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Surface irradiance variability over land in storm-resolving models.

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With increasing horizontal resolution in global models, we may expect an increasingly more realistic representation of cloud development over land as both large-scale circulations and local surface heterogeneities, such as orography and land use type, are better resolved. As clouds are a dominant contributor to inter- and intra-diurnal variations in both solar and thermal surface irradiance, the spatiotemporal irradiance variability should then be better represented than in conventional climate models. Here, we use the 5-year coupled atmosphere-ocean global simulations performed in Cycle 3 of the nextGEMS project to evaluate the surface irradiance variability over land. These 5-year simulations were performed at different resolution, from 4.4 to 28 km, and with two different global models, the Integrated Forecasting System (IFS) and the Icosahedral Nonhydrostatic model (ICON), allowing us to separate the impacts of horizontal resolution and of implementation choices concerning model physics. We select a couple of representative locations with varying climate and land surface characteristics where high-quality irradiance observations from the Baseline Surface Radiation Network (BSRN) are available. While first results show some benefits of increased horizontal resolution, higher resolutions simulations do not consistently produce more accurate surface irradiances than simulations at lower resolution. Furthermore, differences between the IFS and ICON models are often larger than differences between the IFS simulations at varying resolutions. These results suggest that if realistic surface irradiance predictions are concerned, e.g. for solar energy applications, the road to model improvement by increasing horizontal resolution is not straightforward.