



Supplement of

Hourly precipitation fields at 1 km resolution over Belgium from 1940 to 2016 based on the analog technique

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Statistics on geopotential height

In line with section 3.2.1 of the manuscript, some supplementary figures are provided here for years other than 2006 to show the robustness of the selected 4TWS method.

Figures for additional target years

- 5 Since 2006 was selected as the initial year of study, and given that it exhibited markedly different weather conditions, we also include comparative overview figures of geopotential height for two additional years: 2011 and 2012. The year 2011 was characterized by relatively dry and warm conditions, whereas 2012 experienced above-average precipitation and near-normal temperatures.

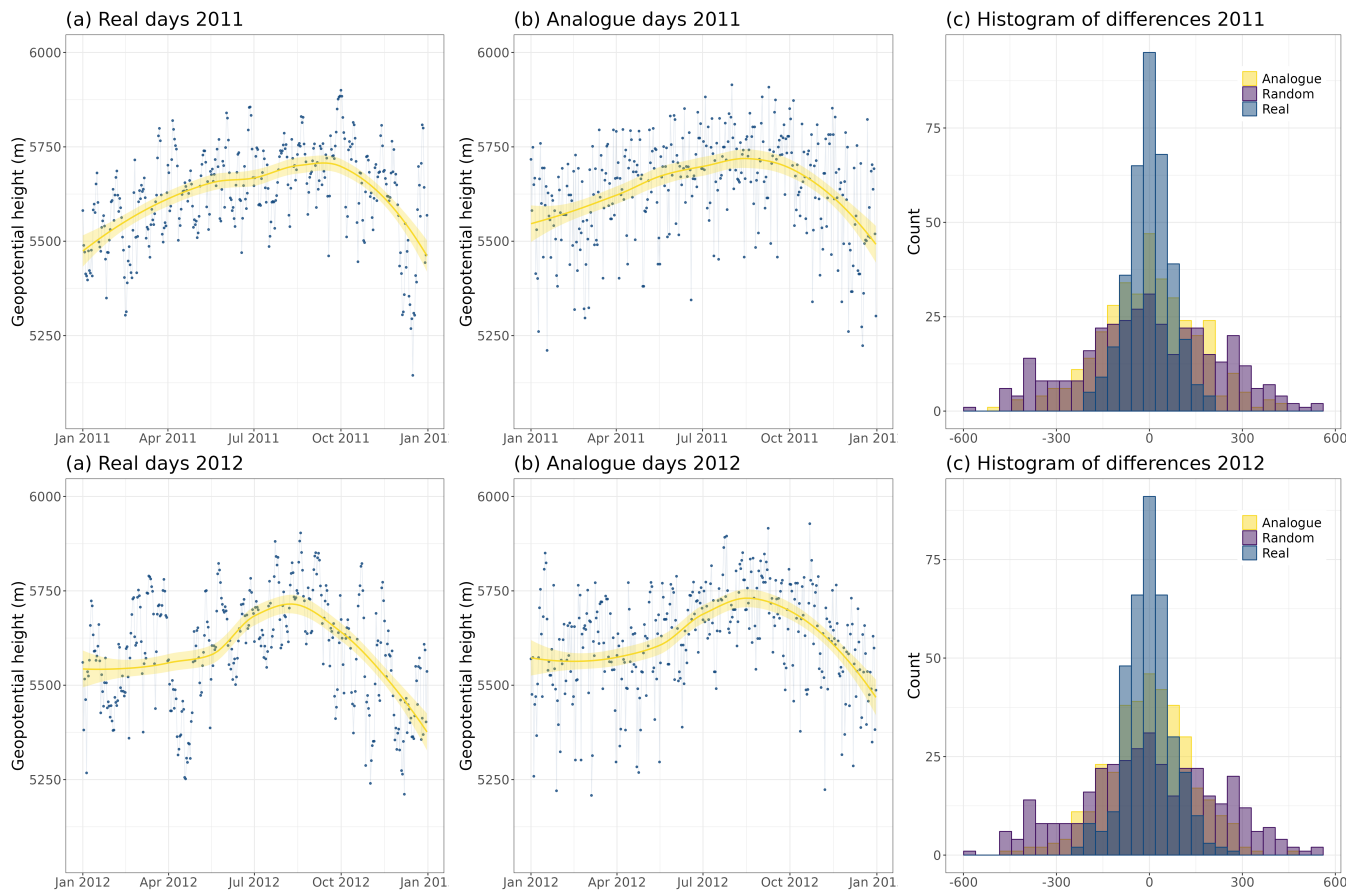


Fig. S1. The temporal evolution in geopotential height at the 500 hPa pressure level at 12 UT in Uccle in 2011 resp. 2012 (panel a); the corresponding data on the best analog days in 2011 resp. 2012 (panel b); differences in geopotential height on analog days, real days and random days in 2011 resp. 2012 (panel c). The yellow curves in the first two plots aid the eye in seeing patterns in the presence of overplotting by fitting a smooth curve to the data.

