The 18th WMO/IAEA Meeting on Carbon Dioxide, Other Greenhouse Gases, and Related Measurement Techniques (GGMT) 13 – 17 September 2015, La Jolla, California, USA

Quantifying the Net Exchange Ecosystem for different land use in Pampa Biome in southern Brazil

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INTRODUCTION

The Pampa is the newest and most unknown Brazilian Biome. In recent decades it has gone through a process of intense land use change and degradation, with the replacement of natural vegetation by rice paddy crops, soybean and exotic forests. Recent studies show that the Pampa has only 36% of its original vegetation in Brazil. Research on carbon and greenhouse gas emissions in Pampa Biome are recent. It is known that the Pampa natural areas contain high stocks of soil organic carbon, and therefore their conservation is relevant for climate change mitigation. In this work we examine the effects of climate on carbon fluxes since 2013, using a flux tower network, SULFLUX. comprises three flux towers in the Pampa biome, two of them being over natural vegetation and the other one over a rice paddy. The flux tower are nearly 100 km apart from each other.

METHODOLOGY

Pampa Biome is located in the Southern Brazil portion, as well as part of Argentina and the entire Uruguay, and is formed principally by natural grasslands that have been used for centuries for grazing livestock.

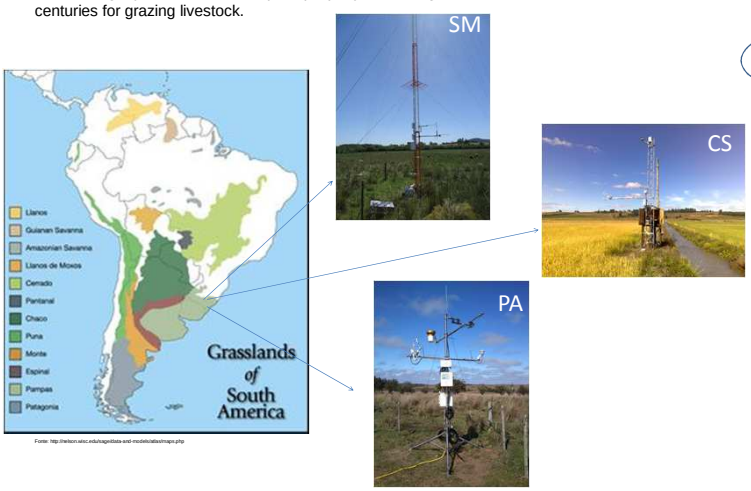

Figure 1 – Location of the flux towers in the PAMPA BIOME in Southern Brazil: (a) CS - Cachoeira do Sul -Rice Paddy ; (b) PA - Pedras Altas - cattle pasture without paddocks; (c) SM- Santa Maria- cattle pasture in paddocks

Table 2: Sulflux network : sites description

Site	CS	PA	SM
City-state (Brazil)	Cachoeira do Sul - RS	Pedras Altas - RS	Santa Maria - RS
Altitude (m)	40,5	375	88
Vegetation	Rice Paddy	Natural vegetation	Natural vegetation
Soil type	clayey red dystrophic	clayey Red - Yellow dystrophic	clayey red dystrophic
Soil texture	Average to clay	Average	clay
Precipitation [mm]	2000	1350	1617
Tar (Tmax eTmin) [°C]	19 (17, 28)	17 (13, 20)	20 (14, 25)
Period measures	10/10/2009–current	26/9/2013-current	20/11/2013-current
Coordinates(Longitude , Latitude) [°]	-53,1479; -30,2771	-53,5339; -31,7258	-53,7597; -29,7241

The eddy covariance technique was used. The Carbon flux was estimated using the Eddy Covariance Method (EC) with the software EddyPro®, versão 5.1.1, Li-Cor (Lincoln, Nebraska, EUA). Data processing of flux carbon dioxide were corrected for inadequate sensor frequency response following standard methods, including despiking, coordinate rotation and air density corrections [Webb et al., 1980; Baldocchi et al., 1988; Aubinet et al., 2000]. Eddy covariance data were processed to determine net ecosystem exchange of CO2 (NEE, µmol CO2 m^{-2} s^{-1}) over 30-minute time intervals. The half-hourly data were then filtered to remove periods with biologically impossible values of NEE (< -50 µmol CO_2 m^{-2} s^{-1} or > 20 µmol CO_2 m^{-2} s^{-1}). No gap filling was performed.

