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Supplement of

How well does a convection-permitting regional climate model represent the reverse orographic effect of extreme hourly precipitation?

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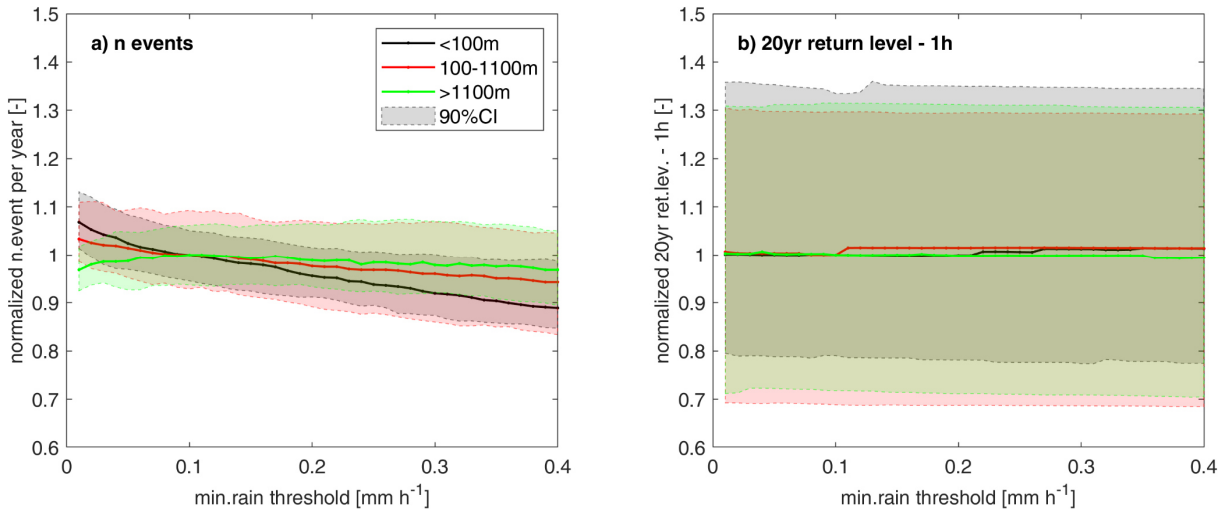
Figure S1. Sensitivity analysis on minimum rainfall threshold for the identification of storms in the CPM data. a) Number of storms for different minimum rainfall thresholds, normalised with respect to the one obtained with threshold=0.1 mm/h (used in the present study). b) 1h duration 20yr return level for different minimum rainfall thresholds, normalised with respect to the one obtained with threshold=0.1 mm/h (used in the present study). The analysis is carried out for three elevation groups. Shaded areas represent the values for the 90% of stations included in the elevation group.
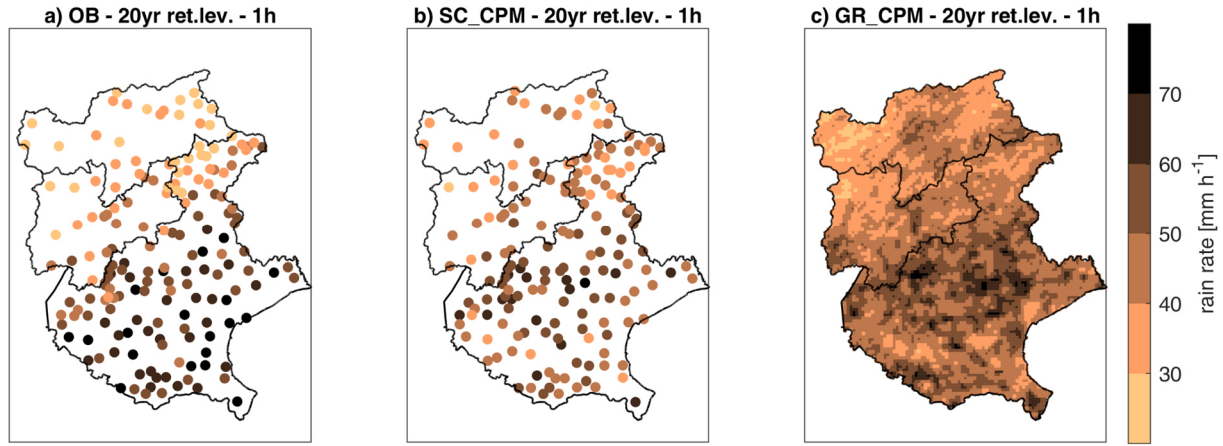

Figure S2. Rain rate map for the 20yr return level at 1h duration, for observations (panel a), station-collocated CPM (panel b), and whole CPM grid (panel c).
