Background*:* The frequency and intensity of extreme weather events (e.g. droughts/floods/heat waves) are predicted to increase in the coming decades as a consequence of increased carbon dioxide, causing major consequences for cities, people and natural ecosystems [3]. General Circulation Models (GCMs) and Land Surface Models (LSMs) are used to forecast climate variability and land surface coupled response, however, many of the models' key components, which relate to land and atmospheric interactions, (e.g. processes contributing to the carbon cycle and controls on the hydrologic cycle) are still not well characterized [4][5][7]. For instance, in Central Amazonia the models fail to represent the correct seasonal cycle of evapotranspiration (ET) and Gross Primary Production (GPP) and typically display peaks in the wet season contrary to observations made in the field (Fig.1a)[2]. Similarly the seasonal cycle of phenology in wet tropical forests tends to be exaggerated by models and in reality is much less apparent (Fig.1b)[2][6]. It is crucial to understand if tropical forests will remain CO_2 sinks in the future, and the model biases have major implications for our ability to make forecasts in these regions. Based on these deficiencies, the following aims were identified for this study.

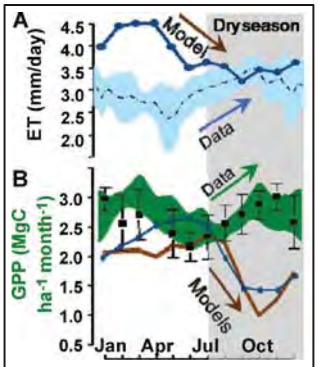

Figure 1 Differences between IBIS LSM (brown), NCAR GCM and Community Land Model (blue) and eddy covariance observations made in the Tapajos National Forest of ET (A) and GPP (B) [2]

Aim 1 ***Analysis of Remote Sensing Datasets:*** Through remote sensing products we were able to estimate net radiation, precipitation, photosynthesis, phenology, cloud coverage, temperature, ET, soil moisture, vegetation water content (from microwave imagery), and groundwater. These are in turn used to understand the interrelationships between these components such as the energy vs. water control of photosynthesis.

Aim 2 ***Comparing findings from Aim 1 with GCM data:*** I will compare my remote sensing analysis with outputs from GCMs (CMIP5) and uncoupled LSMs to determine regions of strong biases and their causes (e.g. overestimation of water and radiation stresses). This will be critical in tropical forests due to their major role as CO_2 sinks. In the wet tropics, the seasonality of GPP and ET is typically shifted (Fig. 1), leading to an inaccurate forecast of net primary productivity (NPP) and water flux sources and sinks.

Contribution to GOAmazon: In my research I am using remote sensing analysis to better understand plant physiological response and processes and how they affect the carbon and hydrologic cycles. Additionally, in summer 2015 I will be part of a field campaign to several of the GOAmazon field sites with collaborators Joseph Berry (Carnegie Institution), Jung-Eun Lee (Brown), Ben Lintner (Rutgers), Laura Borma (INPE), Rafael Oliviera (University of Campinas) and Tomas Domingues (University of Sao Paulo) to perform *in situ* measurements (vegetation water stress, flux measurements and radiosondes) to gather information on plant physiological water stress, fluorescence and to validate the remote sensing data.

References:

[1] Gatti, L.V., et al. (2014), Drought sensitivity of Amazonian carbon balance revealed by atmospheric measurements. *Nature.*

[2] Gonçalves, L., et al. "Overview of the Large-Scale Biosphere–Atmosphere Experiment in Amazonia Data Model Intercomparison Project (LBA-DMIP)" (2013). NASA Publications. Paper 133. http://digitalcommons.unl.edu/nasapub/133

[3] IPCC, 2013: Climate Change 2013: *The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker, T.F., et al. (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp, doi:10.1017/CBO9781107415324.

[4] McDowell, N. et al. (2008), Mechanisms of plant survival and mortality during drought: why do some plants survive while others succumb to drought? *New Phytologist*, *178*(4), 719–739, doi:10.1111/j.1469-8137.2008.02436.x.

[5] McDowell, N. G., and S. Sevanto (2010), The mechanisms of carbon starvation: how, when, or does it even occur at all? *New Phytologist*, *186*(2), 264–266.

[6] Saleska, S., et al. (2007), Amazon Forests Green-Up During 2005 Drought. *Science* 318(5850):612.

[7] Sevanto, S., et al. (2013), How do trees die? A test of the hydraulic failure and carbon starvation hypotheses, *Plant Cell Environ*, doi:10.1111/pce.12141