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Evaluation of surface-based inversions from ERA-Interim and satellite data over Antarctica using dropsonde data from the 2010 Concordiasi Experiment

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Surface-based inversions (SBI), where atmospheric temperature increases with height from the surface, occur very frequently over Antarctica. SBIs play an important role in Antarctic climate; however, much less is known about the characteristics of SBIs over Antarctica than the Arctic. This is mainly due to the scarcity of upper and lower tropospheric observations over Antarctica. The Concordiasi field experiment provided unprecedented high quality meteorological profiles over Antarctica and the surrounding ocean, especially over the continent where satellite retrievals are challenging. Between September and December 2010, a total of 639 dropsondes soundings were obtained as part of Concordiasi.

This study uses the SBIs derived from the Concordiasi high-resolution dropsonde data to evaluate SBI properties from ERA-Interim reanalysis and products from two hyper-spectral satellite instruments, the Advanced InfraRed Sounder (AIRS) and the Infrared Atmospheric Sounding Interferometer (IASI). All three products are operational and are available over the entire Antarctic region.

Preliminary analyses reveal that with recently released versions of AIRS and IASI, occurrences of a SBI agree with the dropsonde data in $\sim$80% of the cases. Analyses with AIRS and ERA-Interim conclude that surface air temperature, not vertical resolution, is the limiting factor in the ability to detect and characterize SBIs. We find SBIs to be more frequent, more intense, and deeper over the continent than over the surrounding ocean and sea ice. The results are very encouraging for future usage of satellite and reanalysis data to study Antarctic SBIs. If the three operational products are successfully validated, they will be used to study SBI variability beyond the time period of the Concordiasi campaign, including studying long-term SBI trends.