Supplement of Atmos. Chem. Phys., 25, 10159–10182, 2025
https://doi.org/10.5194/acp-25-10159-2025-supplement


Atmospheric Chemistry and Physics
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*Supplement of*

# Contribution of gravity waves to shear in the extratropical lowermost stratosphere: insights from idealized baroclinic life cycle experiments

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## S1 Supporting information to Gravity wave occurrence: impact of horizontal and vertical grid spacing

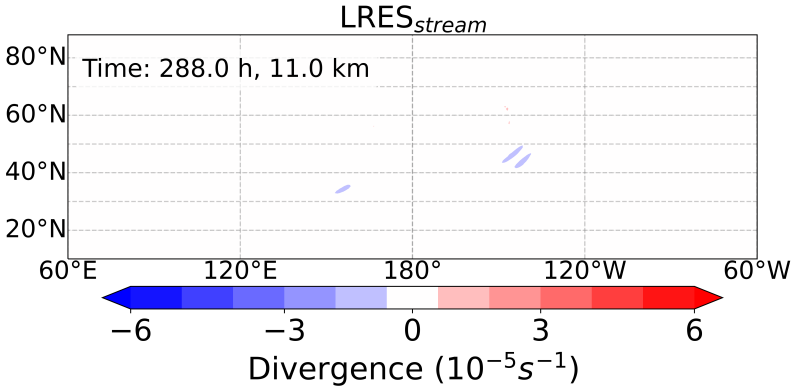


**Figure S1.** The distribution of horizontal divergence at 11 km altitude after 288 h in the LRES experiment indicates that gravity wave signatures are virtually absent in the lower-resolution simulation.

## S2 Supporting information to dynamic instability and turbulence

In this section, we provide further analysis of the temporal evolution of $N^2$, $S^2$ and $S^{2'}$ with respect to the occurrence of gradient Richardson number $Ri$ and their implications turbulence and dynamic instability in the LMS across various simulations. The results are derived from two-dimensional probability density functions (PDFs), which quantify the distribution of $N^2$-$S^2$, and $N^2$-$S^{2'}$ pairs in the LMS for 240, 264, 288 and 312 h of model integration.

