Supplement of "Comparative experimental validation of microwave hyperspectral atmospheric soundings in clear-sky conditions"

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10   This supplemental document presents the vertical level adopted and main matrices used in this study, including S_e, S_a, and K at selected levels.

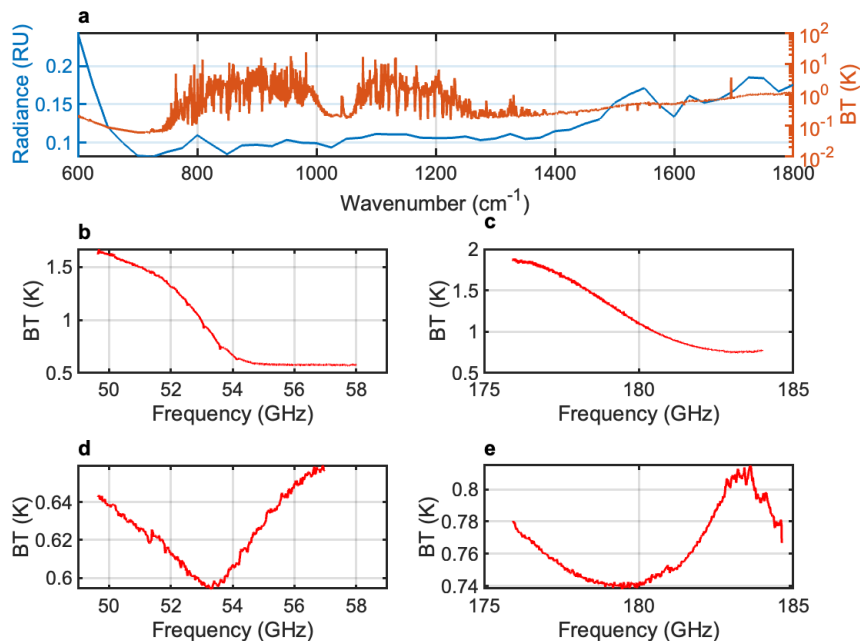



Figure S1. The square root of the diagonal components of S_e for AERI measurements (a), HiSRAMS nadir-pointing measurements at 6.8 km in the oxygen band (b) and in the water vapor band (c), and HiSRAMS zenith-pointing measurements at
15   the surface in the oxygen band (d) and in the water vapor band (e).

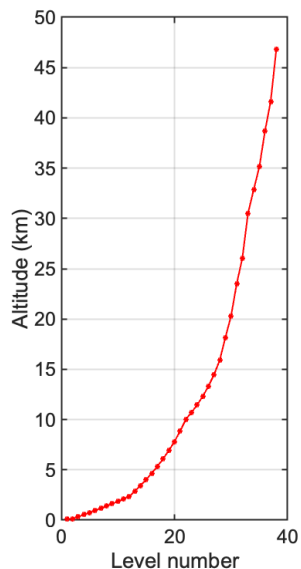



Figure S2. The vertical levels adopted in this study for all the retrievals. We utilize altitude coordinates for the retrievals, determined by averaging the geopotential heights from the a priori dataset.

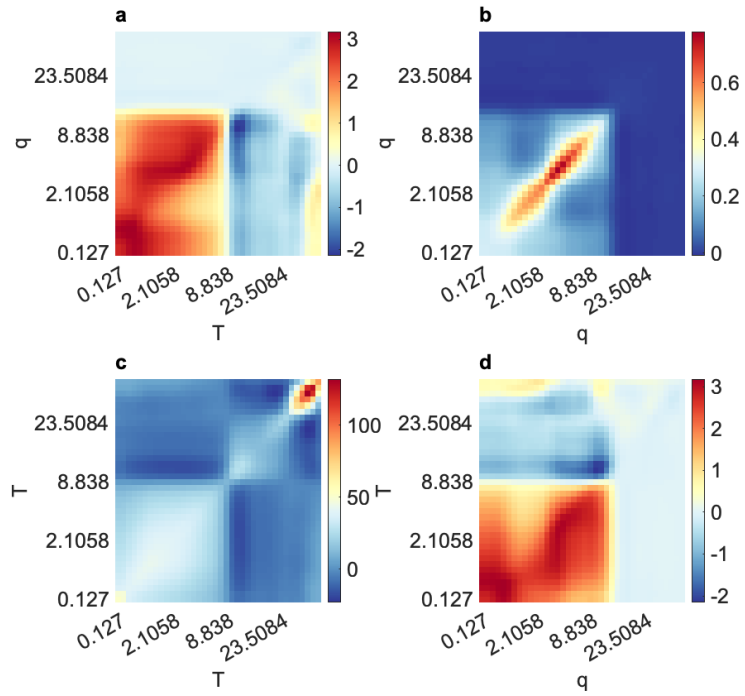



Figure S3. A priori covariance matrix S_a. Here, the label T represents temperature, and q represents the logarithm of the water vapor concentration. All units along the axes are in km.

