XVII EPGMET
Encontro dos alunos de pós-graduação em meteorologia do CPTEC/INPE
HTTP://EVENTOS.CPTEC.INPE.BR/XVII-EPGMET/

EVALUATION OF THE IMPACTS OF BIOMASS BURNING EMISSIONS ON THE NASA GEOS SEASONAL CLIMATE FORECAST

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RESUMO

Emission sources of trace gases and aerosol particles in the South American (SA) and African (Af) continents have a strong seasonal and space variability associated with the extensive vegetation fires activities. Smoke aerosols also act as cloud condensation nuclei affecting cloud microphysics properties and therefore, changing the radiation budget, hydrological cycle and global circulation patterns over disturbed areas (Andreae, et al. 2004; Randles et al. 2013). This study aims to evaluate and quantify the impact of including a comprehensive emission field of biomass burning aerosol on the performance of a seasonal climate forecast system, not only regarding the AOD itself but mainly on the meteorological state variable (e.g., precipitation and temperature). To address the questions put above, we designed two numerical experiments: 1-named "AERO_CTL" which applies the QFED emissions estimated with intra-diurnal variation (hereafter,BBE), and 2-named "AERO_CLM" where the source emission is based on a climatology of the QFED emissions, with only monthly variation (hereafter,BBCLIM). Hindcast simulations were produced using the GEOS5-S2S system with a nominal spatial resolution of 56km. In both experiments, the aerosol feedbacks from cloud developments and radiation interactions were accounted. The two experiments consisted of 4 members each and ran from June to November spanning over the years 2000 to 2015. Model performance was evaluated by calculating statistical metrics on the mean area of SA and Af. Our results demonstrated that the skill model in predicting AOD is significantly improve when BBE source emission is applied over SA, but not over the Af continent. Over SA, the correlation between the AERO_CTL model configuration and MERRA-2 is 0.93 (R2= 0.86, RMS=0.02, BIAS=0.01), while the AERO_CLM model presents a value of 0.81 (R2= 0.65, RMS=0.04, BIAS=0.06). However, the AERO_CTL experiment better represents the inter-annual variability of the AOD in both regions. The gain of the skill in predicting the AOD by the AERO_CTL experiment is also seen in some meteorological variables. We observed an increase in the model skill in predicting the 2-meter temperature and precipitation of up to 0.3 for the AERO_CTL experiment in comparison to the AERO_CLM. AERO_CLM. According to the analyzed hindcast, we inferred that representing the BBE more realistically implies in a significant gain of skills in the seasonal climate forecasting over SA and Af continents.