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Validation Experiments for Wet Deposition Estimates at 5 km x 5 km in Complex Topography

I.D. LEITH[1], D. FOWLER[1], B. REYNOLDS[2], A.J. DORE[3], T.W. CHOULARTON[3], M. MOUSAVI[3], J.A.H. LOWE[2], D. NORRIS[2] AND M. J. ROSSALL[4]

[1]*CEH Edinburgh, Bush Estate, Penicuik, Midlothian EH26 0QB, UK*
[2]*CEH Bangor, University of Wales, Deinol Road, Bangor, Gwynedd, LL57 2UP, UK*
[3]*Physics Department, UMIST, PO Box 88, Manchester, M60 1QD, UK*
[4]*CEH Merlewood, Grange-over-sands, Cumbria, LA11 6JU, UK*

Introduction

Monitoring wet deposition in remote upland areas of the UK is difficult because of accessibility and harsh terrain. These high rainfall areas of the UK however, provide some of the largest inputs of acidity and nitrogen in Europe. To validate current estimates of wet deposition at 5 km x 5 km and determine the influence of complex topography on orographic enhancement a series of field measurements were made in Snowdonia, N. Wales, an area with the largest estimated wet deposition in the UK.

Figure 1a. Rain gauge

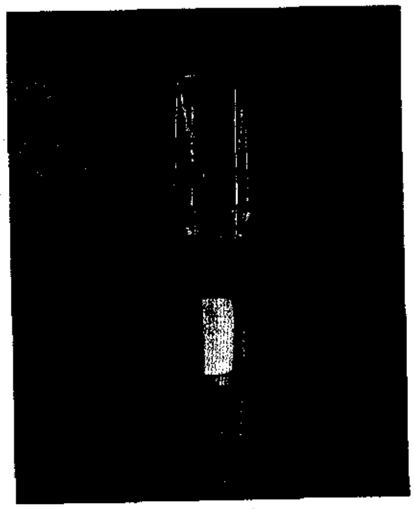

Figure1b. Cloud gauge

Methods

Field measurements of wet deposition (October 1996 and November 1998) were made along two transects using a series of rain and cloud collectors (fig.1a & b). The two transects, each 20 km long (Snowdon (NW-SE and Moel Hebog SW-NE) were along altitudinal gradients. The Llyn Llydaw sites were at a fixed altitude providing precipitation chemistry data for both transects. Prior to the start of each rain event all gauges were washed with de-ionised water. The precipitation from that rain event was then collected simultaneously from both transects. The duration of the sampling period was dependent on weather patterns. Automatic weather stations provided wind speed, wind direction, temperature and precipitation rate and amount.

