Summary of Darwin Glacier Region from a visit in December 2005 to download the EMS

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Condition of Environmental Monitoring Station (EMS)

The Darwin EMS had been positioned inland from Lake Wilson, just north of Diamond Hill. The location, being in a valley and just below the brow of a rise in the valley floor is not ideal for wind measurements (they will be funnelled within the valley), but will give a good idea of the general conditions of the area. All of the sensors were working correctly and, as far as we could ascertain, the memory was intact. Some wind damage was evident, in particular on of the two solar panels had been torn from its mount on the mast. The timing of this damage is unknown, but the remaining panel had clearly managed to maintain the batteries to a healthy state. The panel was not repairable. Instead, we tidied up the wiring remaining from the disconnected panel to remove possibilities of shorting, and left the unit operating from a single panel.

The datalogging unit comprises a Cambell CR10X logger, recording to a 16 Mb memory module (sufficient for >3 years of data). The sensor array comprises; two soil moisture sensors (Megan Balks; University of Waikato), three PAR sensors (Alan Green, University of Waikato), wind velocity and direction (NIWA), air temperature and humidity (NIWA), irradiance and radiance (NIWA) and three soil temperatures (NIWA).

We were able to download the first 3 months of data from the memory module as we did not have a suitable interface to download directly from the module. We were unable to maintain connection between the laptop and the logger for long enough to achieve a complete download in the limited ground time available. Future downloads should be planned to involve swapping of the memory module for a new one and downloading at a base camp.

The full set of data collected from the station has been forwarded to Antarctica New Zealand, and a brief summary is provided here.

Weather summary over 2004-05 summer period

Figures below summarise the data from the EMS.

Data from the wind speed and wind direction sensors suggest that this is a site with low wind velocity, with the majority of wind events around 3m/s, or 6knots (Figure 1). Occasional wind gusts with a sustained average speed of 15-20 knots were recorded on a number of days throughout the summer period. The wind direction was generally from one of two directions, just north of east or just south of west (Figure 2). This is most likely a reflection of the orientation of the valley where the station was situated. There were no big differences between wind velocities from the East or West. No diurnal pattern was evident for wind speed or direction.

Air temperature fluctuated around -5^{o}C for the majority of the summer period. Average air temperatures during the first half of January were -1^{o}C and began to gradually decline after this, with air temperatures in the second half of January averaging -6^{o}C and reaching an average of -14^{o}C by late February (Figure 3). Ground temperature typically showed a strong diel cycle with a 10-15 degree amplitude (Figure 4). A long period of stable soil temperatures from 7-17th January 2005 likely corresponds to lying snow. This is suggested by the coincidence with elevated radiance – in this case likely due to increased reflectance from snow – and high humidity

(Figures 5 & 6). Soil temperature was permanently above zero from Christmas to mid January, but in early and late summer freeze-thaw cycles were daily occurrences.

Average relative humidity was low (less than 50%) over the entire summer period. Relative humidity reached a low average of 36% during November, while during late December averaged 67% with several days above 80% (Figure 6). From the irradiance data it appears that for most days, when it was not snowing, it seems to have been sunny for most or all of the day (Figure 7).

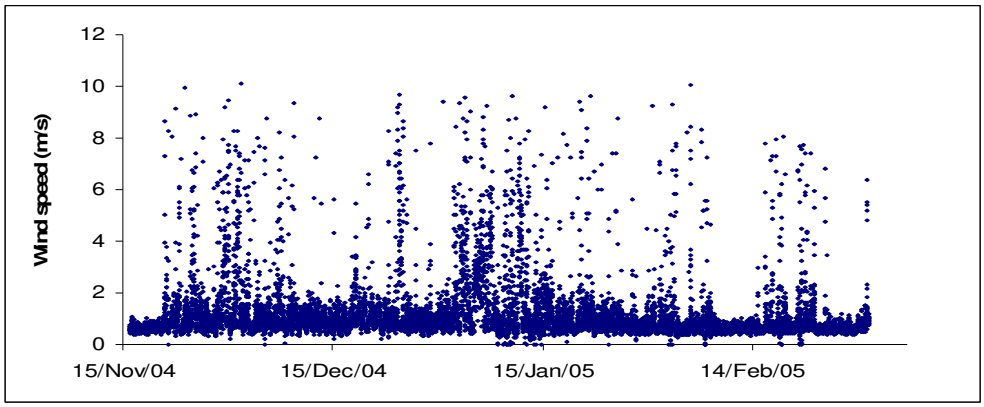

Figure 1. Wind speed (m/s) recoded at the Darwin Region during the 2004-05 summer period.