The overall pattern of geopotential height evolution is similar between the real and analog days. However, the analog days exhibit greater variability in geopotential height between consecutive days, with larger day-to-day changes and reduced temporal persistence compared to the real days. This is evident in both panels (a) and (b), as well as in the corresponding histogram.

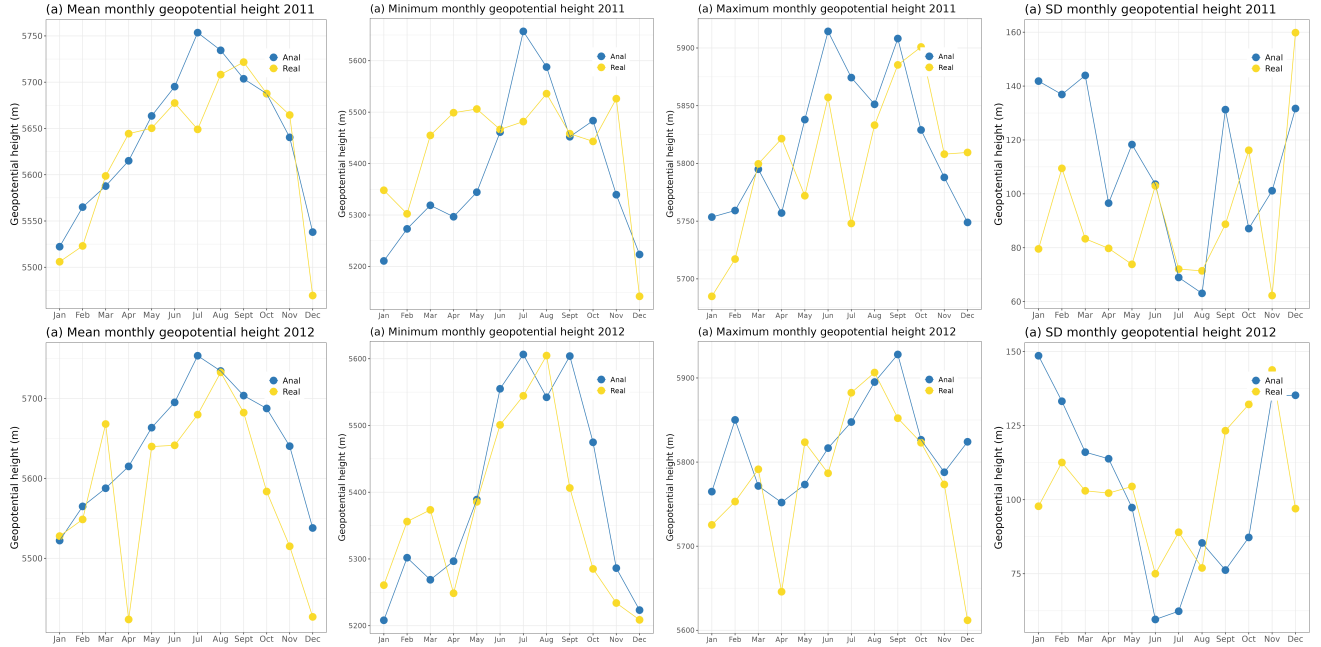


Fig. S2. Monthly statistics of geopotential height at 500 hPa pressure level in Uccle at 12 UT in 2011 and 2012. Respectively mean, minimum, maximum and standard deviation are shown in the figures. Consistent with previous observations, the general pattern between real and analog days is comparable across all four summary measures.