RESULTS

The half hour CO2 flux for three sites in Southern Brazil are showed in Fig. 2 for entire period of data. We can see a seasonality in CO2 flux in all sites. In PA and SM, this seasonality is derived of the variation in solar radiation. However, in CS the seasonality appears principally because the rice growing season.

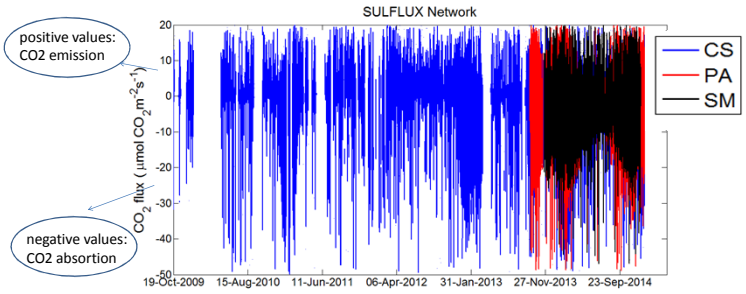

Figure 2. Half hour CO2 flux for CS, PA and SM sites in Southern Brazil.

The annual mean of the daily cycle for entire period of each site is present in Fig.3. The natural fields, with cattle pasture present similar behavior (PA and SM). The variability in solar radiation, between PA and SM, seems to have more influence in CO2 flux than temperature. The crop cultivation (rice paddy in CS) present a small day/night amplitude in a annual mean, but, there are a large difference between growing season and fallow periods (Fig 2).

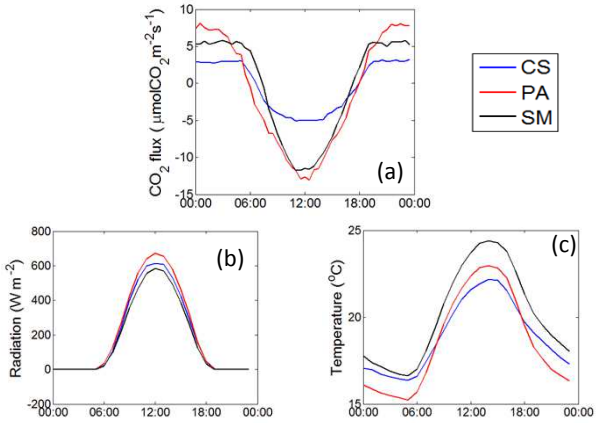

Figure 3. Annual mean of the daily cycle for CO2 flux (a), Solar Radiation (b) and Temperature (c) for CS, PA and SM sites in Southern Brazil.

Table 2: Annual mean of CO2 flux, solar radiation (Rg) and Temperature (T).

	CO_2 (µmol m^{-2} s^{-1})	Rg (W m^{-2})	T(°C)
CS	- 0.294	698.0	18.9
PA	- 0.909	750.4	18.6
SM	- 0.329	626.2	20.1

CONCLUSION

The preliminar results indicate the PAMPA Biome absorbs 0.51 µmol CO2 m^{-2} s^{-1} or 693 g CO2 m^{-2} $year^{-1}$ or 193 g C-CO2 m^{-2} $year^{-1}$. The variability in climatic drivers, land use and soil proprieties have a considerable effect on net carbon exchange

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ACKNOWLEDGEMENTS: Brazilians Agency (CNPq, CAPES, FAPERGS)