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Atmospheric Measurement Techniques
Discussions

Interactive comment on "Improving the bias characteristics of the ROPP refractivity and bending angle operators" *by* C. P. Burrows et al.

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The paper presents an analysis of some forward model errors derived from the discretized nature of the background field. Indeed, even with a perfect physical understanding of the observation, forward models are limited by the finite amount of information that we have, both from the side of the observation procedure, as well as from the side of the background field.

The authors present certain systematic biases associated to the imperfect interpolation between model levels. Finer spacing allows better constraints, for any interpolation algorithm. Wider spacing requires some physical insight in the choice of the interpolation to perform better. From a reference linear interpolation of log N, they verify that biases

arise. Indeed log N is linear in, for instance, a dry isothermal atmosphere.

They propose some modifications that would provide better results in non-exponential atmospheres. We often have some insight on the thermodynamic structure inside a layer. This is notably the case for temperature, which is not constant, but is often structured with a quasi-constant gradient. This leads to another integrable function, which is not an exponential but a power law. It turns out that this is a better interpolator.

Technical comments:

-The authors mention (Sec 4, page 4455, line 15) that the exponential interpolation (linear-log N) is negatively biased, without further comment. I do not think that this is systematically the case, but the sign should be related to the prevailing temperature and moisture gradients. Assuming dry air, the bias of the power law under negative temperature gradient (troposphere, mesosphere) is likely of different sign than that of the corresponding power law under positive temperature gradient (stratosphere).

-The authors mostly elaborate on the issues associated with large spacing of the upper levels, where most of the problem is mathematical (the best interpolation choice for a function that is not exponential but still moderately simple, segments of power law). However, are the large moisture gradients in the low troposphere better tractable? Besides the broken linear distribution for temperature, the authors propose an exponential for moisture. But is the moisture part significantly better, or the distribution is simply too variable and the interpolation presents intrinsic limitations?

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