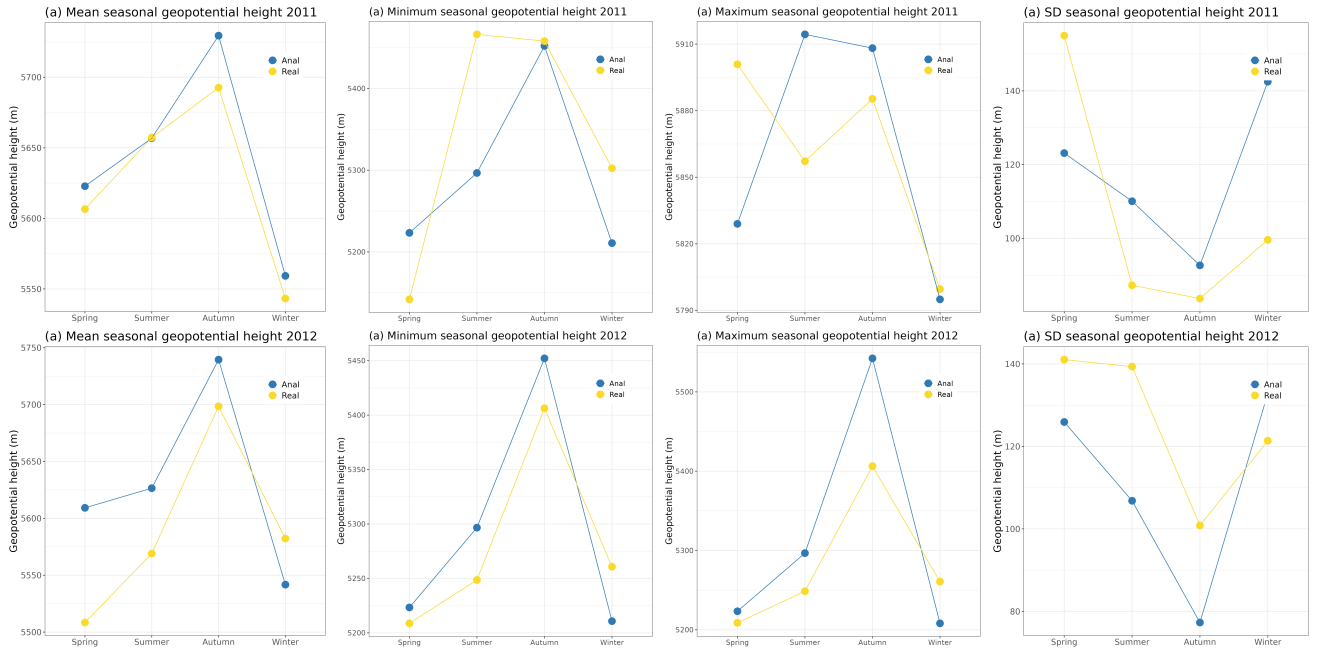


Fig. S3. Seasonly statistics of geopotential height at 500 hPa pressure level in Uccle at 12 UT in 2011 and 2012. Respectively mean, minimum, maximum and standard deviation are shown in the figures. The general pattern observed across all four summary measures shows a high degree of similarity between real and analog days, aligning with earlier results.

Distribution of precipitation amounts based on the selection of a set of analogs

As mentioned in Section 3.3 of the manuscript, an advantage of the high-resolution dataset for precipitation is that this information is not limited to locations where an AWS is available. For any location in Belgium, by selecting the nearest grid point, one can find an analog day precipitation distribution. This increases the applicability of our model and makes it possible to generate precipitation estimations for areas that might otherwise lack sufficient data. An example is presented in the Figure below.

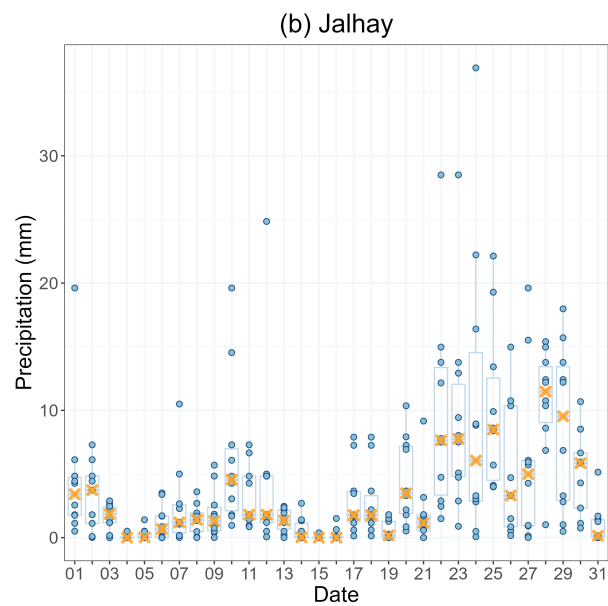
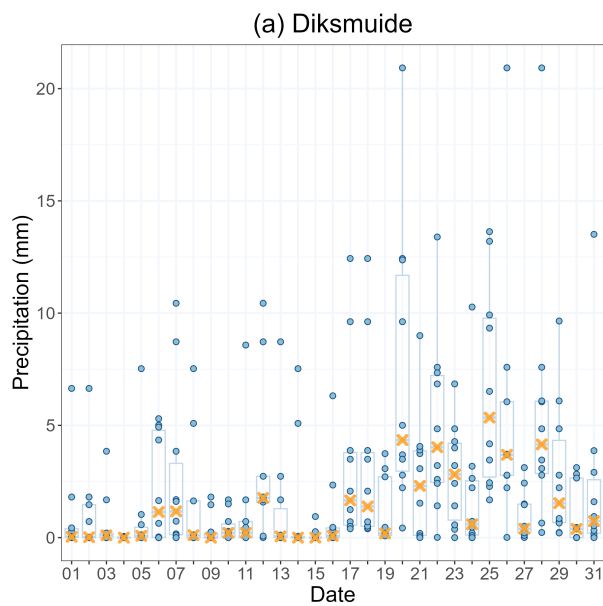


Fig. S4. Distribution of daily precipitation accumulation based on data from the 10 best analog days in January 1995 at (a) Diksmuide and (b) Jalhay, two locations without weather stations. The yellow crosses represent the median precipitation value for each day based on these 10 best analog days.