Geophysical Research Abstracts
Vol. 16, EGU2014-5109, 2014
EGU General Assembly 2014

Development of a satellite-based nowcasting system for surface solar radiation

Sebastian Limbach (1), Katja Hungershoefer (2), Richard Müller (2), Jörg Trentmann (2), Jörg Asmus (2), Elmar Schömer (1), and André Groß (1)

(1) Institut für Informatik, Johannes Gutenberg-Universität, Mainz, Germany, (2) Deutscher Wetterdienst (DWD), Offenbach, Germany

The goal of the RadNowCast project was the development of a tool-chain for a satellite-based nowcasting of the all sky global and direct surface solar radiation. One important application of such short-term forecasts is the computation of the expected energy yield of photovoltaic systems. This information is of great importance for an efficient balancing of power generation and consumption in large, decentralized power grids.

Our nowcasting approach is based on an optical-flow analysis of a series of Meteosat SEVIRI satellite images. For this, we extended and combined several existing software tools and set up a series of benchmarks for determining the optimal forecasting parameters. The first step in our processing-chain is the determination of the cloud albedo from the HRV (High Resolution Visible)-satellite images using a Heliosat-type method. The actual nowcasting is then performed by a commercial software system in two steps: First, vector fields characterizing the movement of the clouds are derived from the cloud albedo data from the previous 15 min to 2 hours. Next, these vector fields are combined with the most recent cloud albedo data in order to extrapolate the cloud albedo in the near future. In the last step of the processing, the Gnu-Magic software is used to calculate the global and direct solar radiation based on the forecasted cloud albedo data.

For an evaluation of the strengths and weaknesses of our nowcastig system, we analyzed four different benchmarks, each of which covered different weather conditions. We compared the forecasted data with radiation data derived from the real satellite images of the corresponding time steps. The impact of different parameters on the cloud albedo nowcasting and the surface radiation computation has been analysed. Additionally, we could show that our cloud-albedo-based forecasts outperform forecasts based on the original HRV images. Possible future extension are the incorporation of additional data sources, for example NWC-SAF high resolution wind fields, in order to improve the quality of the atmospheric motion fields, and experiments with custom, optimized software components for the optical-flow estimation and the nowcasting.