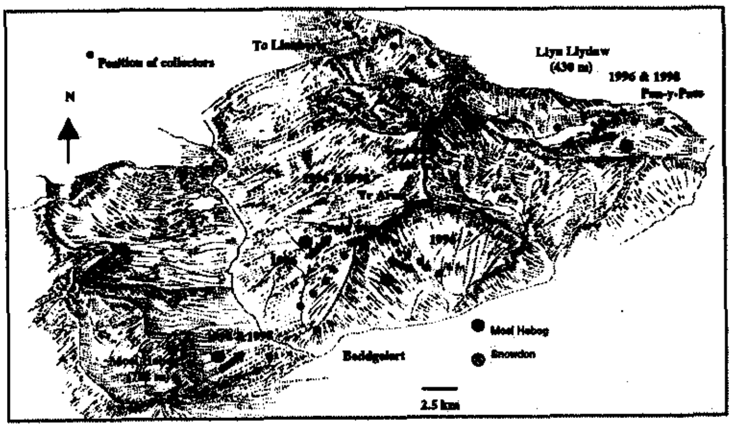

Figure 2. Schematic diagram of the two transects

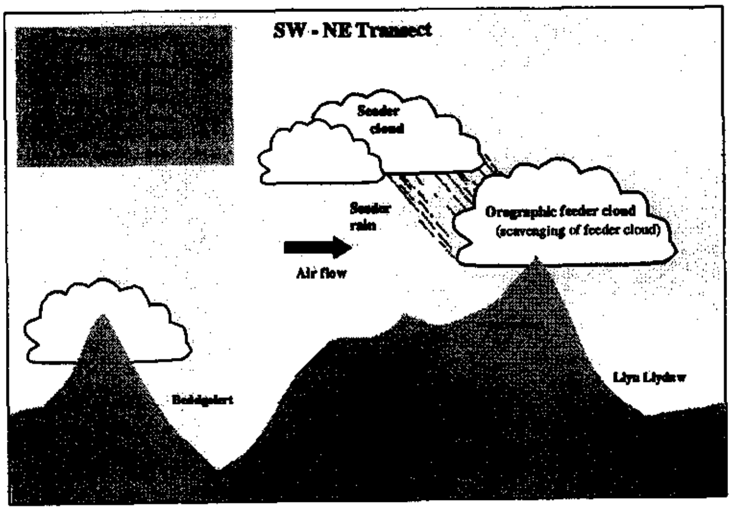

Figure 3. Orographic enhancement of mean SO_4^{2-} concentrations

Results and Conclusions

The concentration of ions in rainfall at hill summits were approximately twice that of low altitude sites (Table 1). The mean concentration of ions within hill cloud scavenged by falling rain were larger than those in low level rain by a factor of 1.4 to 2.5 depending on ion. In complex topography, figure 4 shows that the second and third hills to receive less orographic enhancement than the first hill.

NH_4^+	NO_3^-	SO_4^{2-}	Cl^-
x 2.1	x 1.8	x 1.5	x 1.6

Table 1: Mean orographic enhancement in rainfall concentrations (2 transects, 1998)

NH_4^+	NO_3^-	SO_4^{2-}	Cl^-
1.8	2.5	1.4	1.9

Table 2: The mean ratio of scavenged hill cloud 1996 and 1998

Figure 4

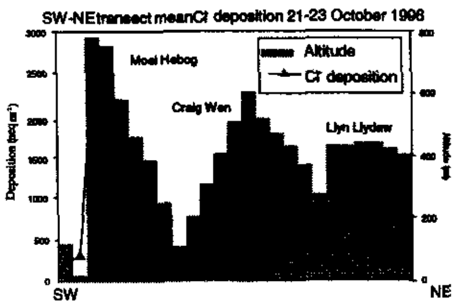

Figure 5 shows the measured orographic enhancement in NO3- deposition to be broadly similar to the model output for Snowdon using annual rainfall data.

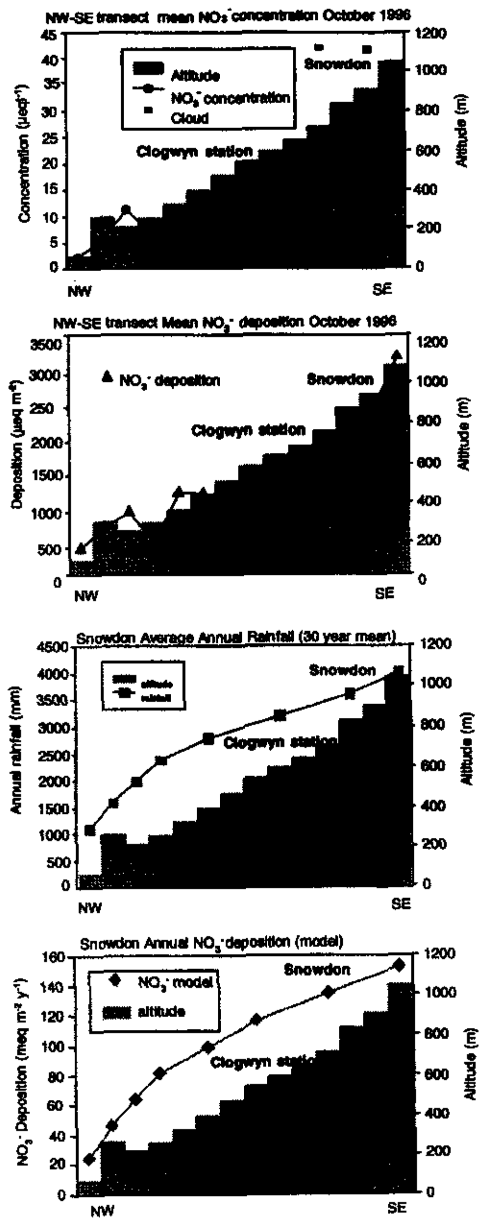

Figure 6 shows annual wet deposition of SO42-- S (kg ha-1) modelled at 1 km x1 km resolution for the 20 km x 20 km grid square centred on Snowdon.

SO_4^{2-} Deposition (kg S ha^{-1})

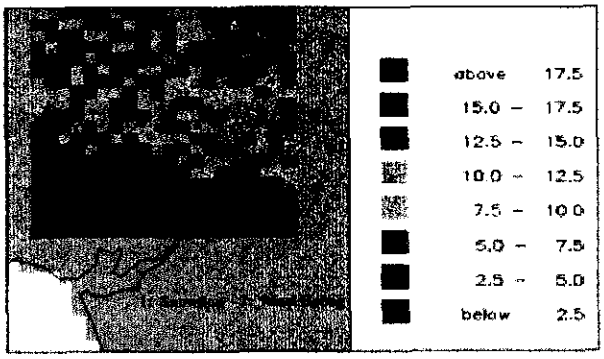

Figure 6

Acknowledgements

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