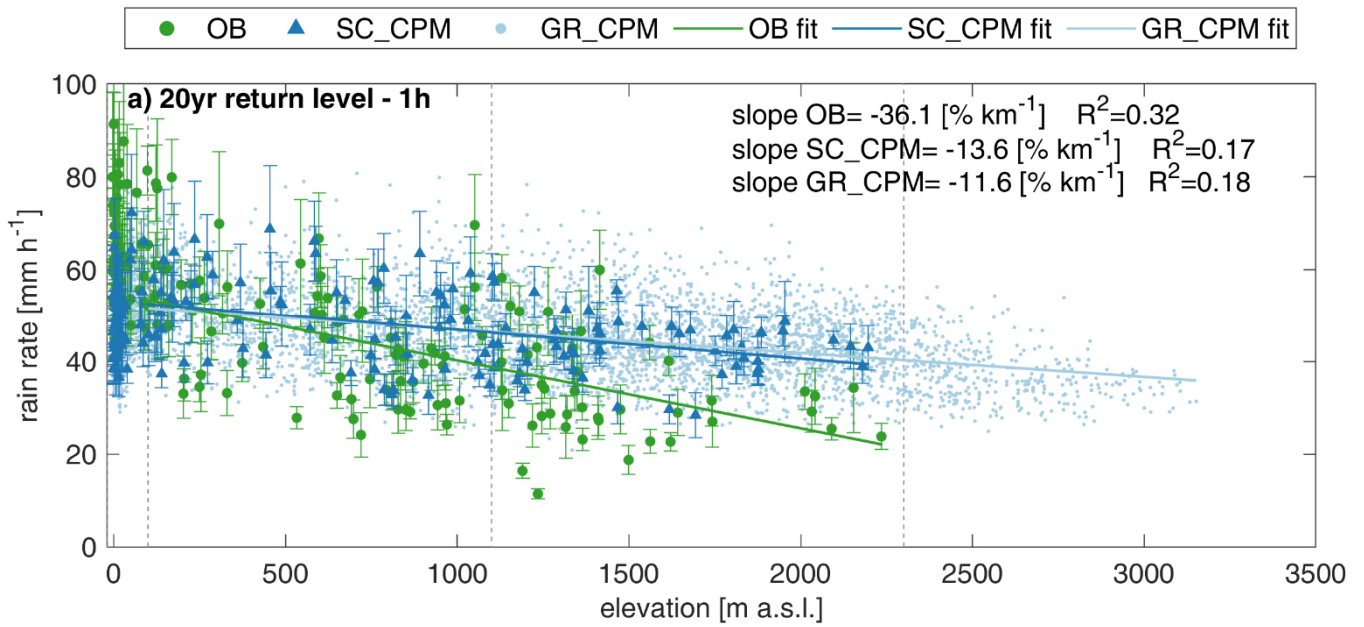
Figure S3. Uncertainty associated with the estimated 20 yr return level at 1 h duration. Error bars represent ± one standard deviation of 1000 bootstrap return level estimates.
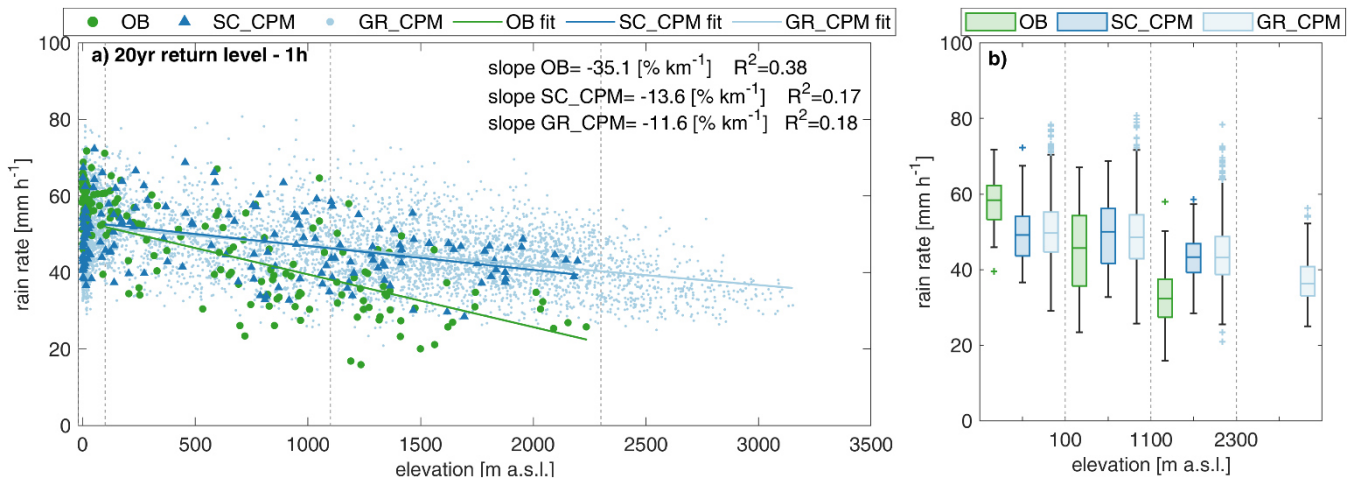

Figure S4. Orographic effect on 1h duration 20 yr return level, for long-record observations. a) Relationship of 1h duration 20 yr return level rain rate with elevation, for long-record observation (OB), station-collocated CPM (SC_CPM), and all grid points (GR_CPM). The linear regressions shown as a solid line are expressed as a percent of the median value and are calculated for the stations above 100 m a.s.l., the coefficients of determination are indicated as R^2; b) Box plots for 1h duration 20 yr return level rain rate, for the three rainfall datasets and 4 elevation groups.
