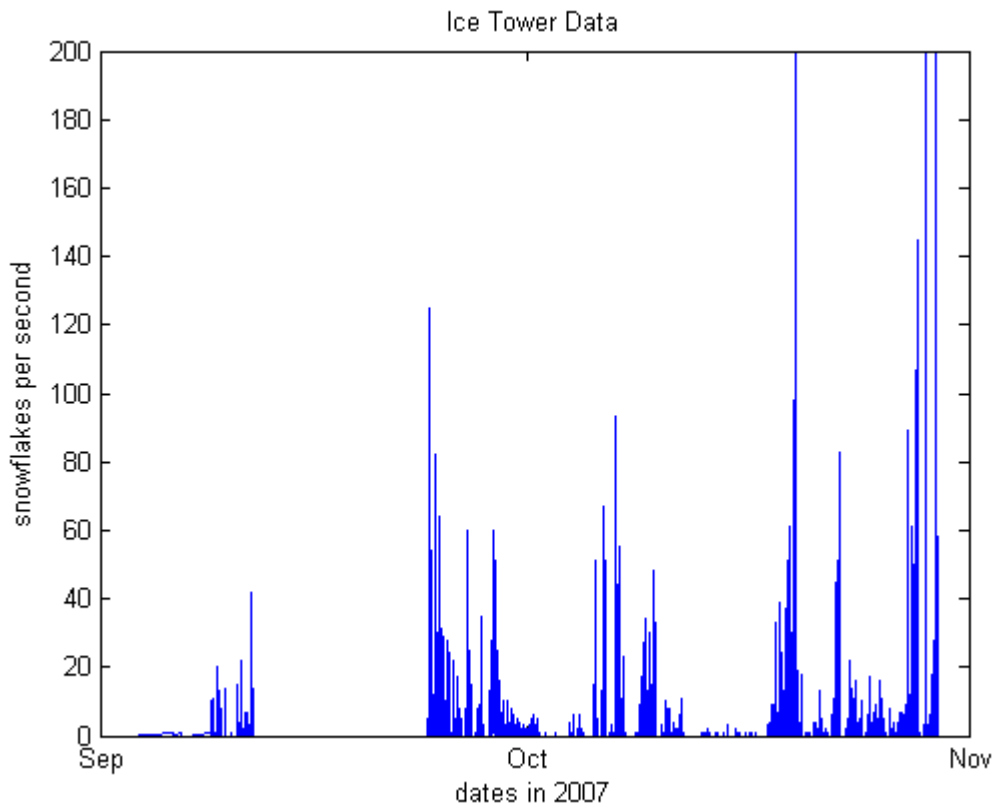


Drifting and Precipitating Snow Measurements

Katherine Leonard, Lamont-Doherty Earth Observatory

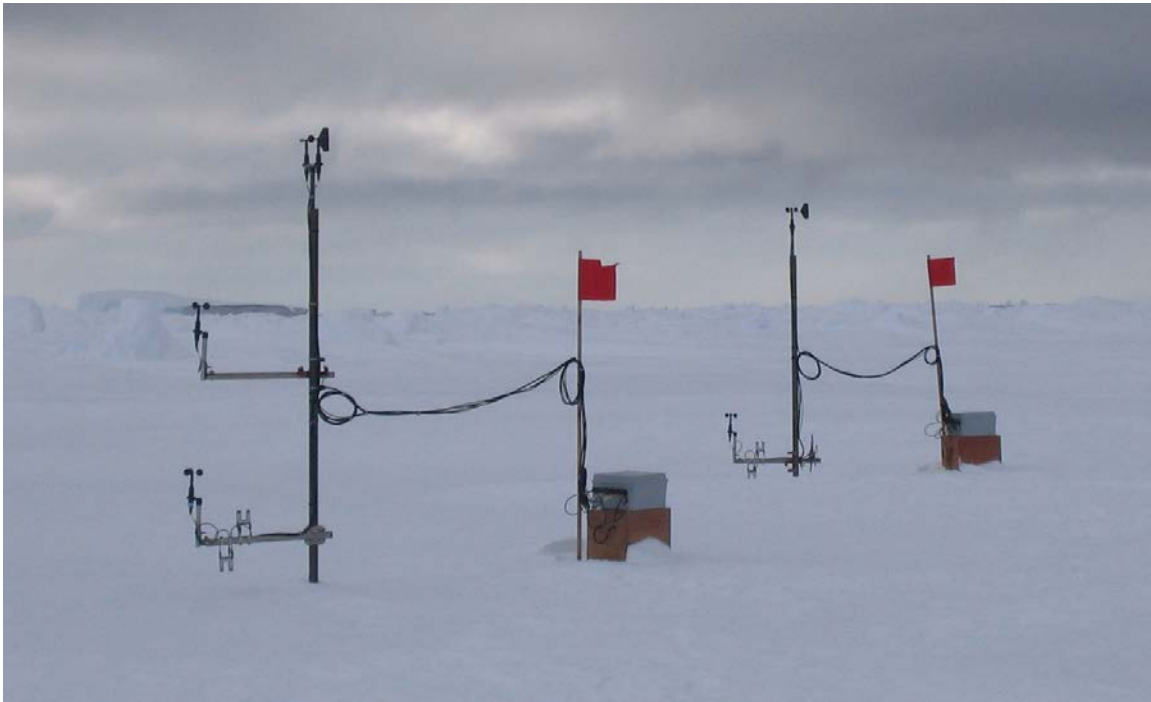
A total of 65,589,749 snow and ice particles were recorded passing through the beams of photoelectric snow particle counters during the portions of NBP07-09 that took place outside the Chilean EEZ. One “snowflake counter” (accounting for 306,186 of the total count) was mounted on the top of the N.B. Palmer’s ice tower, oriented in such a way that it could be used to detect precipitation. Eight others were spread among three masts at two locations on the ice floe during the drift station, collecting profile measurements of the number of snow particles passing through sensors at various heights, in combination with wind profile measurements.

