THE IMPACT OF AEROSOL DATA ASSIMILATION AT THE SURFACE VARIABLES OVER THE AMAZON

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THE IMPACT OF AEROSOL DATA ASSIMILATION AT THE SURFACE VARIABLES OVER AMAZON

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1. INTRODUCTION

Aerosols perturb the earth's energy budget directly by scattering and absorbing radiation (COAKLEY ET AL., 1983) and indirectly by acting as cloud condensation nuclei and in doing so changing cloud properties (TWOMEY, 1977). Their effects on temperature, surface fluxes, hence atmospheric stratification, further influence clouds and so feedback on the radiation. The understanding these process is very important specially over **Amazon forest**, that is a key component of the global carbon and hydrologic cycles and is a region with potential climate change sensitivies.

In this work, the impact of aerosols over Amazon forest is assessed with newest reanalysis of NASA, **MERRA-2**, that improves upon compared to previous, and the important point to climate researches is the **assimilation of atmospheric aerosol data** from various instruments like as AVHRR, MODIS, MISR and AERONET.

2. DATA AND METHODS

2.1 MCD12Q1: In order to character the land cover type and identify only amazon forest was used the MODIS Land Cover Type product (https://lpdaac.usgs.gov). The year used was 2013, the resolution is 500 meters but was interpolated to resolution of MERRA-2, where the land is the predominant land cover type.

2.2 MERRA-2: The Modern-Era Retrospective Analysis for Research and Applications, version 2 (MERRA-2), provides a spatially and temporally consistent view of weather and climate around the globe by assimilating observations into a numerical model. The key components of the system are the GEOS-5 atmospheric model (REINECKER ET AL. 2008) and the Gridpoint Statistical Interpolation (GSI) analysis scheme (WU ET AL., 2002). The MERRA-2 uses the GEOS-5 Goddard Aerosol Assimilation System (**GAAS**, BUCHARD ET AL. 2015) with the Goddard Chemistry, Aerosol, Radiation, and Transport (**GOCART**; CHIN ET AL. 2002) model to analyze **five aerosol species**, including black (BC) and organic carbon (OC), dust, sea salt (SS) and sulfates (SU).

2.3 Simulation Set Up

In order to evaluate the impact of aerosols on the Amazon forest and, consequently the assimilation of aerosols in the MERRA-2 reanalysis, a experiment with the same configurations of the MERRA-2 reanalysis was performed, however, ignoring the atmospheric aerosols. This simulation was named **EXP_NOA** and the initial condition was MERRA-2 (21Z 16 DEZ 2012). The experiment was run until December 2015. More about the set up of the MERRA-2 reanalysis and EXP_NOA simulation can be founded in the figure 1. The impact of aerosols at surface flux and variables was estimated from the difference between MERRA-2 and EXP_NOA. Furthermore, this assessment is made only over area where the aerosol optical depth (AOD) for biomass burning was greater than 50% of the total AOD and total AOD greater than 0.3.