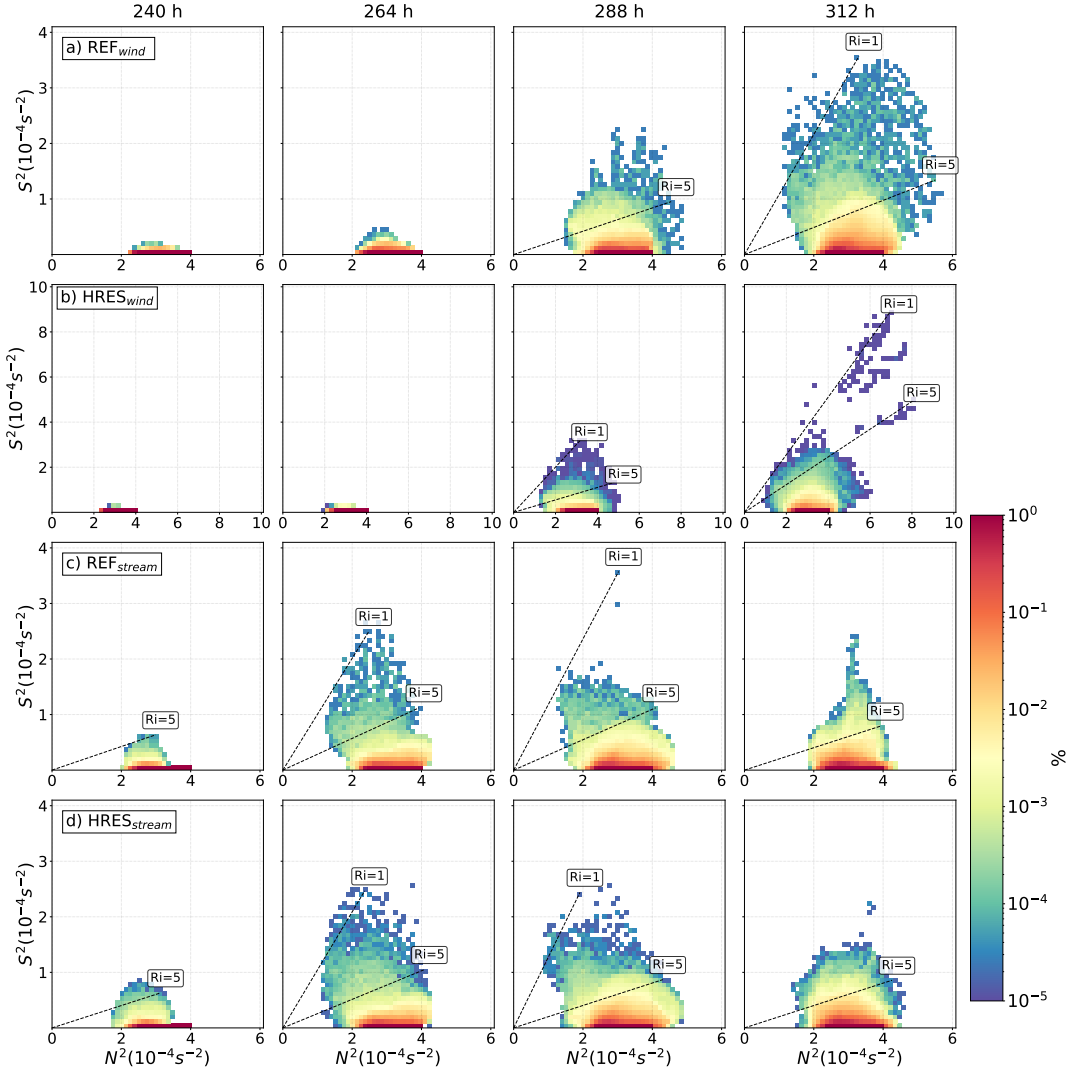


**Figure S2.** Temporal evolution of relative occurrence frequency distribution of $N^2$-$S^2$ pairs for simulations with varying grid sensitivity over Northern Hemisphere in the lowermost stratosphere. Logarithmic occurrence frequency color scale is applied. Dashed lines indicates the gradient Richardson numbers.