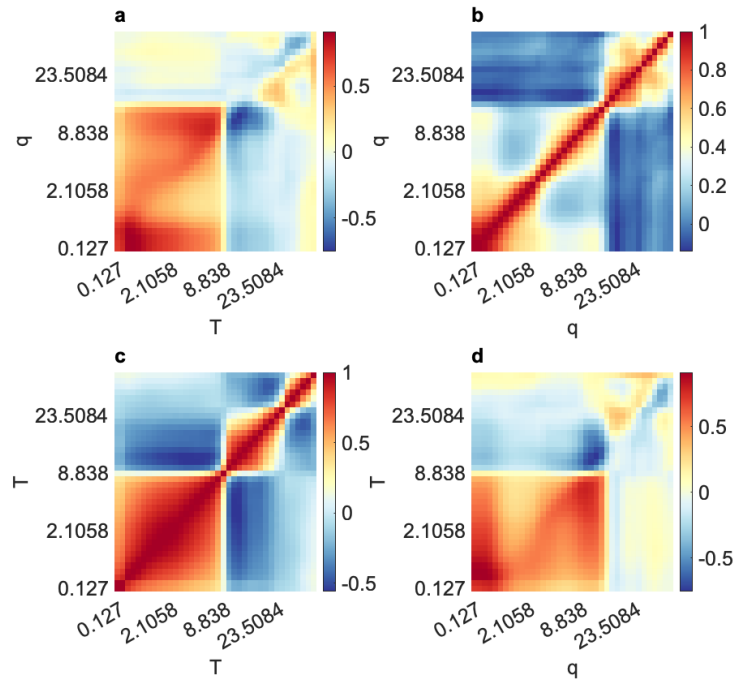



Figure S4. A priori correlation coefficient matrix C_a. Here, the label T represents temperature, and q represents the logarithm of the water vapor concentration. All units along the axes are in km.

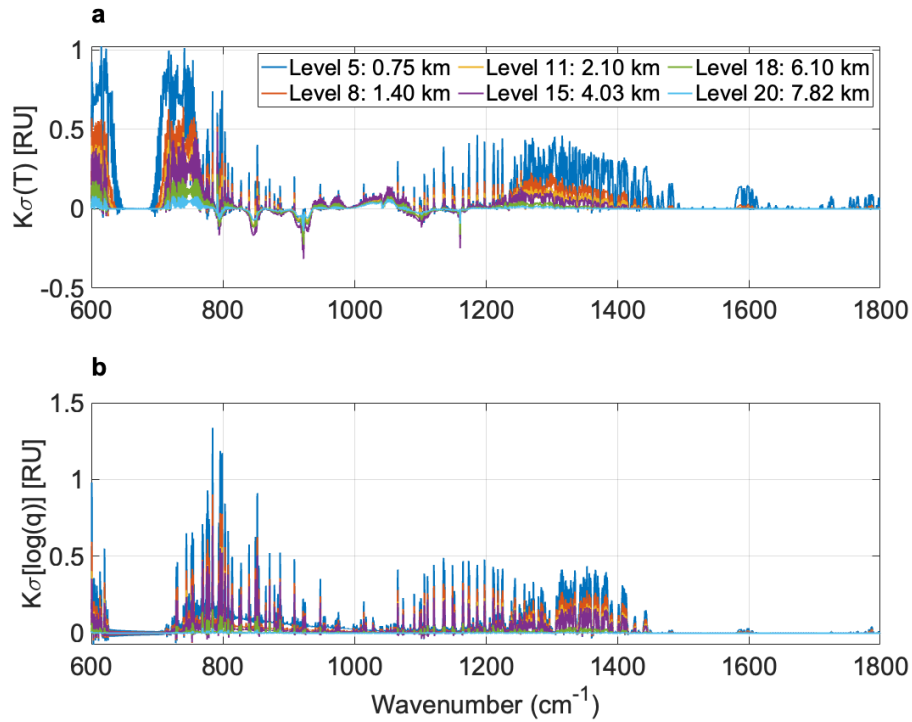
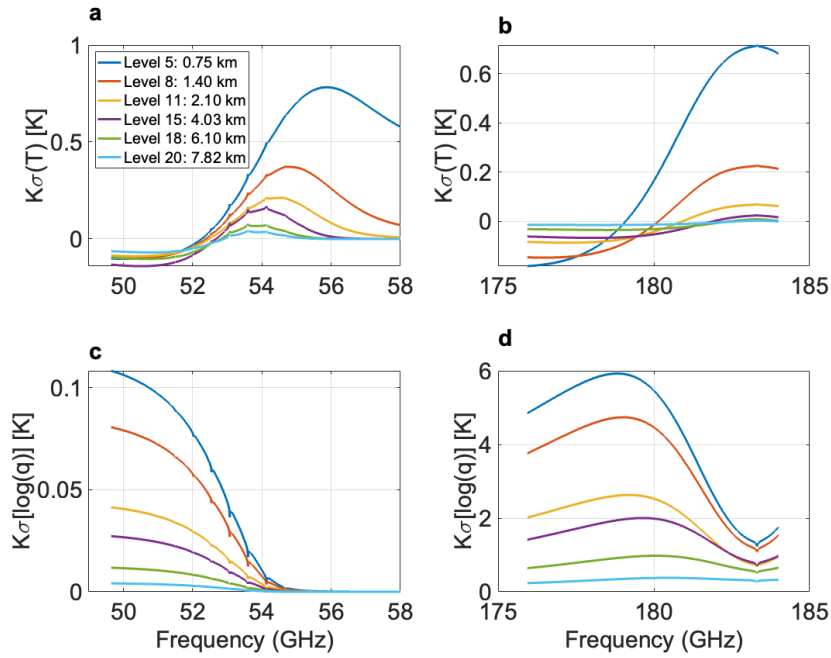



