An Examination of Winter Precipitation at Cypress Mountain, BC, during SNOW-V10

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1) Introduction

The mountainous coastal region of British Columbia experiences substantial amounts of precipitation (Figure 1), especially during the winter months, due to the prevalence of moist, onshore flows. At low altitudes, much of this occurs as rain, but snowfall becomes more dominant with increasing elevations. Quantifying the precipitation between frozen and liquid states is difficult, due to the region’s complex circulation. An examination of data obtained during the SNOW-V10 field campaign (to assist with the 2010 Winter Olympic Games) from Cypress Mountain, located just north of Vancouver (Figure 2), is performed to analyze the occurrence and assess driving mechanisms of precipitation quantity, rate, and type.

2) Data

These analyses will be carried out through examination of the following meteorological data: temperature, relative humidity, wind speed and direction, precipitation type, rate, and accumulation, as well as radar imagery. Data availability is shown in Figure 3.

3) Study Area

The BC Lower Mainland is subject to:
• atmospheric rivers and other large-scale circulation patterns favouring moist air advection from the Pacific Ocean, particularly during the boreal winter (Neiman et al., 2008).
• mean monthly (during the winter months) and mean annual precipitation exceeding 100 mm and 1000 mm, respectively, for Vancouver (Oke and Hay, 1998).
• significantly higher precipitation amounts (> ~2500 mm annually) over most of Cypress Mountain (el. ~1500 m), due to its higher elevation (Oke and Hay, 1998). The mountain acts as a barrier which promotes orographic lift and, therefore, significantly greater condensation. During the winter months, a considerable portion of this precipitation falls as snow.

4) Results

Two sites have detailed meteorological records for the duration of SNOW-V10: West Vancouver (WWA, el. 168 m, blue on Figure 1) and Cypress Bowl South (VOG, el. 885.5 m, red on Figure 1).

Figures 4 to 6 show meteorological data for March 11, 2010. Figure 4 shows WWA and VOG temperatures, precipitation rates, and precipitation types. Figure 5 displays WWA and VOG temperatures, wind speed, and wind direction. Figure 6 shows Micro-Rain Radar data over WWA for fall velocity and reflectivity.

5) Conclusions

Preliminary conclusions for January-April, 2010, over Cypress Mountain are:
• Precipitation up to 1500 mm was observed, but varied by as much as a factor of two.
• Precipitation events often lasted 6-10 h, with embedded heavier precipitation rates occurring for 15-30 min and up to 2-3 h.
• Altitude differences and up-slope processes contributed to whether rain or snow fell.
• Moisture advection at low levels was a prime reason for precipitation accumulation and its alteration led to diversity of amount, rate, and type.

6) References


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