

General comments

This preprint presents a deep reinforcement learning framework to optimize the graupel bulk scattering properties in RTTOV-SCATT. Improving the radiative transfer simulations under cloudy conditions is an important objective, and the reported reductions in the brightness temperature RMSE are encouraging. The comparisons with AWS observations provide a useful evaluation of the proposed framework.

I recommend minor revision before publication.

Specific comments

1. Figure 15 compares the observed - simulated TB differences for the standard RTTOV vs DRL optimized RTTOV, please confirm whether both configurations use identical inputs, including the same AWS-retrieved graupel profiles. This appears consistent with the statement that all subsequent optimization experiments adopt retrieved graupel, but the term “standard RTTOV” does not make the input configuration explicit. A brief clarification in the figure caption would help establish that the comparison isolates the effect of the scattering parameterization. Please also indicate whether the same configuration applies to the subsequent comparisons.
2. The DRL training uses a surrogate NN to estimate the scattering contribution to TB. A brief discussion of how surrogate approximation errors could affect the optimization would help the readers interpret the results.
3. Please discuss the dependence on AWS-retrieved graupel parameters and its implications for the proposed data assimilation application in the Conclusion. In particular, would the operator use model-predicted graupel or AWS-retrieved graupel during assimilation? Please briefly acknowledge the implications of this choice for applicability and for the dependence between the operator inputs and the observations being assimilated.

Technical comments

1. **Lines 34-36:** Please consider replacing “Ice clouds cool the Earth system by **scattering and absorbing** incoming solar shortwave radiation” with “reflecting”. Absorption by clouds heats the atmosphere and should not be directly identified with cooling of the Earth system.
2. Please standardize the naming of the model throughout the manuscript and figures which appear as “RTTOV-ScattDRL”, “RTTOV-Scatt-DRL”, and “RTTOV-SCATT-DRL”.