Figure S5. (a) $K_{AERI,T} \times \sigma(T)$ **at selected levels. This shows the product of the temperature Jacobian,** $K_{AERI,T}$**, and the standard deviation of the temperature profiles in the a priori dataset,** $\sigma(T)$**. (b)** $K_{AERI,q} \times \sigma[log(q)]$ **at selected levels. This presents the product of the water vapor Jacobian,** $K_{AERI,q}$**, and the standard deviation of the water vapor concentration profiles in the a priori dataset,** $\sigma[log(q)]$**. Note that we use the logarithm of water vapor concentration to calculate the water vapor Jacobian.**

35   **Figure S6. The same as Figure S5 but for HiSRAMS ground based zenith-pointing Jacobians. (a) $K_{HiSRSAMS,T} \times \sigma(T)$ in the oxygen band. (b) $K_{HiSRSAMS,T} \times \sigma(T)$ in the water vapor band. (c) $K_{HiSRAMS,q} \times \sigma[log(q)]$ in the oxygen band. (d) $K_{HiSRAMS,q} \times \sigma[log(q)]$ in the water vapor band.**

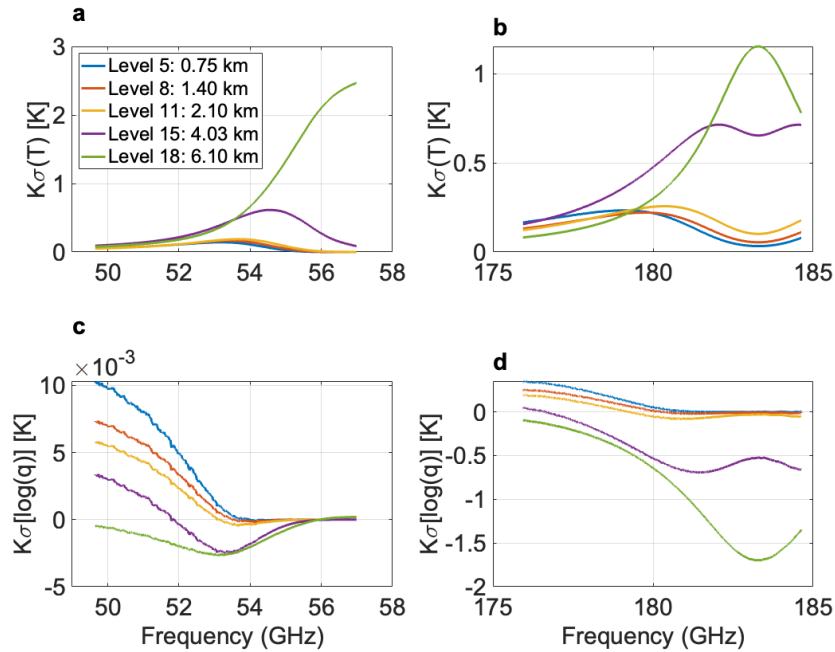



Figure S7. The same as Figure S6 but for HiSRAMS airborne nadir-pointing Jacobians. The observational height is set at 6.8 km.