Technical Corrections

Please find below a list of the technical corrections made to the revised manuscript.

Johannes Horak

P01L03:
Correction of the phrasing in a sentence.

different chain of processes than found in observations. While ~~in the atmospheric sciences~~ guidelines and strategies exist in the atmospheric sciences to maximize the chances that models are correct for the right reasons, these are mostly applicable to full-physics models, such as numerical weather prediction models. The Intermediate Complexity Atmospheric Research

P01L25:
We added a missing “an” and rephrased so that “such” doesn’t occur twice in the same sentence.

when model skill is evaluated from statistical metrics based on comparisons to surface observations only, such an analysis may not reflect the skill of the model in capturing atmospheric processes ~~such as~~ like gravity waves and cloud formation.

P02L11:
We split a sentence in two.

systems place further limits on the verifiability of models. The same limitations apply to model evaluation as well~~, however~~. However, evaluation focuses on establishing the reliability of a model rather than its truth.

P03L09:
We added the word “precipitation” to be more specific. This is a change resulting from a revision that clarified better that problems do not stem from comparing models to measurements, but only if those are isolated measurements without consideration of the underlying process. The resulting changes were not carried over to this sentence.

However, in the literature the evaluation efforts for ICAR so far focused mainly on comparisons to precipitation measurements or WRF output. Gutmann et al. (2016) compared monthly precipitation fields for Colorado, USA, obtained from ICAR

P04L04:
While iterating the manuscript the word “time-dependent” was dropped from this sentence. At this point 3-D should have changed to 4-D, we have corrected this now.

ICAR are a digital elevation model supplying the high-resolution topography $h(x, y)$ and forcing data, i.e., a set of ~~3-D~~ 4-D atmospheric variables as supplied by atmospheric reanalysis such as ERA5 or coupled atmosphere-ocean general circulation

P05L07:
We added a part to clarify since w’ and w are used interchangeably throughout the manuscript but it is never clearly stated (since w = W+w’ and, in linear theory, W = 0).

The vertical wind speed perturbation ~~w'~~ $w = w'$ is calculated from the divergence of the horizontal winds u and v, where $u = U + u'$ and $v = V + v'$, as

P05L27:

Equation 10 erroneously stated (x,y) ∈ B instead of (x,y) ∈ L.

data set and specified by a Dirichlet boundary condition as

$$\psi(x,y,z,t)\Big|_{\sout{(x,y)\in B}\,(x,y)\in L} = \psi_F(x,y,z,t), \tag{10}$$

P05L29:

We corrected for better phrasing.

At the upper boundary T where $n_z = N_z$ and N_z ~~denotes~~ as the grid points along the z direction, a zero gradient Neumann boundary condition is imposed:

P06L04:

We removed remains from an iteration of the manuscript between submission and revision.

Note that capital Ψ denotes not only the advected quantities ψ but also p~~, U and V~~.

P11L01:

We rephrased to add references to the equations in the manuscript and removed the reference to Gutmann et al. (2016) since the equation is now introduced in our revised manuscript.

ICAR calculates the perturbations to the horizontal background wind with ~~analytical equations based on linear theory~~ Eq. (1) and Eq. (2) while the vertical wind speed is calculated ~~to balance the density-weighted horizontal winds (see Eq. 9; Gutmann et al., 2016)~~ according to Eq. (8). Perturbations to the potential temperature and microphysics species fields, on the other hand, result from advection and microphysical processes calculated with numerical methods. In ICAR-O this introduces a time dependency for

P13L19:

We corrected term “group” to “species” since this is the term introduced in context with the microphysics scheme in Section 2.1.

ratio of the respective hydrometeor ~~group~~ species and $\rho_{ij}(t)$ the density of dry air within the grid cell. Note that in contrast to

P15L32:

We added local time since the abbreviation LT is never introduced.

The case study focuses on the 6 May 2015 LT (local time), a day with stably stratified large-scale northwesterly flow through-

P16L14:

We corrected “south-north” to the correct specification “north-south”.

$-8.4\,\mathrm{m\,s^{-1}}$ to $8.2\,\mathrm{m\,s^{-1}}$ compared to the $-10.0\,\mathrm{m\,s^{-1}}$ to $10.0\,\mathrm{m\,s^{-1}}$ derived from the analytical expression. While, for the ~~south-north~~ north-south perturbations, the analytical solution yields $v' = 0\,\mathrm{m\,s^{-1}}$, ICAR-N calculates an average magnitude

P19L21:

We corrected a non subscripted v to a subscript v.

~~$\tilde{\phi}_z(qv)$~~ $\tilde{\phi}_z(q_v)$ still exhibits minima and maxima at higher elevations due to the periodicity of the vertical velocity field (see

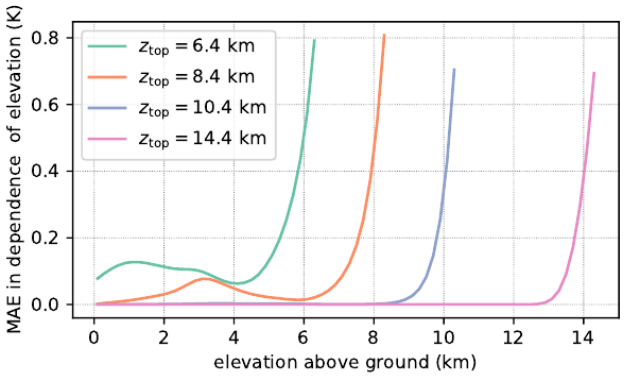
P21 Caption of Figure 3:

We corrected the indicated contour spacings, they erroneously listed the intervals of the filled contours that are already shown in the colorbars. However, they should state the intervals of the violet to teal contour lines, which they now do.