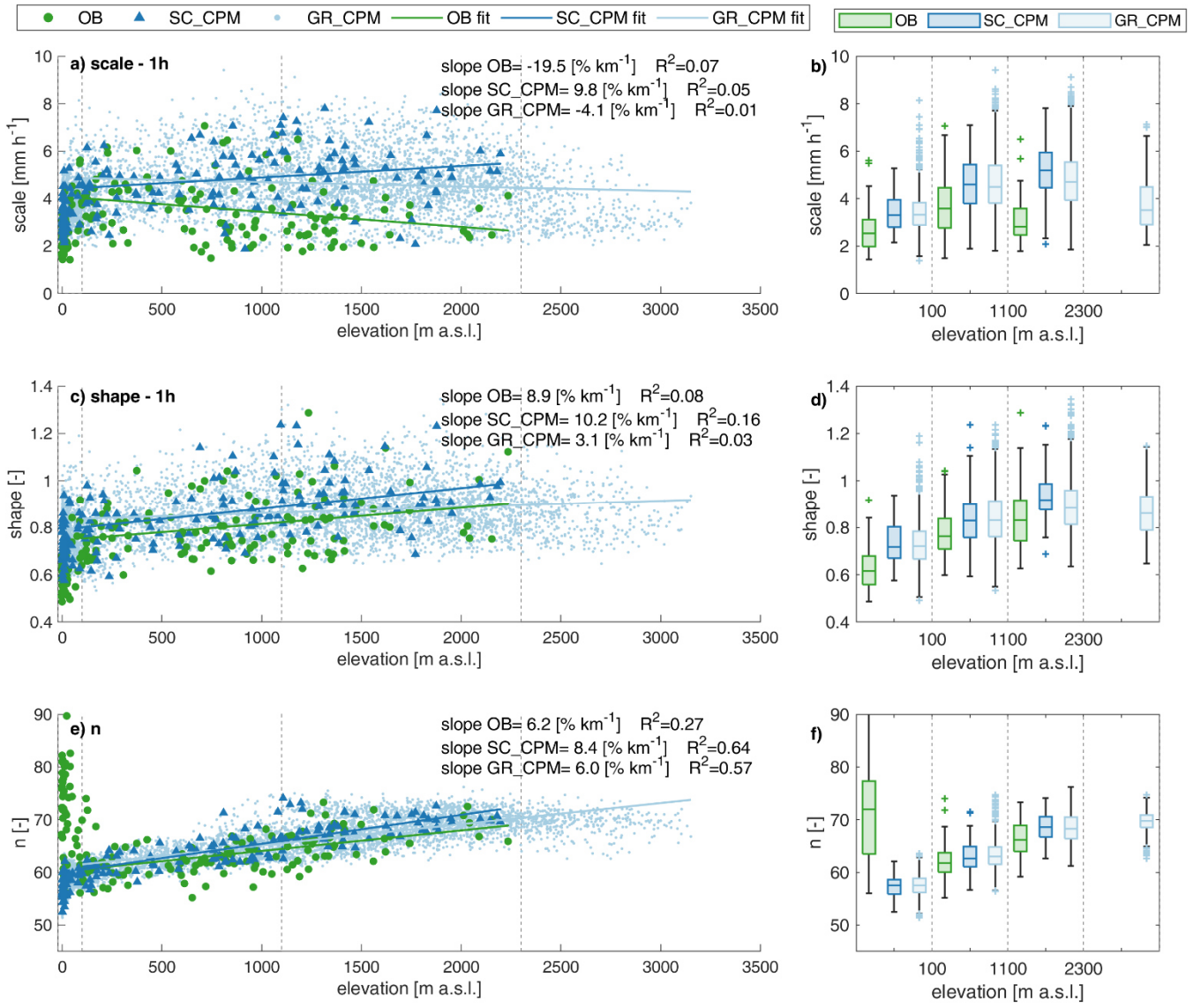
Figure S5. Orographic effect on distribution parameters at 1h duration. a,c,e) Relationship of 1h duration scale, shape, number of events with elevation, for observation (OB), station-collocated CPM (SC_CPM), and all grid points (GR_CPM). The linear regressions shown as a solid line are expressed as a percent of the median value and are calculated for the stations above 100 m a.s.l., the coefficients of determination are indicated as R^2; for the scale parameter the OB and the SC_CPM slopes result significantly different at the 5% level (see test description at section 3.3). b, d, f) Box plots for 1h duration scale, shape, number of events, for the three rainfall datasets and 4 elevation groups.