Precipitation was frequent during the cruise, and the ship’s orientation during the drift station was such that the winds typically blew snow through the Ice Tower sensor’s beam, so it was able to record most (if not all) snowfall during that time. While the ship was underway, apparent winds oriented parallel to the direction of travel often precluded precipitation data being recorded. A notable gap in the data displayed below is the time spent in Punta Arenas in mid-September, when the ice tower system was turned off.



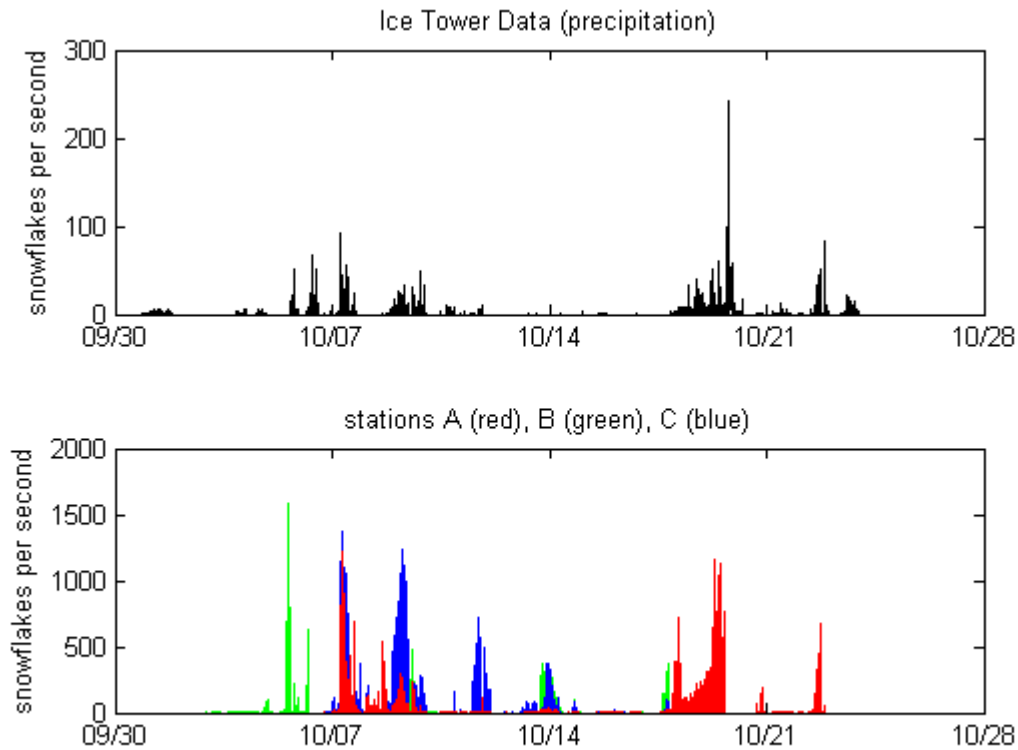
The photoelectric snow counters used for this project were Wenglor Corporation YH03NCT8 fork sensors, which produce an electrical pulse signal when their near-infrared beams (3cm long measurement area) are interrupted by objects as small as 30 microns. The ice tower measurements were logged at ten second intervals for the duration of the cruise. The data was recorded by a Campbell CR10X datalogger located inside the

ice tower, and powered by a portable 12V power supply which ran on ship's power. The recorded measurements included a one-second sample of snowflakes passing through the beam, the average number of snowflakes during the ten second interval, the maximum number of snowflakes per second and the time of that maximum, and the total number of snowflakes that passed through the beam during the ten seconds between data records. Additionally, the temperature measured by the CR10X's internal thermister was recorded every ten seconds (in this case, the inside temperature in the ice tower), as was the voltage received by the datalogger.



Two of the three stations set up on the sea ice were identical, with one of each of those stations at sites Brussels and Liege. Those stations ("B" and "A", respectively) consisted of two photoelectric sensors, three cup anemometers, and a wind vane, powered by a 12V car battery and recorded on a Campbell CR10X data logger (left-hand station in photo, above). The third station had four photoelectric sensors, mounted on two arms that were oriented perpendicular to one another, two rather than three anemometers, and was recorded onto a Campbell CR23X data logger. This third station "C" was located approximately five meters away from station A on a flat undisturbed area near site Liege.

The dimensions of the brackets and pipes used for mounting the sensors were such that the beams of the two sensors on each station were approximately 32 cm apart vertically, with the lower sensor's beam height within 10cm of the snow surface. The profile of particle number concentration during drifting or blowing snow is greatest within the lowest 10-15cm of the air column, with diminishing total numbers and particle sizes of ice particles above that height. This relationship was clearly shown at all three stations during all events with moderate to strong winds and moving snow.



Typical conditions during the ice station included precipitating or recently precipitated snow, thus most of the data recorded during that month reflect conditions that cannot be used to validate models of pure drifting snow transport. The interval around October 14th, when little to no precipitation was recorded by the Ice Tower system included a distinct drifting snow event recorded at all three stations, which does meet the criteria for model validation data. While this data was collected to address questions of spatial variability in snow drift, which can clearly be seen in the above plot as the adjacent stations A and C frequently recorded different magnitudes of drift, the addition of the precipitation record adds significantly to the usefulness of the data set. It has been proposed that the threshold wind speed for drift initiation may be lower for recently precipitated snow than for snow that's been sitting around for awhile. Other suppositions regarding the difference in roughness length for new and old snow surfaces may also be explored using the data collected during this cruise.