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Can we improve how we verify cloud forecasts?

Kristian Pagh Nielsen (1), Emily Gleeson (2), and Jan Fokke Meiring (3)
(1) Danish Meteorological Institute, Copenhagen Ø, Denmark (kpn@dmi.dk), (2) Met Éirann, Dublin, Ireland (emily.gleeson@met.ie), (3) The Royal Netherlands Meteorological Institute, De Bilt, The Netherlands (meirink@knmi.nl)

Sunshine - or shortwave irradiance - is the primary energy source for all meteorological processes. Less than 50% of the shortwave irradiance is in the form of visible light. Most of the absorbed shortwave irradiance is re-emitted as heat - or longwave irradiance. The solar and longwave irradiances are listed as Essential Climate Variables (ECVs) in the recent WMO report: "Status of the Global Observing System (GCOS) for Climate". Despite this there is a lack of high quality solar irradiance measurements. Longwave irradiance measurements are even more sparse.

Also, weather models are often not verified against the irradiance measurements when they are present. Here a source of better constraining sub-grid physics tunings is left untapped.

Solar irradiances can be estimated from satellite measurements, but care should be taken that the satellite-derived irradiances have trained against high quality ground-based measurements. Beside climate observations, irradiance observations are important for both existing and upcoming solar energy technologies.

We present results and examples of our work with verifying weather models against irradiance measurements. Irradiance measurements give additional information about clouds and aerosols beyond what can be retrieved from ceilometers or human cloud cover observations. They give information on the overall atmospheric transmittance in clear sky, overcast sky, and convective cloud sky conditions. Of these the latter condition, in particular, often cannot be resolved in geostationary satellite images. For such conditions also high temporal resolution (minute-scale) and directional irradiance measurements provide valuable information about the convective clouds. Since the subgrid-scale dynamics and precipitation physics in these are major uncertainties in current weather models, we suggest that enhanced use of irradiance measurements and overall extended networks of these should be prioritised in meteorology.