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Assessing surface solar radiation fluxes in CMIP5 model simulations

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Sophisticated Earth System models (ESM) are an essential research tool for better understanding the global climate system and its interactions. They are indispensable tools for providing projections about potential evolutions of the Earth climate in the future.

Given the complexity of these deterministic models, it is essential to have a solid knowledge of the uncertainties of the model results in difference aspects of the models. The present paper presents results from a comprehensive study analyzing the shortwave surface radiation fluxes.

State-of-the-art globals datasets of surface radiation components (surface solar radiation flux, surface albedo, surface net radiation flux) are used to benchmark results from the recent Coupled Model Intercomparison Project (CMIP5) in a standardized manner at the regional to global scale. Different skill score metrices are compared. All CMIP5 models are ranked according to their performance skill scores.

The uncertainties from current observational records compared to uncertainties in climate model simulations are also analyzed. The results indicate that there are still large uncertainties (inconsistencies) among the different existing global surface radiation dataset which lead to rather different (relative) model rankings. In other words, the rank of a model is not only determined by the skill of the model itself, but also largely by the choice of a benchmarking (reference) dataset. As the differences resulting from the choice of different observational datasets are larger than between different models, progress in surface radiation flux simulations of climate models might depend on further progress in achieving consistent observations of surface radiation fluxes from space.