Δ = MERRA-2 − EXP_NOA

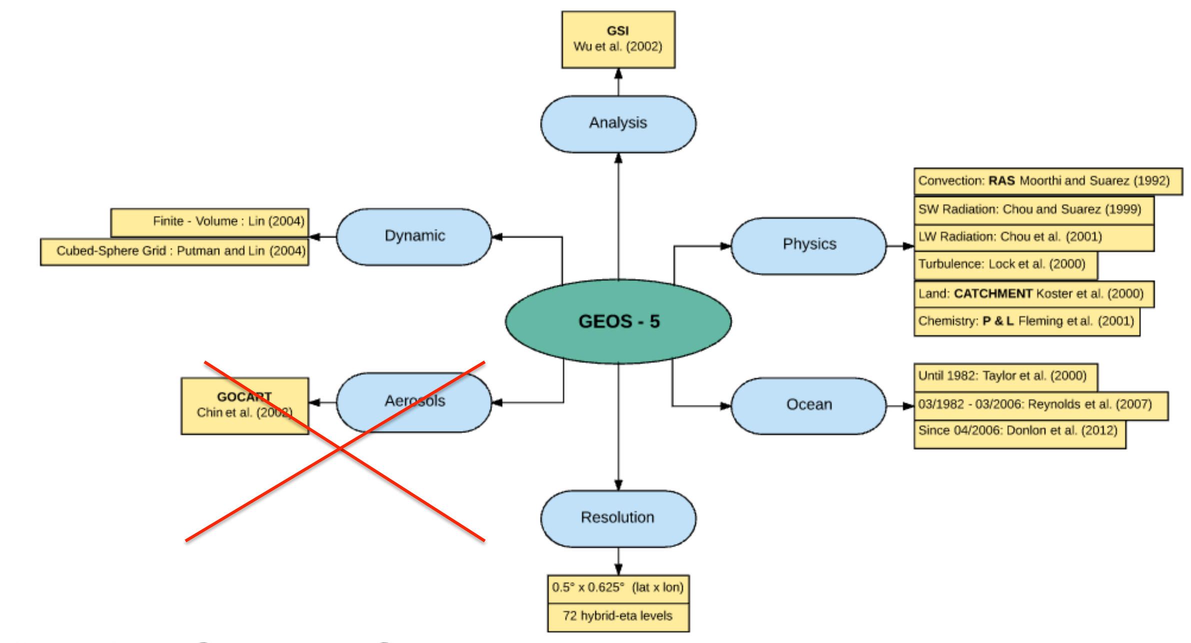

Figure 1: Scheme of the configuration of the MERRA-2 reanalysis and experiment EXP_NOA. The only difference between their is that in MERRA-2 the GOCART model is online.

3. RESULTS

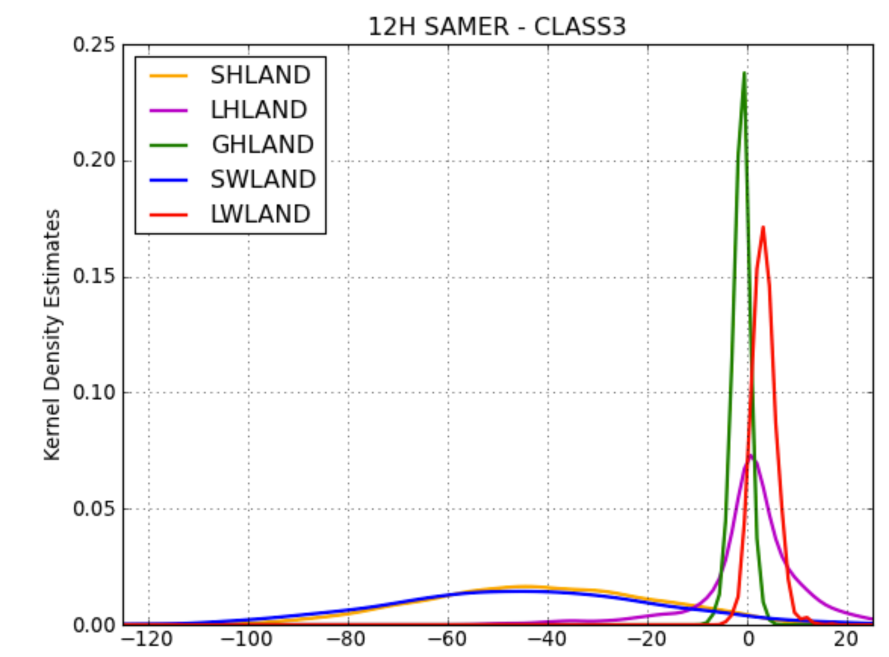

Figure 2: Estimation of kernel density for the **SWLAND, LWLAND, SHLAND, LHLAND, GHLAND** variables on the Amazon rainforest at noon.

Table 1: Statistics of the impact of aerosols at noon over Amazon forest.

NOON (12h)	Higher Probability	Mean	SD
SWLAND	-45.68 W/m²	-45.05 W/m²	26.91
LWLAND	2.88 W/m²	3.24 W/m²	2.41
SHLAND	-44.43 W/m²	-41.59 W/m²	22.86
LHLAND	0.88 W/m²	0.94 W/m²	11.37
GHLAND	-1.13 W/m²	-1.27 W/m²	1.75
TSURF	-	-0.59 K	0.35
PBLH	-	-116.9 m	79.04

