Spotlight on Student Research

Formation and Characterization of Precipitation, Kananaskis, AB

Some of the most extreme and costliest natural disasters in Western Canada are caused by precipitation events. These events are complicated and are not yet fully understood. The formation of precipitation particles is a complex process and is one that is not currently included in forecasting techniques. There is a need to improve the understanding of those processes to better predict precipitation events.


Ida gets ready to release a radiosonde balloon to retrieve information on the vertical profile of the atmosphere.

Ida Hung, a recently graduated Masters student from the University of Manitoba, studied precipitation events in the Kananaskis region to better understand the drivers and formation of precipitation, particularly during the cold season. Ida's work contributes to improving forecasting systems and climate change projections for the region where cold precipitation (i.e. ice crystals, snow) is common. The formation of precipitation particles are influenced by many factors in the atmosphere and understanding those factors can be improved through detailed observations of precipitation at and near the surface.


Instrumentation used in Ida's research, including (L-R) geonor with alter shield, sounding system, optical disdrometer, Micro Rain Radar, and microphotography.

Ida focused her research on 11 precipitation events that occurred during March and April 2015 at the Kananaskis Emergency Site. These events were chosen for having specialized ice crystal and solid precipitation particle observations. Although Ida utilized various instruments in her study, her focus was on analyzing microphotographic images. Precipitation particles were collected on a black velvet pad at various intervals (10 s up to several minutes) based on the intensity of the event. Ida analyzed 1,183 images with 17,504 ice crystals and solid precipitation particles that were organized

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Changing Cold Regions Network (CCRN)

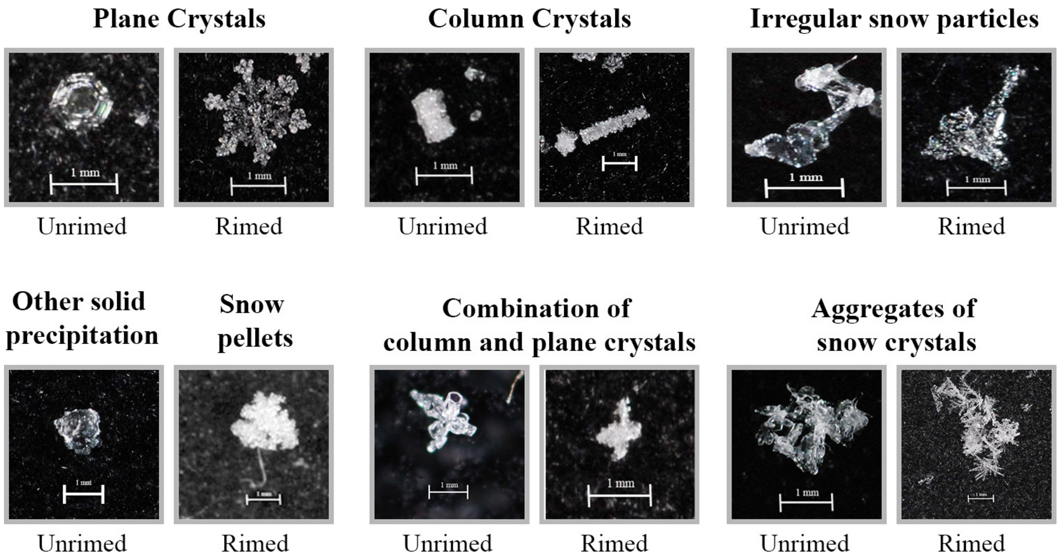
CCRN is a Canadian research network that aims to understand, diagnose, and predict the rapid environmental change occurring in the interior of western Canada. The Network is funded over five years (2013-2018) by the Natural Sciences and Engineering Research Council of Canada (NSERC) through its Climate Change and Atmospheric Research Initiative.

www.ccrnetwork.ca


Ida Hung, MSc

Ida recently defended her graduate research successfully under the supervision of Dr. Ronald Stewart at the University of Manitoba (U of M). She now is working at the U of M as a graduate research assistant continuing to look at winter precipitation in the Kananaskis Valley as well as interpreting Pseudo-Global Warming results from the 2013 Alberta Flood.

into 12 categories. Crystal types form under different temperature and vapour conditions in the atmosphere so identifying the different crystal types provides insight to the conditions aloft.



Representative examples of the 12 categories that the precipitation particles were placed into.

Precipitation varied considerably in the 11 events analyzed; 62% of the ice crystals and solid precipitation particles were rimed which means that they had collected supercooled droplets aloft. Ida also noted that 14% of the events contained rimed and unrimed particles occurring simultaneously which implies very different particle evolutions and trajectories to the surface.

Sublimation of particles below clouds played a significant role in limiting the overall accumulated precipitation at the surface. The degree of this mass loss is affected by the density of the falling particles. Accreted particles have higher densities and therefore fall faster and have a greater likelihood of reaching the surface. Such particles were often seen at the surface when temperatures were above 0°C, ranging up to 9°C. Models and diagnostic techniques must account for the complexity of precipitation formation to predict its correct location, amount, and phase.

Ida found that the precipitation events at the Kananaskis Emergency Site were of light intensity, similar to precipitation features and formation processes inferred in some regions of northern Canada. Ida's work provides insight into the great complexity that precipitation forecasting techniques must account for in regions such as Kananaskis and highlights the crucial need to understand the full evolution of particles aloft. This includes the influence of varying particle types, densities and trajectories down to the surface through regions with, for example, supercooled water as well as sub-saturation.

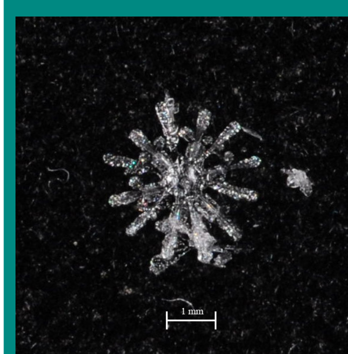
Definitions

Rime: snow crystals with frozen droplets on the surface, formed by the rapid freezing of supercooled water droplets as they impact exposed objects. Commonly observed stuck on trees after a storm.

Supercooled: a state in which liquid does not freeze at temperatures below the normal freezing point.

Sublimation: the process of snow and ice changing into water vapour in the air without first melting into water; this can reduce the amount of precipitation that reaches the surface.

Accretion: The growth of an ice crystal by collision with supercooled cloud drops that freeze wholly or partially upon contact (American Meteorological Society, 2012).



A twelve-branched dendrite photographed on April 5, 2015.

Link to Ida's thesis: http://hdl.handle.net/1993/31960