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pan-European gridded dataset for global radiation

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Based on a dataset of about 500 meteorological stations for daily global radiation and sunshine duration, a pan-European gridded dataset for global radiation is developed. This dataset will contain daily sums of global radiation from January 1950 onward at a resolution of 0.1 degree (about 10km), including ensemble-based uncertainties. Spatially the station network is inhomogeneous and stations are located too far apart to create a high resolution global radiation grid based on station data alone. Therefore, patterns from the satellite product CERES (Clouds and the Earth's Radiant Energy System), which provides a spatially continuous grid from 2000 onward, will be combined with the ground-based observations.

Using self organizing maps (SOMs) the commonly occurring patterns are extracted from the CERES irradiance dataset resulting in a set of patterns that have a physical meaning. This approach stands apart from using the more common, but physically meaningless, Principal Component Analysis to define dominant modes of variability. Hereby we assume that the patterns from the SOMs also occurred before 2000. Using advanced interpolation techniques, with feature selection and uncertainty-related weighting of the input data, enables an integrated data driven solution, even with fewer observations. The interpolation techniques are validated using spatial separated k-fold cross-validation. Considering the computational power required for this approach, a cloud-based solution is used. The resulting high-resolution gridded global radiation dataset will be part of the European Climate Assessment & Datasets (E-OBS) family of datasets which are operationally supported by the Copernicus Climate Change Service (C3S) and updated monthly. Applications of this dataset are in the renewable energy sector, for hydrology and agriculture and climate change assessment.