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Cloud characterization for trace gas retrievals over snow using O2-O2 and oxygen B-band absorption

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Geostationary measurements of trace gases provide valuable air quality data at unprecedented temporal scales. At high latitudes challenges begin to arise, such as lines of sight that stray from nadir, and (during winter) limited sunlight and pervasive snow cover. Motivated by the desire to fully take advantage of TEMPO (Tropospheric Emissions: Monitoring of Pollution) measurements over Canada, we investigate one of these issues: snow.

A key challenge with measurements over snowy scenes is the similar reflectivity of snow and clouds. Trace gas algorithms rely on the contrast between surface and cloud reflectivities to estimate an effective cloud fraction which is necessary to characterize the light path for cloudy scenes. This snow-cloud ambiguity ultimately compromises the data quality, denying the opportunity to capitalize on the potential increase in surface sensitivity offered by the high reflectivity of snow. Here we present an algorithm that simultaneously uses O2-O2 and oxygen B-band absorption to extract cloud data for trace gas retrievals while reducing dependency on the surface-cloud reflectivity contrast.