**ATS/CIRA Colloquium**

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**Visiting ATS from the Desert Research Institute, Storm Peak Laboratory, Steamboat Springs**

# Chemical, Biological, and Hygroscopic Properties of Aerosol Organics at Storm Peak

**Hosted by Christina McCluskey**

**Thursday, May 9, 2013**

**ATS room 101; Discussion will begin at 3:30pm**
**Refreshments will be served at 3:00pm in the weather lab**

Aerosols affect the Earth's radiation balance directly by scattering sunlight and indirectly through their role as cloud condensation nuclei (CCN). These effects are enhanced for hygroscopic aerosols, which absorb water as a function of relative humidity, grow in size, scatter more light, and serve as cloud condensation nuclei. Absorption of water vapor by aerosols to produce haze and cloud droplets depends on their dry size and chemical composition. Large-scale climate models initially treated CCN as though the only soluble material they contained was sulfate. However, organic material can be a significant fraction of aerosol mass at urban and remote locations. There is considerable evidence that organic compounds impact aerosol hygroscopic growth and CCN activity.

A combined field and laboratory study was conducted to improve our understanding of the chemical and hygroscopic properties of organic compounds in aerosols sampled in the background continental atmosphere. $PM_{2.5}$ (particles with aerodynamic diameters smaller than 2.5 μm) aerosols were collected from 24 June to 28 July, 2010 at Storm Peak Laboratory in the Park Range of northwestern Colorado. New particle formation was frequent at Storm Peak Laboratory during this campaign, and the samples were not influenced by regional dust storms. Filter samples were analyzed for organic carbon (OC) and elemental carbon (EC), water soluble OC (WSOC), major inorganic ions, and detailed organic speciation. WSOC was isolated from inorganic ions using solid phase absorbents. Hygroscopic growth factors and cloud condensation nucleus (CCN) activity of the WSOC were measured in the laboratory. Organic compounds comprised the majority of the mass of measured species and WSOC accounted for an average of 89% of OC mass. Daily samples were composited according to back-trajectories. On average, organic acids, sugars, and sugar alcohols accounted for a significant fraction of the WSOC. Based on the composition of these compounds and that of high molecular weight compounds identified using ultra high-resolution mass spectrometry, the organic mass to organic carbon ratio of the WSOC was estimated. The hygroscopicity parameter (κ) derived from CCN measurements and the hygroscopic growth factors measured with HTDMA on the isolated WSOC will be presented. The growth factor results compare favorably with estimates from a thermodynamic model which explicitly included organic compound characteristics determined in the chemical analysis.

On-going work is endeavoring to quantify the presence of biological aerosols found on the filter samples. The presence of arabitol, mannitol and oxalic acids may be associated with airborne fungal spores/conidia which were observed directly on the filters using high resolution electron microscopy. Additionally, relatively high concentrations of sugars (glucose, sucrose, fructose, etc.) as compared with levoglucosan indicates that biological species such as fungi, bacteria, pollen, etc. contributed significantly to the WSOC fraction during this study.

Link to colloquium videos and announcement page: http://www.atmos.colostate.edu/dept/colloquia.php