Gap Flow and Taku Wind Events Over Downtown Juneau and South Douglas

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Overview: South East Alaska's steep terrain along with the water ways of the inside passage provide numerous micro climate locations. Due to a limited population and sparse observation network many of these micro climates are not well documented; one exception being the Taku wind events affecting the Gastineau Channel, Downtown Juneau and South Douglas regions of the Juneau Borough and Northern Admiralty Island Zone. During these mountain wave and gap flow events high winds may not be produced along other regions of the Zone such as near the Juneau Airport and Mendenhall Valley.

The terrain of Juneau rise steeply with elevation changes from sea level to about 6,000 feet in only a dozen miles. Main terrain features of the zone are the Coast Mountains and Juneau Ice Field to the east, Taku inlet to the South East, and Stephens Passage and Southern Lynn Canal to the West. Gastineau Channel divides South Douglas Island from the Downtown Juneau area with Salisbury Ridge, Mount Roberts and Mount Juneau along the eastern edge. The Juneau Airport and Mendenhall Valley areas have a less dramatic rise in terrain in comparison.

Synoptic Scale: Gap flow events being more common but with less severe wind, have a similar synoptic set up to Taku events which require additional elements. Both events require a tight pressure and thermal gradient with an east west orientation along the coast. Cold high pressure air mass over British Columbia with a warmer low over the eastern Gulf of Alaska provides both the thermal gradient and packed pressure field. Two variations on the synoptic set up are the dominance of the high or low features with a stronger high being a longer lasting and stronger event.

Local Ingredients: In addition to the synoptic set up, ingredients for Taku events include above mountain inversion, cross-barrier flow near 3000 ft and critical level near 500 mbs. Gap flow wind events are usually limited in area with high winds observed at Point Bishop; located at the entrance to Taku Inlet roughly 12 miles south of Downtown Juneau. During Taku events in addition to high winds along interior passes high winds measured at the Juneau Federal Building (located in Downtown Juneau), the South Douglas profiler, and Juneau Rock Dump may reach up to 60 to 100 mph. During these events winds along the Mendenhall Valley and near the Juneau Airport are limited due to orientation of terrain such as the Heintzleman Ridge.

Forecasting / Tools: With synoptic scale pattern forming or in place local tools have been developed to determine probability of Taku events. Referencing an "ingredients based weighting guide" the three main ingredients for Taku winds: above mountain inversion, cross-barrier flow and critical level near 500 mbs, are given an individual ranking from 0 to 6. Totaling the individual elements provides a scale for unfavorable to favorable event occurrence. In addition local model soundings along with time series vector analysis are checked for the Taku ingredients. Observations from stations along ridge tops and local profilers help to identify cross barrier flow.

References: The Taku Wind of Southeast Alaska: Its Identification and Prediction. Coleman, Dierking. Weather and Forecasting, Vol. 7 No. 1 March 1992.

Effects of a Mountain Wave Windstorm at the Surface. Dierking. Weather and Forecasting Vol. 13 Sept 1998.