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GeoDay Abstract

Climatological and meteorological conditions associated with rain-induced periglacial debris flows in the Cascade Range, USA

In November of 2006 an intense rainstorm of tropical origin, known colloquially as “Pineapple Express,” inundated the Pacific Northwest region of the United States, initiating numerous periglacial debris flows on several of the stratovolcanoes in the Cascade Range of Oregon and Washington. Rain-induced periglacial debris flows are the result of the over-saturation and subsequent collapse of steep moraine in formerly glaciated valleys. These debris flows rapidly aggrade channels, deposit thick sediments in their path, and severely damage infrastructure.

Here we focus on Mount Hood, Oregon and Mount Rainier, Washington in the investigation of meteorological and climatological conditions surrounding rain-induced periglacial debris flow events and the variability of these conditions over time. Both anecdotal and observational evidence suggest that the Pineapple Express storms are a likely triggering mechanism for these rain-induced debris flows on the stratovolcanoes. Dates for the debris flow events for each mountain were linked with corresponding Pineapple Express storm events. Preliminary analysis suggests that one or more particular climatological or meteorological conditions may be central to the initiation of debris flows, though these conditions may not always be present during Pineapple Express storms. Antecedent snowpack conditions are also hypothesized to play an important role in periglacial rain-induced debris flow initiation as the presence of snow cover on the moraines and glaciers is thought to reduce the likelihood of a debris flow.

Radiosonde data from Salem, Oregon (SLE) and Quillayute, Washington (UIL) data are used to examine the relationship between freezing levels of storms associated with debris flows. Precipitation data from SLE and UIL are compared to precipitation data from Paradise and Government Camp Co-op stations to explore orographic enhancement during these storm events. NCEP-NCAR reanalysis data is used to determine flow origin and regimes at the 500mb level for the debris flow date +/- 3 days, and NOAA reanalysis of tropospheric integrated moisture flux is used to assess strength and direction of atmospheric water vapor transport. Additionally, Snowpack Telemetry (SNOTEL) data are used to examine the antecedent snowpack conditions for each debris flow event.