

Atmospheric circulation patterns associated with extreme events in Alaska

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Extreme events in Alaska include exceptionally heavy precipitation as well as high or low temperatures relative to climatological normal. These normals vary tremendously from the rainforest climate of Southeast Alaska to the polar desert of the Alaska's North Slope. In this study, we document the large-scale circulation patterns responsible for record high and low temperatures, as well as record high 5-day precipitation amounts. The events are identified for a set of approximately 20 first-order stations having nearly complete daily observational data for the period 1949-2012. The large-scale circulation fields are obtained from the gridded sea level pressures and 500 hPa geopotential heights of the NCEP/NCAR reanalysis. The large-scale signatures of extreme temperature events vary with location and season. For example, maximum temperatures in the Interior are favored by strong Chinook flow with low sea level pressure and 500 hPa heights to the west during the winter, but by above-normal sea level pressure and ridging aloft in the summer. Extreme minimum temperatures are favored by low geopotential heights over Alaska in all seasons and by strong surface high pressure in the winter. The upper-level trough is teleconnected to downstream ridging over the West Coast of Canada and the contiguous U.S. Heavy precipitation extremes over Southeast Alaska and the Aleutians are associated with winter cyclones in the Gulf of Alaska and extreme North Pacific Ocean, respectively. During summer, sea level pressure patterns consistent with westerly or southwesterly surface winds having a long over-water fetch produce heavy precipitation in interior, western and northern Alaska. Ongoing work includes the examination of CMIP5 model projections to determine whether the circulation patterns conducive to extreme events in Alaska are likely to increase or decrease by the middle and late 21st Century.