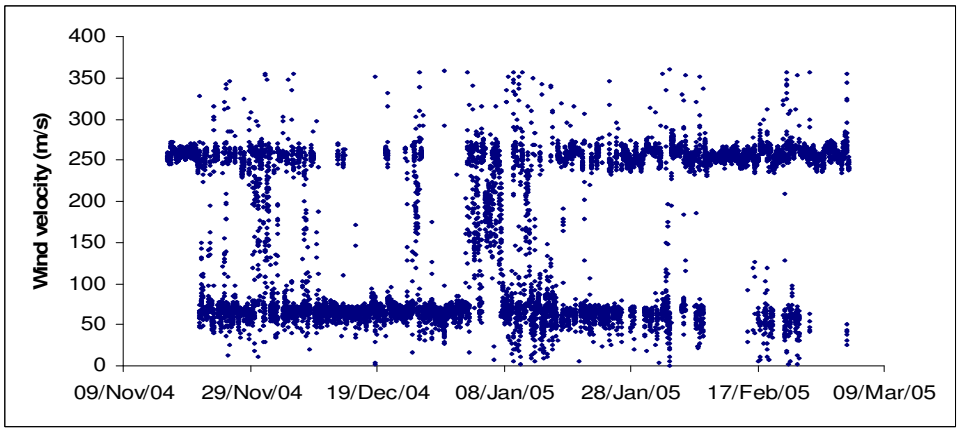

Figure 2. Wind direction as recorded during 2004-05 summer period at the Darwin region.

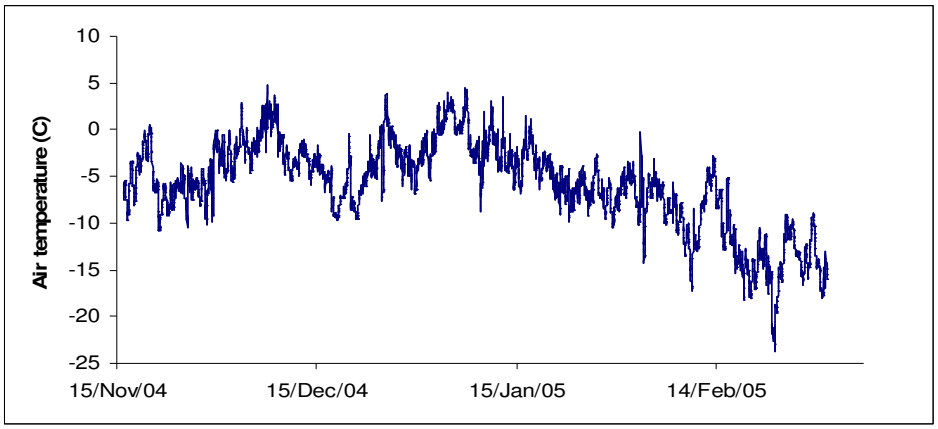

Figure 3. Air temperature recorded at the Darwin region during the 2004-05 summer period.

