Oral Presentation
Theme 3.1: Biogeochemical Processes - Processes Understanding and Human Impacts
Keywords: atmosphere

Invited Keynote: Inter-annual variation of Amazon greenhouse balances 2010-2014: nature and causes

Gatti, Luciana Vanni* (1,2); Gloor, Manuel (3); Miller, John B. (4); Domingues, Lucas G. (1,2); Silva, Marcelo G. (1,2); Aragao, Luiz E. O. C. (1); Marani, Luciano (1); Correia, Caio C. S. (1,2); Peters, Wouter (5,6); Borges, Viviane F. (1,2); Ipia, Alber H. S. (1); Basso, Luana S. (2,3); Anderson, Liana O. (7); Alden, Caroline B. (8); van der Laan-Luijkx, Ingrid (9); Barichivich, Jonathan (10); Santos, Ricardo S. (1,2); Crispim, Stéphane P. (1,2); Costa, Wellisson R. (1,2); Rosan, Thais M. (1)
1: INPE - National Institute For Space Research, Brazil; 2: National Institute of Nuclear and Energy Research - IPEN, Brazil; 3: University of Leeds, UK; 4: National Oceanic and Atmospheric Organization - NOAA, USA; 5: Dept. of Meteorology and Air Quality Environmental Sciences Group Wageningen University, The Netherlands; 6: Centre for Isotope Research Energy and Sustainability Research Institute Groningen Groningen University, The Netherlands; 7: National Centre for Monitoring and Warning of Natural Disasters - CEMADEN, Brazil; 8: CIRES / University of Colorado Boulder, USA; 9: Utrecht University, IMAU, the Netherlands; 10: Instituto de Conservación, Biodiversidad y Territorio, Universidad Austral de Chile, Chile

Net carbon exchange between tropical land and the atmosphere is potentially important because the vast amounts of carbon in forests and soils can be released on short time-scales e.g. via deforestation or changes in temperature and moisture. Such changes may thus cause feedbacks on global climate, as have been predicted in earth system models. In the tropics, the Amazon is most significant in the global carbon cycle, hosting by far the largest carbon vegetation and soil carbon pools (~200 PgC). Because of the very large precipitation amounts, approximately 20-25% of its area is seasonally flooded and thus it is also an important region for methane emissions. From 2010 onwards we have extended an earlier greenhouse gas measurement program to include regular vertical profiles of CO_2, CH_4, N_2O, CO, SF_6, from the ground up to 4.5 km height at four sites along the main air-stream over the Amazon Basin. Our measurements demonstrate that surface flux signals are primarily concentrated to the lower 2 km and thus vertical profile measurements are ideally suited to estimate greenhouse gas balances. Clearly a higher measurement density is desirable. We are in the process of expanding the number of surface and airborne sampling sites as well as the number of trace gases measured. Nonetheless, because of the homogeneity of the vegetation (forests) and the coherent east to west trade-winds over the Basin, these data already permit a range of insights about the magnitude, seasonality, inter-annual variation of carbon fluxes and their controls. Most recent years have been anomalously hot with the southern part of the Basin having warmed the most. Precipitation regimes also seem to have shifted with an increase in extreme floods. Approximately 20 percent of Amazon forests have been deforested by now and development pressure on forests continues. For the specific period we will discuss the year 2010 was anomalously dry, followed by 4 years wet (2011, 2012, 2013 and 2014) and another dry year (2015/16 -El Nino year). This period provides an interesting contrast of climatic conditions in a warming world with increasing human pressures. We will analyze the effect of this climate variability on annual and seasonal carbon balances for these five years using our atmospheric data. We will estimate fluxes using a simple, but powerful back-trajectory based atmospheric mass balance approach. Our data permit us not only to estimate net CO_2 and CH_4 fluxes, but using carbon monoxide we estimate carbon release via fires and thus the net carbon balance of the unburned land vegetation. We will relate fire emissions to controls of land vegetation functioning and independent diagnostics like fire counts. We will also discuss what our results suggest for the role of the tropics of the global carbon balance.

Session:
Theme 3 (part 1): Biogeochemical Processes
Tue, 22 August 2017: 14:00 - 15:30