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Concentration-dependent deposition velocities for ammonia – from lab to field.

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Estimates of the dry deposition of ammonia (NH_3) gas in a field fumigation experiment on an ombrotrophic bog have been made by the inferential technique, using measured wind speed at 2 m, and air concentrations at two heights above the vegetation. The parameters for a concentration-dependent surface resistance term were derived from flux measurements over the same vegetation in a chamber study, separating stomatal from non-stomatal resistances (Jones et al., Atmos Environ, 41, 2049-1061, 2007). Application of these values to the field experiment led to estimates of NH_3-N deposition from 3 kg N $ha^{-1}y^{-1}$ in ambient air, with an NH_3 concentration at 0.5 m above the canopy of 0.7 μg m^{-3}, to 70 kg N $ha^{-1}y^{-1}$ where annual average air concentrations were 100 μg m^{-3} and concentrations during fumigation were up to 1600 μg m^{-3}. The equivalent deposition velocities (at z=0.5 m) were 0.016 m s^{-1} in ambient air and 0.003 m s^{-1}at100 μg m^{-3}. The differences between annual deposition estimates made from independent air concentration data at 0.1 m and 0.5 m above the canopy were small for distances more than 10 m from the source, after vertical mixing was complete. Over 4 years (2003 to 2006) and at 8 sampling points more than 10 m from the NH_3 source, the mean difference between the dry deposition estimates, using NH_3 concentrations measured at 0.1 m and 0.5 m above the canopy, was 2%. Use of a constant surface resistance, with no concentration dependence, as commonly used in inferential models of dry deposition, would have predicted deposition up to 8 times too large for this experimental examination of the direct effects of NH_3 on bog vegetation.