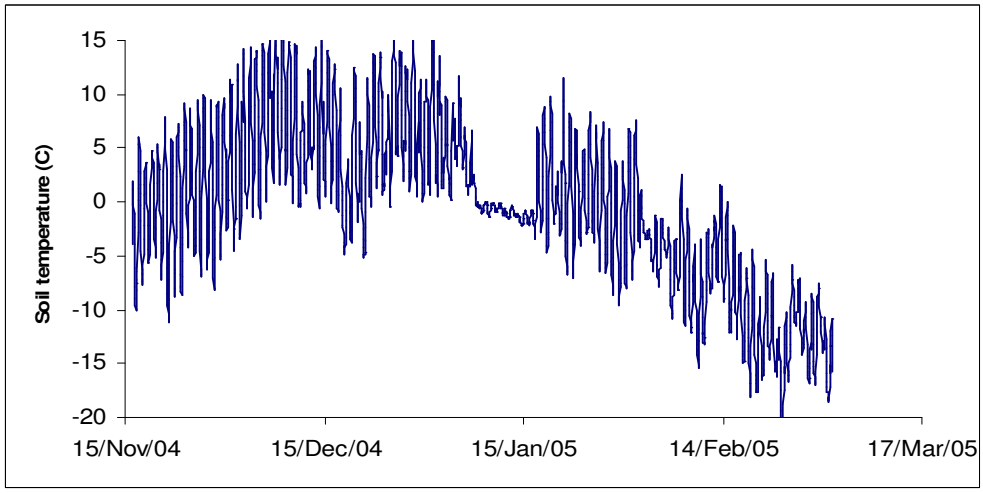

Figure 4. Soil Temperature recorded at the Darwin region during the 2004-05 summer period.

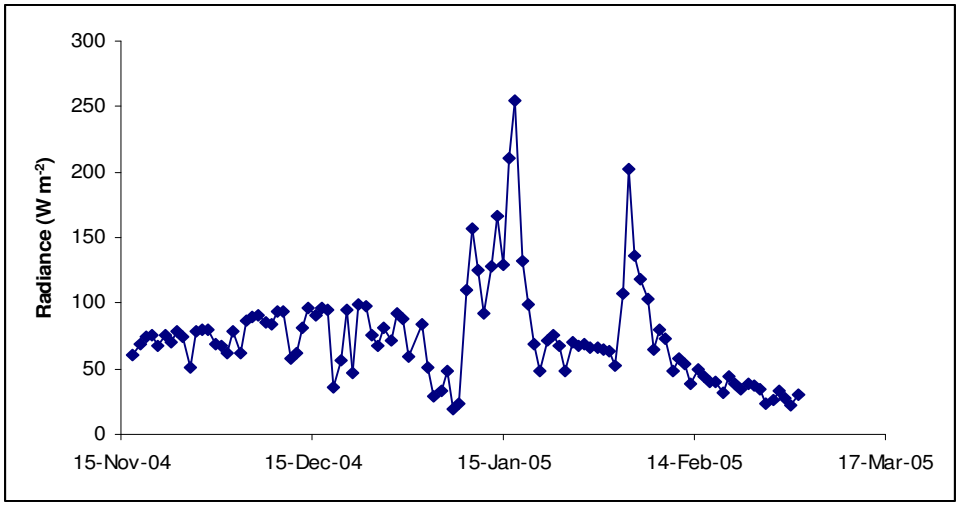

Figure 5. Mean daily radiance (outgoing radiation) recorded at the Darwin region during the 2004-05 summer period.

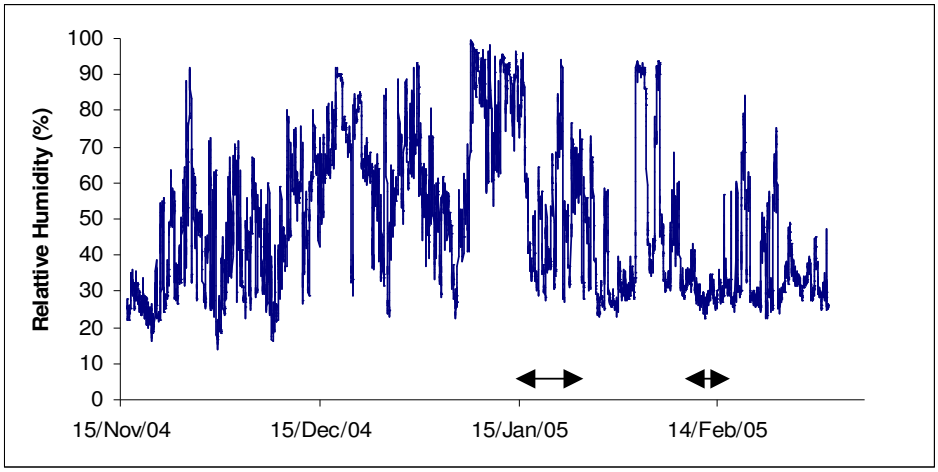

Figure 6. Relative Humidity recorded at the Darwin region during the 2004-05 summer period. Snow lay on the ground for the duration of the two arrows (sensed as high reflectance of incoming solar radiation and through soil moisture).