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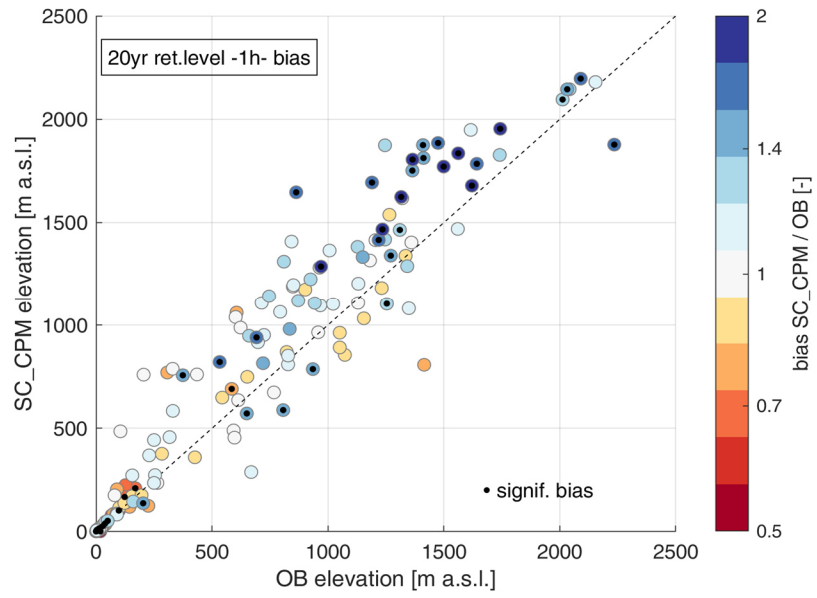
Figure S6. Comparison of elevation at the observation locations (OB) and at the Station-Collocated CPM (SC_CPM); the colour of the dots indicates the bias on 1h duration 20 yr return level at 1 h duration, the distance from the bisect represents the bias on elevation.
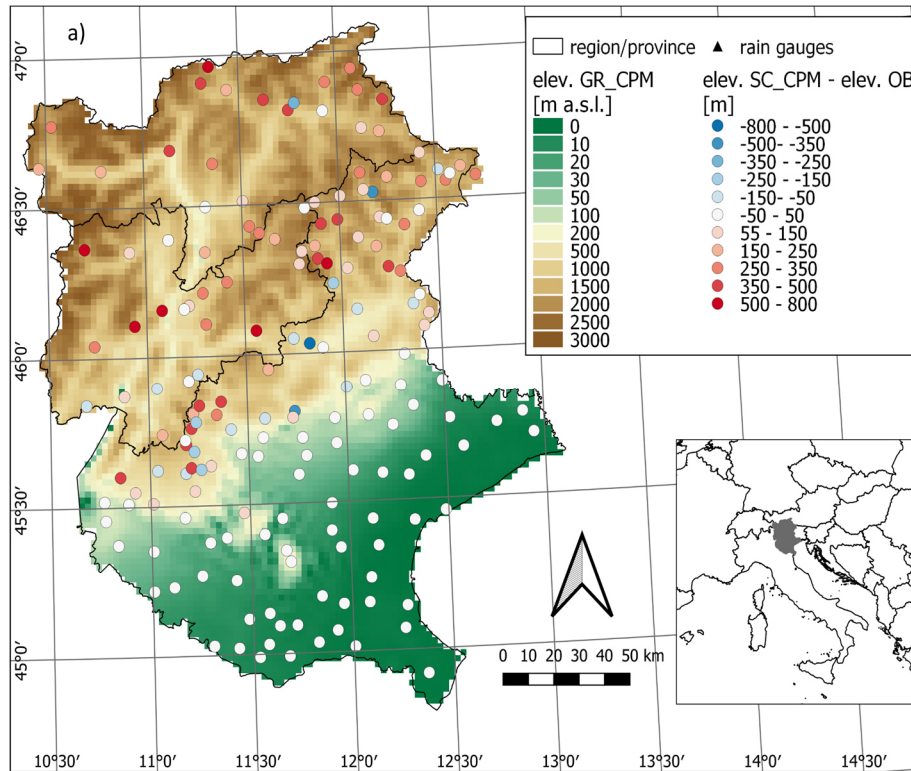
Figure S7. Orography of the study area as represented in the grid CPM, and elevation difference between station collocated CPM and observations (colored dots).