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Boundary-layer Measurements and Surface Fluxes at Study of Environmental Arctic Change (SEARCH) Sites in Northern Canada

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Several sites near the coast of the Arctic Ocean have been identified for enhanced instrumentation to monitor the changing Arctic climate and help understand the processes producing these changes. These installations include instrumentation for surface flux and surface energy budget measurements to better understand the important surface-layer processes in these stable high-Arctic coastal environments, and validate and possibly modify existing surface turbulent flux parameterizations. Beginning in 2004, remote sensors and in-situ instrumentation were installed at Alert (82.5N, 62.3W) and Eureka (80.0N, 85.9W), both on Ellesmere Island in Nunavut in northern Canada, in collaboration with Environment Canada. At Alert, the installations to date have included a Baseline Surface Radiation Network (BSRN) suite of instruments, soil temperature profiles, and a sonic anemometer to measure the complete surface energy budget. At Eureka, the installations have included a cloud radar and lidar to monitor the cloud macro and microphysical properties and a 10-m flux tower instrumented at various heights for surface-layer turbulence measurements. Sonic anemometers are located at 3 and 8 m heights while high-speed moisture and CO2 measurements are made at 7.5 m height. The thermal profile is measured by several slow T/RH sensors and differential temperature pairs at 2, 5 and 10 m heights. Surface characteristics are measured by thermal soil probes, an infrared surface temperature sensor, and a sonic snow-depth sensor. Downwelling broadband visible and infrared radiation measurements are made at the top of the tower. Meteorological stations have existed near both of these sites for many years, and

include twice-daily synoptic sounding measurements. The turbulence-measurement sites at both sites are 2-7 km inland and 80-180 m above sea level, and are separated from some of the other measurements, such as the soundings, by 3-7 km. Hence, because both sites are located in complex terrain in a coastal environment with variations in surface characteristics and attendant local and mesoscale processes, the analysis of the boundary-layer processes at both of these sites is expected to be challenging. Preliminary analysis of the turbulence characteristics at these sites has begun. Near-surface atmospheric environment, surface energy balance, and turbulent characteristics obtained for different conditions are discussed. These data are compared with measurements of atmospheric turbulence made over the Arctic pack ice during the Surface Heat Budget of the Arctic Ocean experiment (SHEBA) in the Beaufort Gyre from October 1997 through September 1998.