Global modelling of pre-industrial aerosol nucleation

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New particle formation (NPF) in the atmosphere accounts for around half of global cloud condensation nuclei (CCN) [1]. To date, most treatments of NPF in global aerosol models have considered only sulphuric acid or sulphuric acid with ammonia, amines or organic molecules [2]. However, in the pre-industrial atmosphere, sulphuric acid and ammonia were much less abundant. Unerstanding pre-industrial nucleation is important in order to quantify the baseline aerosol concentration that must, in effect, be subtracted in a calculation of aerosol radiative forcing [3].

The CLOUD experiment at CERN has determined a mechanism for ion-induced particle formation purely from the oxidation products of biogenic monoterpenes without sulphuric acid [4]. Global modelling using this mechanism indicates that organic vapours may easily be more important for particle formation than sulphuric acid in the pre-industrial boundary layer over land. For the first time, this biogenic nucleation can be combined with previous CLOUD results on nucleation involving sulphuric acid with either ammonia or organic molecules to represent pre-industrial particle formation to the best of our current knowledge.

This presentation will summarise the atmospheric implications of the new CLOUD mechanism. We will show first estimates of the fraction of CCN formation from nucleation [1] in the pre-industrial atmosphere from the GLOMAP aerosol model [5]. The pre-industrial atmosphere was likely to be more sensitive to small perturbations than the present-day atmosphere [3]. We therefore explored the effect of variations in ion concentration due to the solar cycle on *pre-industrial* CCN formation via organic and inorganic ion-induced nucleation, and we will present the first results.

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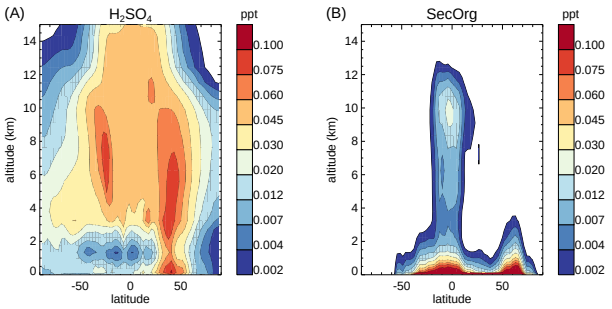

Figure 1: Annual mean mixing ratios of sulphuric acid (A) and condensable secondary organic vapours 'SecOrg' formed from biogenic monoterpenes (B) in the GLOMAP aerosol model for the year 2008. Most new particles are formed below 2km altitude.

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