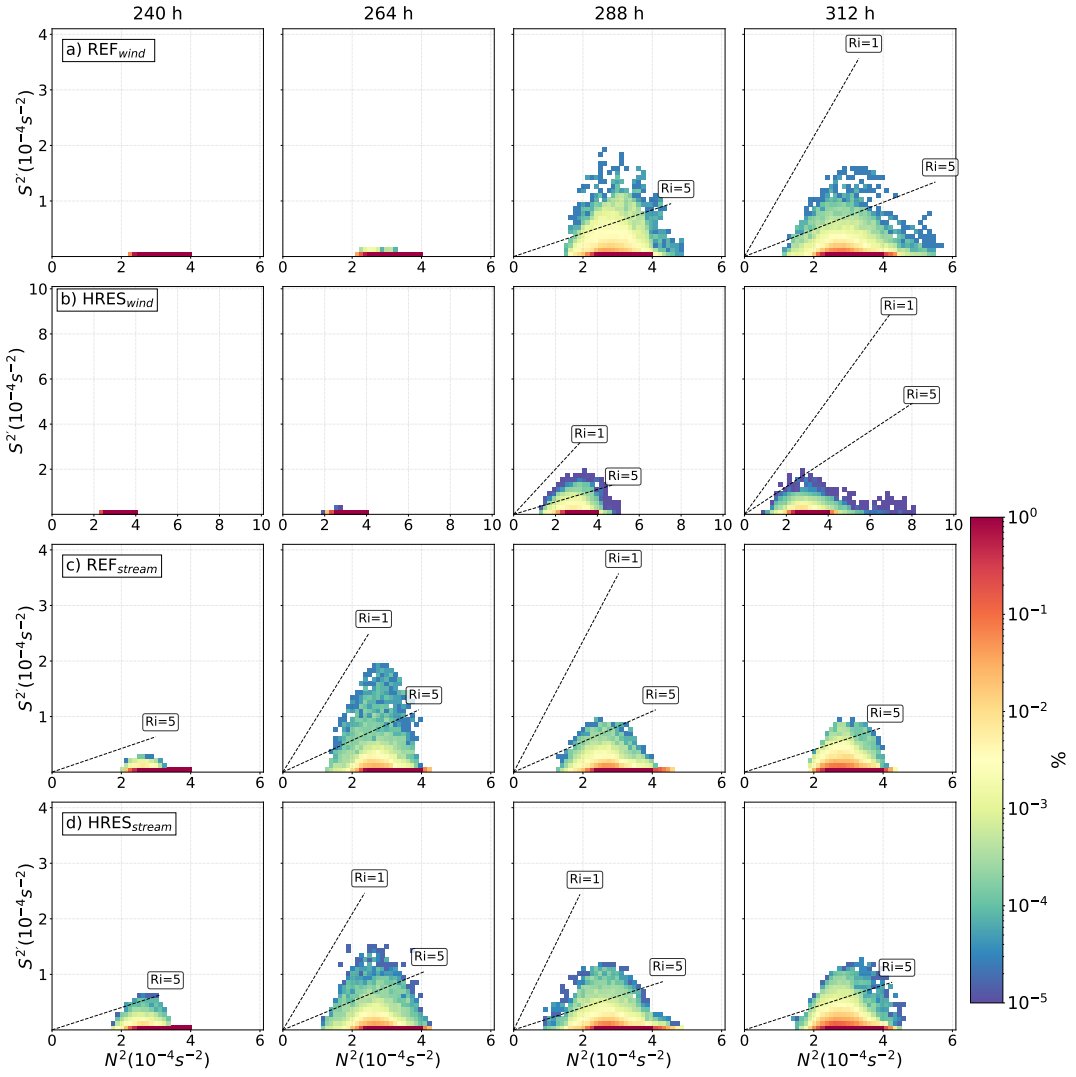


**Figure S3.** Temporal evolution of relative occurrence frequency distribution of $N^2$-$S^{2'}$ pairs for simulations with varying grid sensitivity over Northern Hemisphere in the lowermost stratosphere. Logarithmic occurrence frequency color scale is applied. Dashed lines indicates the gradient Richardson numbers.

