BACTERIAL PHENOTYPES: IMPLICATIONS FOR CLOUD CONDENSATION. Natasha DeLeon-Rodriguez[1], Arnaldo Negron[1], Nimmy Matthew[2], Aikaterini Bougiatoioti[1,3], Samantha M. Waters[1], Athanasios Nenes[1], and Kostas Konstantinidis[1], [1] Georgia Institute of Technology, Atlanta, Ga., USA, [2]Carnegie Mellon University, Pittsburg, Pa., USA, [3]National Technical University, Athens, Greece.

Introduction: Microorganisms are sampled from diverse and often extreme environments, including the atmosphere. For decades, it has been known that bacteria and fungi reach high altitudes where their various morphologies, phenotypes, and genotypes may allow them to participate in weather events. In support of the latter, a subset of these organisms have been shown to cause ice formation at higher-temperature ranges (-2°C to -15°C), i.e. heterogenous ice nucleation, compared to non-biological particles of comparable sizes [1].

In addition to being ice nucleation active (INA^+), microorganisms have been implicated as cloud condensation nuclei (CCN). Their role in cloud formation is supported by numerous studies recovering microorganisms from cloud and rain [2], as well as, a few laboratory studies on CCN-capable microorgansisms [3].

It is possible that in the case of some cells, cloud condensation and ice nucleation may be coupled. Before a cell may cause ice nucleation, the cell must be sheathed or submerged in a droplet; one such mechanism for this to occur is through vapor adsorption onto aerosolized cells. However, little is known of what makes different organisms good cloud condensation nuclei compared to good ice nuclei. Here, we report on methods investigating bacterial phenotypes, of various air and rain laboratory isolates, which may relate to CCN activity.

Experimental Setup: This work investigates how hydrophobicity of bacteria may contribute to CCN activity, i.e. a more hydrophilic cell surface would coalesce water vapor better than a more hydrophobic cell surface. For the purpose of determining hydrophobicity of cells, contact angle measurements were performed by standard methods [4]; bacteria were grown overnight, washed, filtered uniformly, and the resulting cell lawn was analyzed for contact angle of a water droplet.

After contact angle was determined, bacteria were put through a CCN counter. Briefly, bacteria are aerosolized then encounter two, in-line dryers, cells are size selected through an electric field (DMA), and then pass to the CCN counter, which counts cloud condensation particles at different supersaturations. SEM images taken of cells at various points in the set-up confirm their passage through our system.

Preliminary Results: Our results indicate that more hydrophilic cells (as determined by contact angle measurements) condense water vapor on their exterior at a lower critical supersaturation level than hydrophobic cells, ~0.1% and ~0.2%, respectively . This has larger implications for cloud formation on a global scale; in regions with lower supersaturation, hydrophilic cells may scavenge water vapor at a higher rate than hydrophobic microorganisms.

References: [1] Maki L. R. et al. (1974) *Appl. Microbiol., 28,* 456-459. [2] Vaitilingom M. et al. (2012) *Atmos. Environ., 56,* 88-100. [3] Bauer H. et al. (2003) *J. Geophys. Res., 108,* 4658-4663. [4] Busscher H. J. et al. (1984) *Appl. Environ. Microbiol., 48,* 980-983.