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Radiative closure tests of collocated hyperspectral microwave and infrared radiometers

Lei Liu et al.

Correspondence to: Lei Liu (lei.liu5@mail.mcgill.ca)

Section 1: The impact of the LBLRTM versions

The most recent release of LBLRTM, v12.16, became available in December, 2022. We compared the radiative closure difference for AERI measurements between utilizing v12.9 and v12.16 (Figure S1). The primary discrepancy arises in the far-infrared spectral range. Within the spectral range exhibiting notable radiance disparities between the two LBLRTM versions, the radiance differences between simulations and actual observations are already significant due to relatively insufficient calibration at the spectral detector's edge. We began simulating the AERI-observed DLR in 2018. To ensure consistency with our previous work, we decided to utilize version 12.9 in this study.

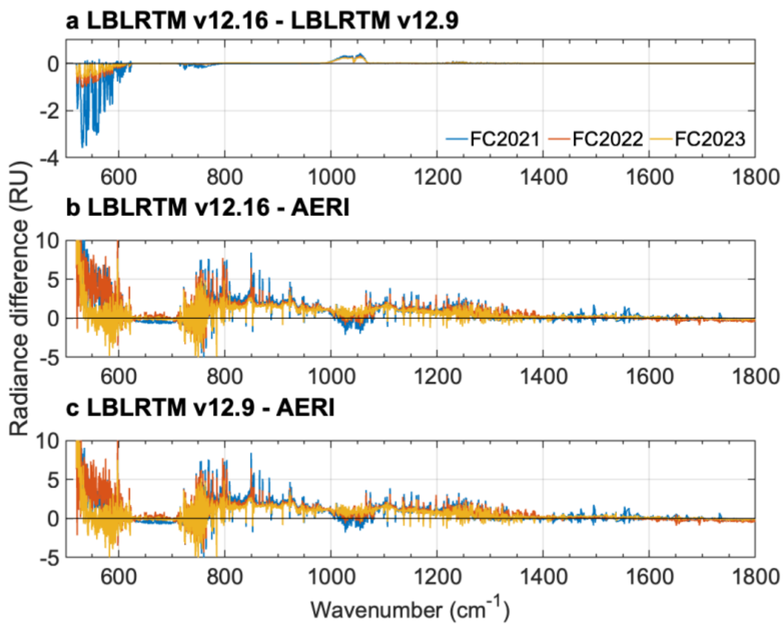

Figure S1. (a) DLR difference between LBLRTM simulations using version 12.16 and version 12.9. (b) DLR difference between LBLRTM v12.16 simulations and AERI observations. (c) DLR difference between LBLRTM v12.9 simulations and AERI observations.

Section 2: The AERI channel selections

Different greenhouse gases exhibit distinct absorption features at various AERI channels. Using FC2023 data, we computed the total column optical depth contributed by different greenhouse gases (CO_2, H_2O, O_3, CH_4, N_2O, and CFCs) at each AERI channel. Subsequently, each AERI channel is labeled based on the greenhouse gas that contributes the most to the total column optical depth (Figure S2).

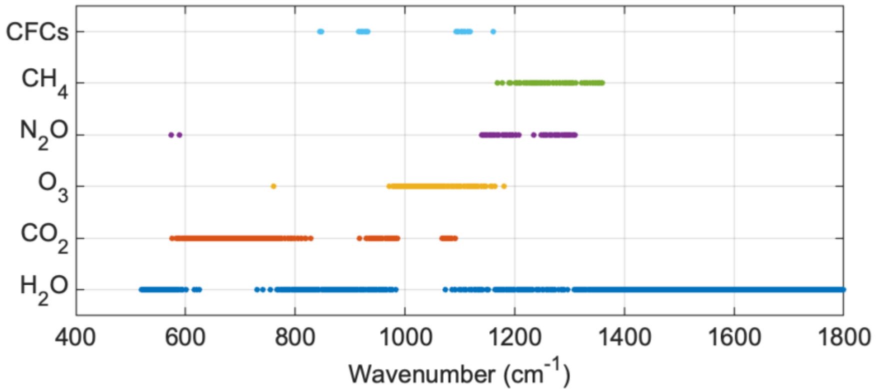

Figure S2. AERI channel labels. Each AERI channel is labeled according to the greenhouse gas that contributes the most to the total column optical depth.