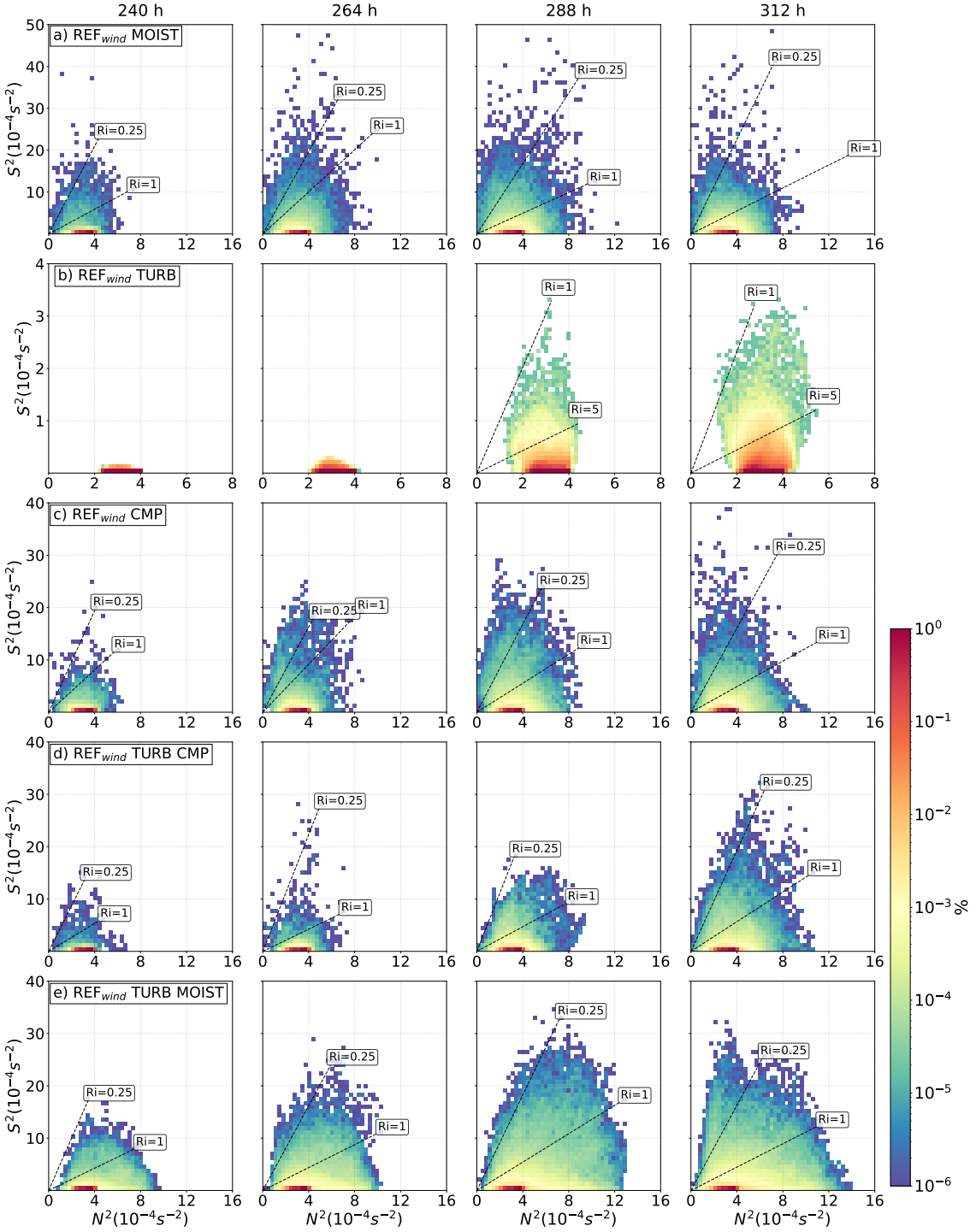


**Figure S4.** As in Figure S2 but for the REF$_{wind}$ simulations with varying physical processes.

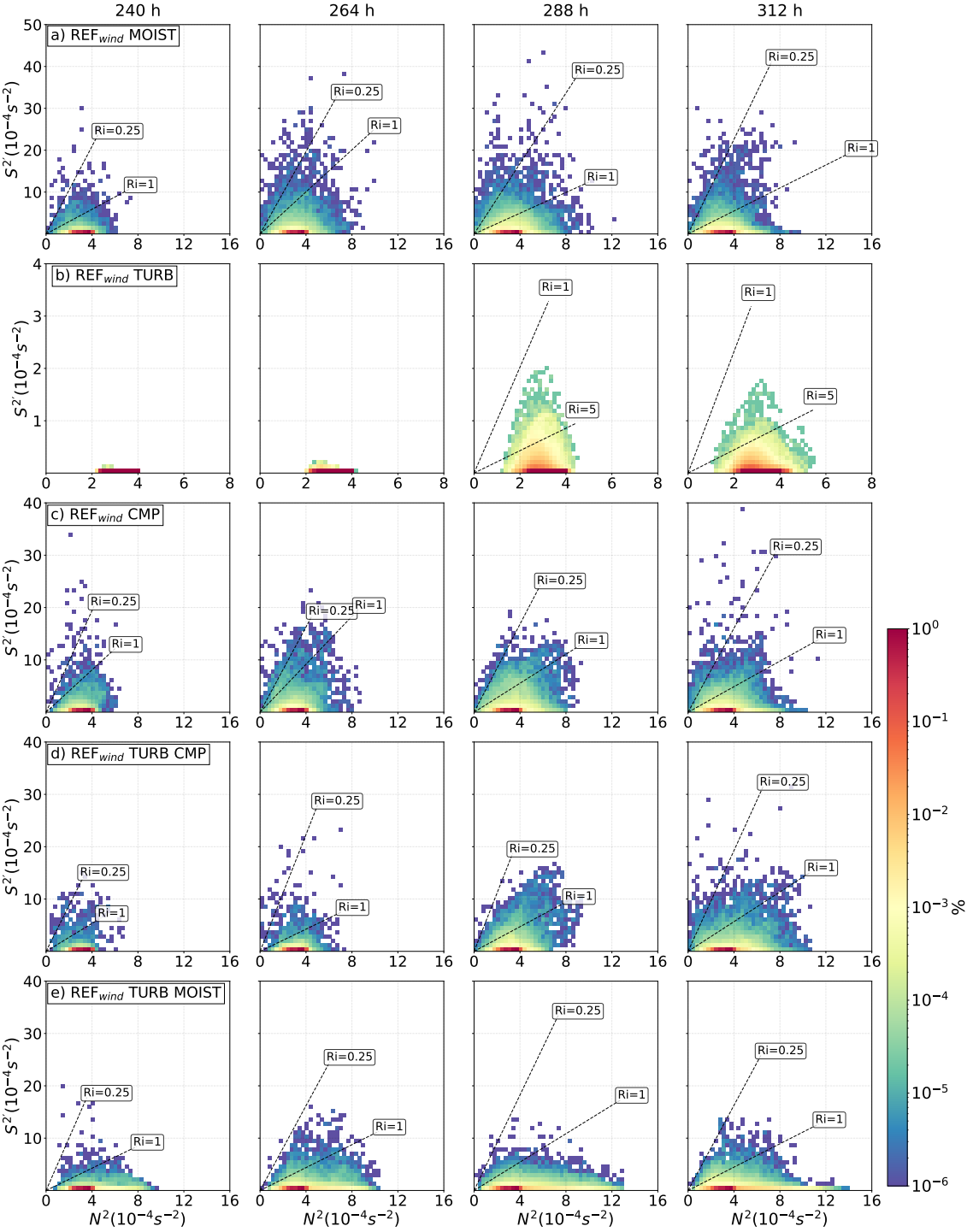


**Figure S5.** As in Figure S3 but for the REF$_{wind}$ simulations with varying physical processes.

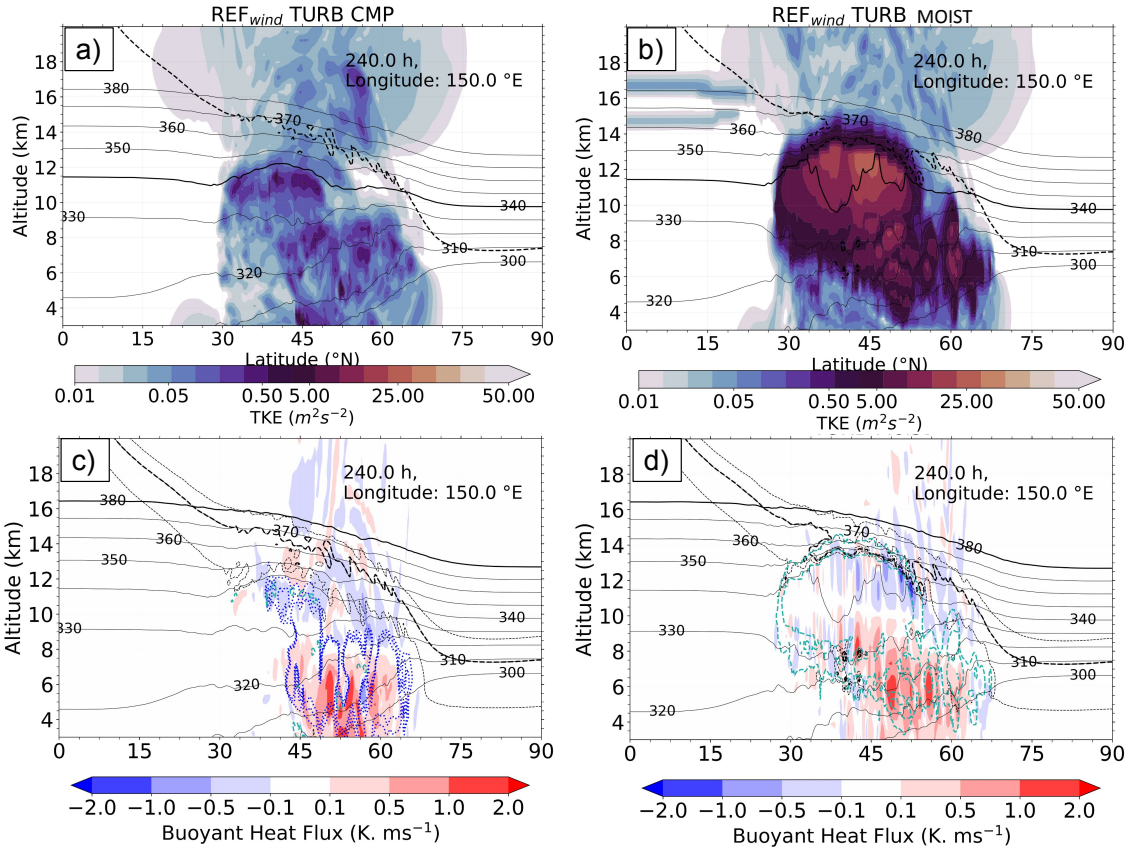


**Figure S6.** Vertical cross section of (a, b) turbulent kinetic energy (TKE, in $m^2s^{-2}$) and (c, d) buoyant heat flux (BHF, in K.m$^2s^{-1}$) for simulations REF$_{\text{wind}}$ TURB CMP & REF$_{\text{wind}}$ TURB MOIST. The green lines in c and d indicate maximum TKE with cloud ice content (qc, in $kg.kg^{-1}$) in blue.