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Short-term forecast of solar surface radiation using satellite imagery

Isabel Urbich and Richard Müller
German Weather Service, Research and Development, Germany (isabel.urbich@dwd.de)

The increasing use of renewable energies as a source of electricity has led to a fundamental transition of the power supply system. The integration of fluctuating weather-dependent energy sources into the grid already has a major impact on the load flows of the grid. As a result, the interest in forecasting wind and solar radiation with a sufficient accuracy over short time horizons grew. A short-term forecast of solar surface radiation can be obtained by the application of an optical flow method on the effective cloud albedo determined from visible satellite imagery by MSG (Meteosat Second Generation). The optical flow method utilized here is TV-L1 from the open source library OpenCV (Open Source Computer Vision). This method uses a multi-scale approach to capture cloud motions on various spatial scales. After the clouds are displaced the solar surface radiation is calculated with SPECMAGIC NOW which computes the global irradiation spectrally resolved from satellite imagery. SPECMAGIC has been extensively validated by the CM SAF team (Climate Monitoring Satellite Application Facility) and external users of the CM SAF data. It is also the basis of the solar radiation data used by the photovoltaic energy calculator PVGIS (www.pvgis.eu) by the Joint Research Centre. Due to a high temporal and spatial resolution of satellite measurements solar radiation can be forecasted from 5 minutes up to 3 hours with a resolution of 0.5 °. The presentation will start with a brief description of the method for the short-term forecast of solar surface radiation. Subsequently evaluation results will be presented and discussed. Finally an outlook of further developments will be given.