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Monthly gridded dataset for sunshine duration over Slovenia

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Gridded time series of sunshine energy are essential information for variety of technological areas such as agriculture, forestry, civil engineering and in particular in designing and sizing the solar energy systems. However, the availability of observed solar radiation energy measurements is spatially and temporally inadequate. For Slovenia, time series of sunshine duration measurements are much longer (average length app. 50 years) than measurements of solar radiation energy (average length app. 15 years) and their spatial density is also higher (43 stations versus 15 stations). This was the main reason for construction the homogeneous monthly gridded dataset of sunshine duration instead of solar radiation energy. For the needs of energy sector, solar radiation energy could be assessed from sunshine duration.

The time series, used in environmental studies, should be homogeneous, since inhomogenities mask the real climate signal and thou lead to false conclusions. In our contribution, the methodology for calculation the gridded dataset of monthly sunshine duration in 1 km resolution for Slovenia is presented. The mean monthly value of sunshine duration is decomposed into climate normal and monthly anomaly signal. Spatialisation into 1 km grid is performed for each signal separately. Before spatialisation procedure, all sunshine duration time series were subject of rigorous quality control and afterwards, daily values for mathematical horizon were calculated, taking into account terrain and neighbourhood obstacles. The next step was homogeneity check of all available time series. In that step high quality long time series were selected, homogenised on monthly basis and missing values were interpolated. Finally, we've got homogenised time series for 29 stations around Slovenia.

For spatial interpolation of monthly normals all available data (including inhomogenous and incomplete climate data series) were used to include as much information about spatial variability as possible. For cold period months (November to February), when fog is a frequent and persistent phenomenon, which influences spatial variability of sunshine duration especially in the basins, the information about fog occurrence was included in the interpolation procedure. Since the observations of fog occurrence on meteorological stations are spatially and temporally inhomogeneous, the fog climatology was assessed using satellite measurements in visual channel

For calculation of gridded monthly anomalies only homogenised climate series were used to assure temporal homogeneity of the resulting monthly gridded time series. For spatialistion of both signals (normal and anomalies) regression kriging was used, taking into account different explanatory variables (terrain variables, satellite measuremenst. . .). Cross validation of interpolation models shoved promising results.