UNIVERSITY OF THE PHILIPPINES

Master of Science in Meteorology

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Characterization of Frost Events in Benguet, Philippines

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ABSTRACT

Frost events are rare in a tropical country like the Philippines, yet, this weather event affects the region of Benguet. Until now, it is difficult to study the characteristics of frost in detail due to the scarcity of observational data, compounded by the complex terrain in this isolated region. This study aimed to characterize frost formation in Benguet with the use of land surface temperature (LST) observations from MODIS satellite, numerical simulation of surface temperature using available ground weather station, Weather Research Forecasting (WRF) model, synoptic weather maps, as well as digital elevation model (DEM). Comparing the result of the WRF simulation and MODIS satellite observations to the ground weather observations, it was found that WRF performs well to both daytime and nighttime as compared to the remote sensing data. In spite of the subtle difference, both yielded temperature values consistent with anecdotal reports of 10 °C by local farmers and agriculturists established as threshold for frost occurrence. The prevailing synoptic weather system and the corresponding mesoscale patterns were found to have a vital contribution to frost events. The synoptic wind pattern from the NCEP FNL reanalysis showed that frost events coincide with weak northeasterly wind flow during boreal winter. Weak monsoon flow are due to several synoptic scale flow patterns like intrusion of strong easterlies, difluence of wind due to tropical cyclones at the east of the country, or mid-latitude high pressure systems positions. Weak wind speed and above freezing temperature during frost occurrences led to the conclusion that frost events in Benguet are primarily radiative frost.

MODIS data was used to map the risk of frost over the study area. The risk is associated with the physiographic factors that contribute to the mesoscale extreme events in the mountainous area of Benguet. Results showed that the elevation and

morning potential insolation (MPI) are among the physiographic variables that influence the frost risk. Moreover, a Frost Event Indicator for Benguet was developed by applying multinomial logistic regression on WRF-simulated weather parameters.