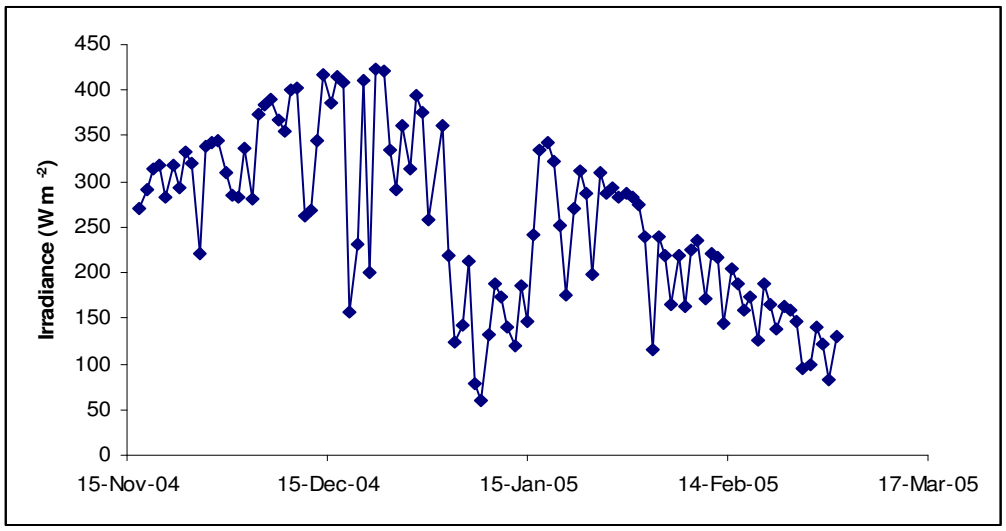

Figure 7. Mean daily Irradiance (incoming radiation) recorded at the Darwin region during the 2004-05 summer period.

Preliminary observations on freshwater systems in the Darwin Area.

Foggy Dog area

The overflight suggested that a large lake has previously existed in the Foggy Dog Valley, dammed at its southern limit by the Darwin Glacier and reaching almost to the head of the valley. This lake appears to have reduced in volume, and left a series of smaller water bodies within the historical basin (Figure 8), some of which appear likely to be connected during periods when large amounts of melt flow off of the glaciers. At the time of the visit (late December), these were all frozen, although moats were evident in all cases. Water supply to these water bodies appears to be from the adjacent glaciers, and several are in contact with glacier ice. Depth and size of these small lakes could not be assessed from the air. The Foggy Dog system also includes a

number of isolated ponds (Figure 9). The hydrology appears to be endorheic, in that there was no evidence that these ponds overflowed out of the Foggy Dog Valley, suggesting that they may be accumulators of salts, though no evidence of salt accumulation around the pond margins was seen. There may be brines in the bases of the ponds. No evidence of microbial mats on the pond edges was seen. The suitability of this system for limnological research depends on the thickness and permanence of the ice, the equipment available to penetrate this ice cover, the range of water qualities found in the area and the presence of microbial mats in parts of the lakes that can be readily sampled.

In addition to the ponds of the Foggy Dog Valley, glacier dammed lakes were noted on the side of the Darwin Glacier, where meltwater was trapped between the rocky ides of the valley and the glacier itself. These appear to form a series of cascades of lakes which fill and overflow one to the other during the summer.

Moraine Ponds

The second large system of ponds noted were those on the moraines on the ice shelf/land margin just as Lake Wilson is approached from the North (Figure 10). This system has previously been visited by K081 and is already quite well documented. It is in close proximity to what appears to be an extensive area of supra-glacial ponds on the ice of the Darwin Glacier or Ross Ice Shelf.