teal contour lines weaker vertical convergence in the range ~~of $\pm 1.5 \cdot 10^{-3}\,\mathrm{s}^{-1}$~~ between $-4.5 \cdot 10^{-4}\,\mathrm{s}^{-1}$ and $0\,\mathrm{s}^{-1}$ spaced in increments of ~~$0.3 \cdot 10^{-3}\,\mathrm{s}^{-1}$~~ $0.9 \cdot 10^{-4}\,\mathrm{s}^{-1}$. The red contour line indicates where $w = 0\,\mathrm{m\,s}^{-1}$. In panel (b) grey and black lines additionally indicate the

P22 Figure 4:

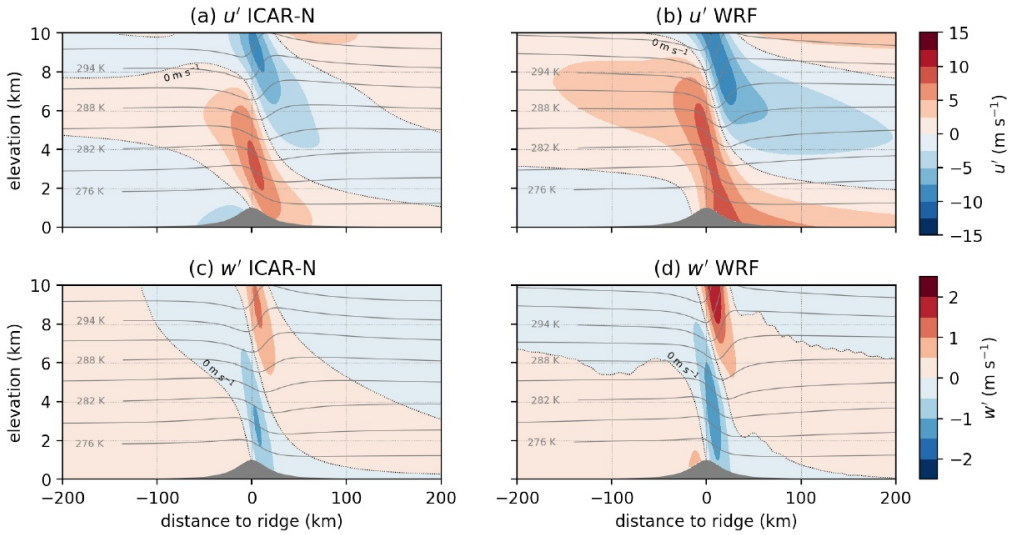
We corrected the y-axis label. This is in response to a previous reviewer comment that was addressed in the text. However, the y-axis label in the Figure was not adjusted, it previously read “horizontally averaged MAE (K), now it is “MAE in dependence of elevation (K)”



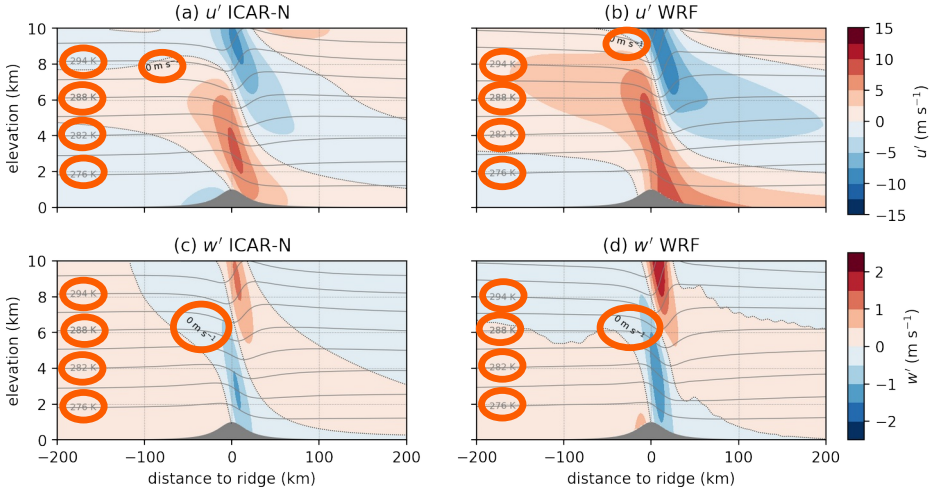
P30 Figure 10:

We slightly adjusted some label positions in Figure 10 and made adjustments so that the isentrope labels are now not crossed out by the isentropes anymore. The changes are highlighted with orange circles in the “Previous Figure 10” farther below.

Updated Figure 10:



Previous Figure 10:



P30 Figure 10:
We adjusted the title of Figure 13f. It was previously erroneously "f) ICAR-N – ICAR-O_{4km}" and now correctly states " f) ICAR-N – ICAR-$O_{15.2km}$" (orange highlight in text indicates the change).

P38L35:
We adjusted the phrasing to avoid double brackets.

triggered by higher topographies~~(~~, see Eq. (19)~~)~~. However, note that the dependence on the ridge height is weak compared to the dependence on the background state.

P39L07:
We added a missing unit

which correspond to approximately the uppermost ~~1~~ 1 km to 2 km of the domain, and result in only a negligible influence on

P41L07:
Corrected a spelling error

- The method described in this study to determine Z_{min} may be applied to idealized simulations and ~~a real case~~ real cases alike. This was demonstrated as proof of concept.

P41L11:
We rephrased for clarity.

- While most of the tested boundary conditions (in comparison to the default zero gradient boundary condition) are suitable to reduce the errors in the water vapor and potential temperature fields, no tested combination of these boundary conditions ~~can achieve~~ results in a lower value for Z_{min}.