# 7. Remote Sensing of the Late-Summer Boundary Layer Near the North Pole

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This project has two objectives. The first is to demonstrate the performance and synergy of a suite of remote sensors from NOAA/ETL designed to sample the shallow Arctic boundary layer at high temporal resolution. The scientific objective is to deduce the transient mixing processes transporting heat, momentum, and aerosols in the generally stable Arctic PBL. The latter will use collaboration between CIRES, NOAA, and University of Stockholm scientists. Preliminary results from the first objective indicate that the second objective should be attainable.

To facilitate linking changes in atmospheric properties and aerosol concentrations to Arctic boundary layer (ABL) structures and processes, a suite of appropriate remote sensors was designed and deployed on the Swedish icebreaker *Oden* and on the pack ice near the North Pole during the Arctic Ocean Expedition-2001 (AOE-2001) in July and August, 2001. This suite consisted of two Doppler sodars, a 915 MHz wind profiler, a scanning 5 mm radiometer, and an S-band Doppler radar. These sensors were chosen to obtain observations of the thermal, kinematic and turbulent structure in the lowest 400-1000 m of the ABL with temporal resolution of an hour or less. They complement each other well, but also have a degree of redundancy. The data from the remote sensors are validated and checked for consistency with the episodic measurements provided by a tethered balloon and kites, 6 hourly GPS rawinsondes, and the hourly surface data.

The preliminary results (e.g., Figs. 1 & 2) demonstrate the synergistic potential of this suite of instruments for providing the thermodynamic and kinematic profiles with the high temporal and spatial resolution necessary to study transitory mixing events in the Arctic boundary layer. Future work will utilize this data to study the link between the quasi-persistent, thermal and kinematic features of the ABL (e.g., surface-based mixed layers, low-level jets within the stable air above, and low-level stratus clouds and fog), and more transitory features and processes often related to the quasi-persistent features. These transitory features and processes may facilitate vertical exchange. Some of the structures and processes possibly related to vertical exchange include breaking gravity waves, cloud-top cooling, surface mixed layers, and horizontal roll vortices. Many of these transitory features and processes occur on time scales of an hour or less, and should have been captured by the suite of sensors.

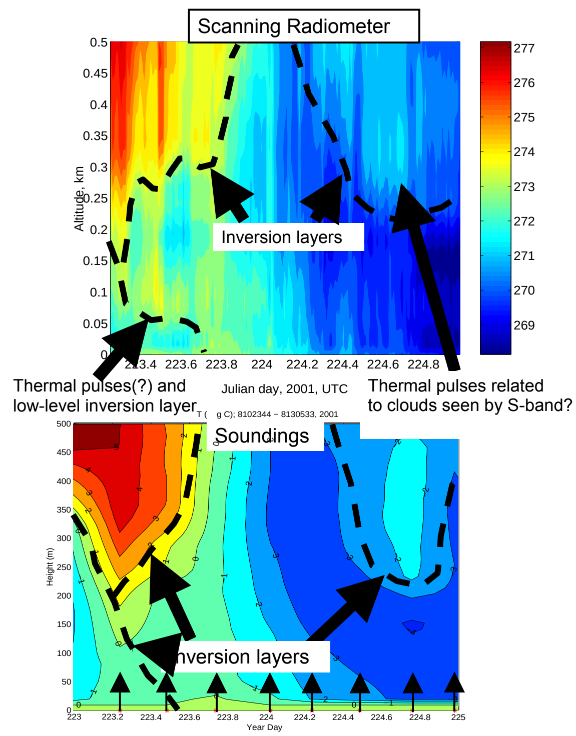


*Fig. 1: Time-height sections of temperature from a) the 5-mm scanning radiometer and b) the 6-hourly rawinsondes during Aug. 11-12 (JD 223-224). The arrows along the x axis show the times of the rawinsonde launches.*

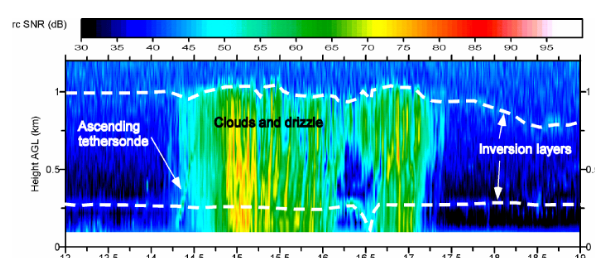


*Fig.2: Time-height section of reflectivity from the low mode of the S-band radar for 13-19 UTC on JD224. Also shown are inversion layers as determined from the rawinsondes and the scanning radiometer and the enhanced backscatter from a tethersonde.*