6.009 Design of a novel aircraft open-path cavity ringdown spectrometer.

Early Career Scientist

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Abstract:

Aerosols and their effect on the radiative properties of clouds contribute one of the largest sources of uncertainty to the Earth's energy budget. Many current global assessments, of atmospheric aerosol radiative forcing rely heavily on remote sensing observation; therefore, *in situ* aircraft and ground-based measurements are essential for validation of remote sensing measurements. Cavity ringdown spectrometers (CRD) measure aerosol extinction and are commonly used to validate remote sensing

observations. These instruments have been deployed on aircraft based platforms over the years thus providing the opportunity to measure these properties over large areas in various conditions. However, deployment of the CRD on an aircraft platform has drawbacks. Typically, aircraft based CRDs draw sampled aerosol into a cabin based instrument through long lengths of tubing. This limits the ability of the instrument to measure:

1) Course mode aerosols (e.g. dust)
2) Aerosols at high relative humidity (above 90%)

Here we describe the design of a novel aircraft based open path CRD. The open path CRD is intended to be mounted external to the cabin and has no sample tubing for aerosol delivery, thus measuring optical properties of all aerosol at the ambient conditions. However, the design of an open path CRD for operation on a wing-mounted aircraft platform has certain design complexities. The instrument's special design features include 2 CRD channels, 2 airfoils around the open Path CRD and a configuration which could be easily aligned and rigid at the same time. This novel implementation of cavity ringdown spectroscopy will provide a better assessment of the accuracy of remote sensing satellite measurements