6.037 Deployment of both dense networks and small numbers of low-cost and minimal infrastructure air quality sensors. A study in variable sensing scales..

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Abstract:

A major component of targeted air quality and associated measurement studies (e.g. for urban or industrial source apportionment, biomass burning plume extents or sea-breeze recirculation) is the better characterisation of horizontal scales of variability and relating these outputs to model and/or satellite products. There is particular interest in understanding how high spatio-temporal density in-situ data from emerging network systems can be reconciled with sub-satellite or model pixel scales (especially in high gradient areas and at pixel edges).
Data collected from high-density sensor networks during the NASA DISCOVER-AQ (Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality) campaign-based study are presented here alongside data from a dual sensor deployment in Malaysian Borneo with the aim of comparing site specific methodologies and outcomes.
As part of DISCOVER-AQ, autonomous, low-cost, high-density networks of air quality sensors were deployed. The 2 main deployments were 10 sensors for 3 months in Houston and 15 sensors for 5 weeks in Denver/Boulder (CO, NO, NO_2, SO_2, O_3, temperature and %RH at I minute resolution). These networks were designed to capture horizontal variability at very high spatial and temporal resolution. Vertical distribution at one site was also investigated in Colorado with sensors deployed on the 300m Atmospheric Observatory tower facility.

As part of an ongoing University Malaya study on low cost sensing technologies in logistically difficult environments, 2 sensors have been deployed for approximately 6 months at the Danum Valley research centre in Malaysian Borneo (relatively undisturbed dipterocarp forest). The sensors are located on the 75m station tower looking at potential trans-canopy concentration gradients (CO, NO, NO_2, SO_2, O_3, temperature and %RH at I minute resolution).

This work describes initial outcomes and selected data from these deployments and outlines ongoing studies (including current instrumental limitations) based on data collected.