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Exploiting aircraft observations of emitted radiation across the infrared to infer Arctic surface emissivity

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Recent work has shown that incorporating more realistic representations of snow and ice infrared surface emissivity in climate models can significantly reduce Arctic surface temperature biases and may play a key role in determining the pace of change in the region. However, due to a lack of 'in-situ' observations of surface emissivity over snow and ice, particularly at far-infrared (FIR) wavelengths (wavelengths > 15 [U+F06D]m), the emissivity representations used in the modelling studies thus far are based on theoretical estimates.

Following on from initial work by Bellisario et al (2017), which exploited near surface flights to derive the first ever aircraft based estimates of FIR surface emissivity, here we present retrievals of infrared spectral surface emissivity made from the Tropospheric Airborne Fourier Transform Spectrometer (TAFTS) and Airborne Research Interferometer Evaluation System (ARIES), flying at altitude over Greenland during March 2015. We describe the flight campaign and instrumental setup as well as the retrieval method, including the quality control performed on the observations. The results indicate that it is possible to retrieve surface information in the FIR from altitude, with the frozen surfaces overflown showing emissivities that have distinct spatial and spectral variability.