from the dynamics interfered from consecutive satellite images or taken from a meso-scale meteorological model. Dynamic irradiance information is then derived from the cloud field structure and the cloud motion vector.
This contribution, which is linked to subtask A - Solar Resource Applications for High Penetration of Solar Technologies - of IEA SHC task 46, will present thes different approaches and discuss examples in view of validation, need for auxiliary information and respective general applicability.