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Processes Affecting the Annual Surface Energy Budget at High-Latitude Terrestrial Sites

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Instrumentation at four Study of Environmental Arctic Change (SEARCH) sites (Barrow, Eureka, Alert, and Tiksi) have been enhanced in the past 6 years, including during the 2007-2008 IPY. Data from these sites are used to investigate the annual cycle of the surface energy budget (SEB), its coupling to atmospheric processes, and for Alert, its interannual variability. The comprehensive data sets are useful for showing interactions between the atmosphere, surface, and soil at high temporal resolution throughout the annual cycle. Processes that govern the SEB variability at each site are identified, and their impacts on the SEB are quantified. For example, mesoscale modulation of the SEB caused by forcing from the local terrain (downslope wind events) and coastlines (sea and land breezes) are significant at Alert and Eureka, with these processes affecting both radiative, turbulent, and ground heat flux terms in the SEB. Sub-seasonal and interannual variations in atmospheric processes and SEB impact soil thermal structures, such as the depth and timing of the summer active layer. These analyses provide an improved understanding of the processes producing changes in surface and soil temperature, linking them through the SEB as affected by atmospheric processes.