Title: Observations and Modeling of the Green Ocean Amazon (GoAmazon2014/5)
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The strong hydrologic cycle of the Amazon Basin is one of the primary heat engines of the Southern Hemisphere. Any accurate climate model must succeed in a good description of the Basin, both in its natural state and in states perturbed by regional and global human activities. At the present time, however, tropical deep convection in a natural state is poorly understood and modeled, with insufficient observational data sets for model constraint. An ARM planning document conferred a priority status to studies of deep tropical convection over land in the Amazon Basin [ACRF, 2007]. Furthermore, future climate scenarios resulting from human activities globally show the possible drying and the eventual possible conversion of rain forest to savanna in response to global climate change. Based on our current state of knowledge, the governing conditions of this catastrophic change are not defined. Human activities locally, including the economic development activities that are growing the population and the industry within the Basin, also have the potential to shift regional climate, most immediately by an increment in aerosol number and mass concentrations, and the shift is across the range of values to which cloud properties are most sensitive (e.g., natural conditions of 300 particles cm^{-3} still prevail in much of the Amazon Basin during the pristine wet season and cloud properties are most sensitive to shifts from 300 to 1000 cm^{-3}).

The present proposal expands GoAmazon2014, approved in October 2010, into a GoAmazon campaign, consisting of GoAmazon2014 and GoAmazon2015 (this present proposal). The GoAmazon campaign seeks to quantify and understand how aerosol and cloud life cycles in a particularly clean background in the tropics are influenced by pollutant outflow from a large tropical city. The GoAmazon project addresses the susceptibility of cloud-aerosol-precipitation interactions to present-day and future pollution in the tropics. In particular, the proposed second year of measurements as part of GoAmazon2015 will enable comparative year-to-year variability in the measurements and will be an important step forward in knowledge about interannual differences in the Amazon Basin and their effects of atmospheric and ecosystem functioning.

The interannual differences in the Amazon Basin are already known to be very significant. For instance, both 2005 and 2010 were very dry years. Year 2009 was exceptionally wet. Owing to dramatic changes from year-to-year, we can state that to a high likelihood that the observations of GoAmazon2014 and GoAmazon2015 will be quite different in rainfall totals and associated impact in atmospheric composition, in particular for atmospheric cleansing downwind of the Manaus plume. Differences in rainfall initiate sequences of key differences in atmospheric and ecosystem functioning. The purpose of GoAmazon2015 is to increase the statistical population of cases and subcases, identifying those findings specific to one year or the other compared to those findings common to both years, thus validating the general representation in models of the effects of pollution on the natural atmosphere and ecosystem. The strategy to meet this objective is to employ a comparative analysis to a consecutive year's data set. In the context of interannual variability, comparative differences and similarities between years 2014 and 2015 will both quantitatively define the representativeness of many of the observations and place years 2014 and 2015 within the context of longer historical and future time records.

The proposed study is aligned with the ARM vision of obtaining a detailed, representative, and accurate description of Earth's atmosphere in diverse climate regimes through the deployment of strategically located in situ and remote sensing observatories. In particular, the proposed study will improve the understanding and representation in climate and Earth system models of clouds and aerosols as well as their interactions and coupling with the Earth’s surface.