This research has developed new high-resolution climate products for Southeast Alaska, which is a region characterized by extreme topographical gradients. The climate regimes of Southeast Alaska vary widely from temperate rainforests to expansive glaciers and each of these locations is being impacted differently by our rapidly changing climate. To explore these localized changes, this research has produced dynamically downscaled climate model datasets at 1- and 4-km spatial resolution and at a daily time step for both historical (1981-present) and future periods (2031-2060). These downscaled simulations include one reanalysis (i.e., the Climate Forecast System Reanalysis; CFSR) and two climate models (i.e., the Geophysical Fluid Dynamics Laboratory Climate Model version 3 and the Community Climate System Model version 4).

These new datasets provide a range of expected trends and changes in variability to important climate drivers like temperature, precipitation and snow cover. While the utility of these datasets is expected to be broad across many disciplines, current analyses are focused on changes that impact: hydropower generation, fish habitat, forest health, and avalanche danger in Southeast Alaska. Hydropower and fish habitat restoration projects, for example, are commonly concerned with inter-annual precipitation totals, rain-snow partitioning and seasonal temperatures. Meanwhile, widespread forest mortality events and increased avalanche danger have been associated with threshold-based climate extremes.

The downscaled CFSR products are validated using the Moderate Resolution Imaging Spectroradiometer (MODIS) Aqua datasets from 2002-present. This is done for land surface temperature, precipitable water, and snow cover. This comparison gives an understanding of the CFSR bias, which is then related to the historical and future climate model distributions. The future simulations are based on the Representative Concentration Pathway 8.5 (RCP 8.5) emissions scenario, which best follows the current trajectory of greenhouse gas emissions.