Supra-glacial ponds

Extensive meltwater systems were evident on the surface of the Darwin Glacier where it flattened out as it joined the Ice Shelf (Figure 10). The ponds were not directly flown over, and no further comments are possible at this stage.

Other ponds

From previous visits we know of ponds on Diamond Hill, but this area was not flown over on this trip. Many other suitable localities for the existence of ponds occur in the region, as this appears to be an ideal site to address several of the overarching hypothesis of the Latitudinal Gradient Project..

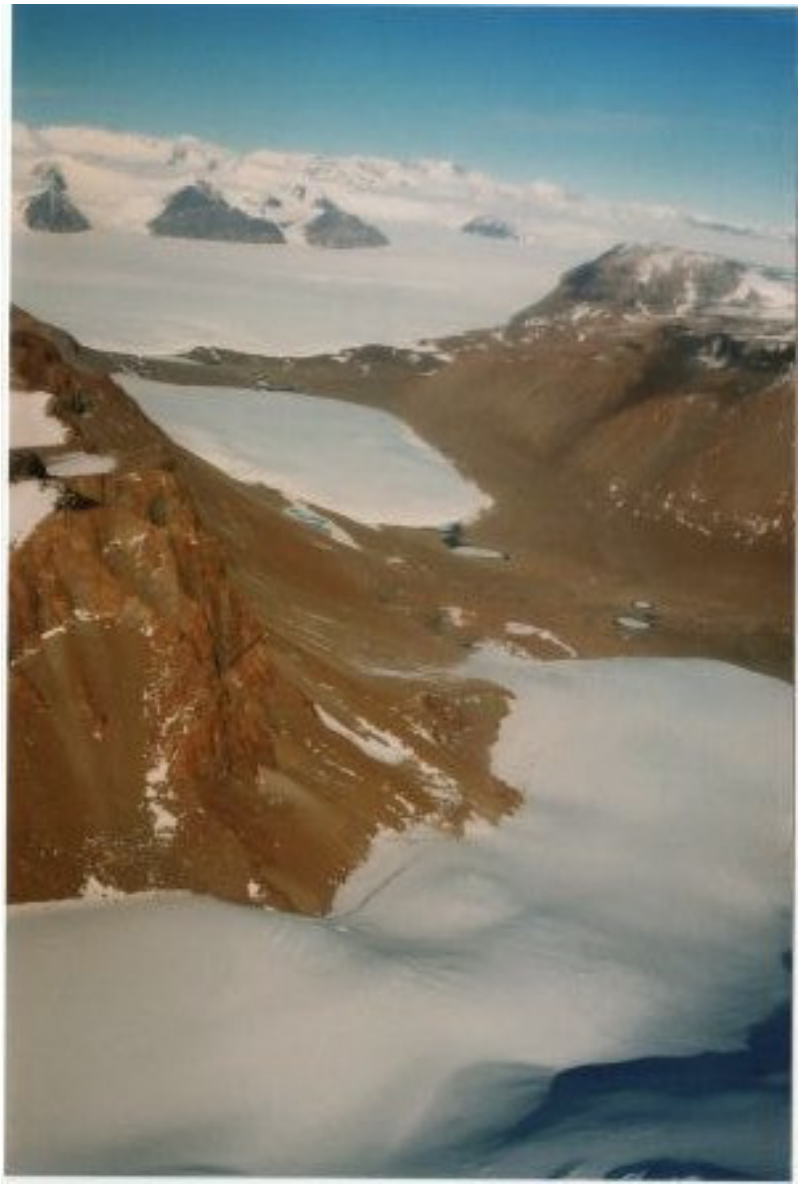

Figure 8. Looking south along the Foggy Dog Valley. Two groups of small lakes can be seen either side of the glacier front in the centre of the picture (the Foggy Dog itself), and indications of a previously high lake level can be seen on the valley walls opposite the camera.

Figure 9. The system of small lakes, which clearly have fluctuating levels, in the area between the Foggy Dog (left) and the Darwin (right) Glaciers.

Figure 10. Ponds on the moraine at the north-east corner of Lake Wilson. Supra-glacial meltwater can also be seen on Lake Wilson itself.