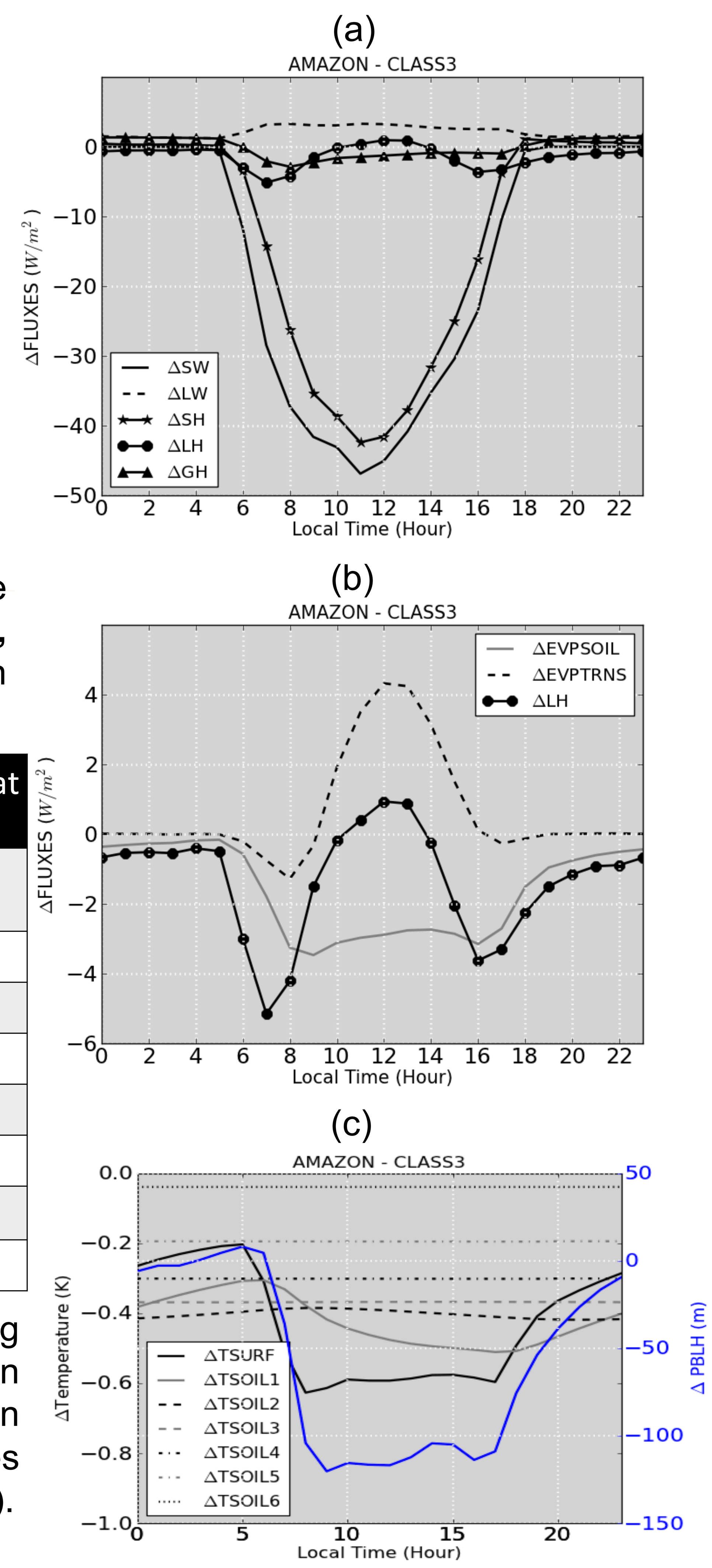

Figure 3: Impact of biomass burning aerosols on the diurnal cycle of Amazon rainforest surface variables. In (a) radiation net, (b) latent flux, and (c) soil temperatures and planetary boundary layer height (PBLH).

4. CONCLUSIONS

- ★ Although the average reduction in solar radiation reaching the surface is -45.68W/m² at noon, at some places it may be much less.
- ★ The reduction of net solar radiation (SW+LW) in the smoke area at the surface (41.81 W/m²) is mainly compensated by a reduction of surface sensible flux (41.59 W/m²).
- ★ The latent heat flux **decrease early morning** and **late afternoon** by approximately -6W/m². However, in the **late morning to early afternoon** there is an **increase** related mainly to the **increase in transpiration**. The cooler midday temperature in the presence of aerosols reduce the midday vapor pressure term and so DECREASES the STOMATAL RESISTANCE, hence INCREASES the TRANSPIRATION.
- ★ The maximum reduction of the PBLH is about (~120m) and occurs at 0900LST. Diurnal changes in the height of the PBLH are determined by the surface buoyancy flux and capping inversion.

5. ACKNOWLEDGEMENTS

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