



Supplement of

Assessing the added value of the Intermediate Complexity Atmospheric Research (ICAR) model for precipitation in complex topography

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Figure S1. Box and whisker plot of the mean daily precipitation (y-axis) for each season $\overline{P_{24h}}$ (se) at alpine weather stations as measured or calculated by ICAR_{CP} and ERAI (x-axis). All amounts were calculated using the entire P_{24h} time series available at each weather station. The lower boundary of the box indicates the 25th percentile, the upper boundary the 75th percentile and the horizontal dashed line the mean. Whiskers show the minimum and maximum values of the data set.



Figure S2. Synoptic weather patterns and their associated regimes for New Zealand. Each panel lists the pattern identifier and its relative frequency in brackets next to it, while the contour lines depict the geopotential height (m) at 1000hPa. Reproduced from Kidson (2000), copyright Royal Meteorological Society.



Figure S3. Panel (a) shows the coefficient of determination r^2 between modeled and measured $\overline{P_{24h}}(ws, wp)$ calculated for each alpine weather station for ICAR_{CP} (orange disks) and ERAI (blue squares). Panel (b) shows the SS_{MSE} of ICAR_{CP} over ERAI in modeling $\overline{P_{24h}}(ws, wp)$ at alpine weather stations. The connecting lines serve as guides to the eye.



Figure S4. Dependence of SS_{MSE} and HSS at alpine stations on the Froude number regime, calculated for all available data. The state of the atmosphere is classified as stable for $\overline{N^2} > 0$ and near stable for $\overline{N^2} \le 0$. The x-axis indicates atmospheric stability and Froude number regime, connecting lines serve as guide to the eye. Not enough data points where available to calculate scores for near stable conditions.



Figure S5. Box and whisker plot of the mean daily precipitation at alpine stations (y-axis) in dependence of atmospheric stability and Froude number regime (x-axis). The lower boundary of the box indicates the 25th percentile, the upper boundary the 75th percentile and the horizontal line the median. Whiskers show the minimum and maximum values of the data set.



Figure S6. $\overline{P_{24h}}$ (ws, wp) as a function of weather pattern (wp) and weather station (ws) at all alpine weather stations for measurements (black pentagons), ICAR simulations (orange disks) and the ERAI reanalysis (blue squares). The connecting lines serve as guides to the eye.