Toward an integrated quasi-operational air quality analysis and prediction system for South America

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1. Introduction
Recent industrialization and urbanization in South America (SA) have notably exacerbated the air pollution problem. Consequently, there is a strong demand for developing ever-better assessment mechanisms to monitor the air quality at different temporal and spatial scales and minimize its damages. We aim to design and implement an integrated system to monitor, analyze and forecast the air quality in SA along with its impacts upon public health and agriculture. Here we present the results of the first stage which is the air quality modeling in the whole SA and south-eastern Brazil.

2. Methodology
Weather Research and Forecast model with Chemistry (WRF-Chem) is used in this study [1]. Model domains and configurations are shown in Fig 1 and Table 1, respectively. Results of two domains are presented here: 1) the WRF-Chem domain (50x50 km) of SA including nested domains focusing on regional scale with 10x10 km (white solid line) and dual scale with 2x2 km (dashed solid line) resolutions for megacities. Results of the domains 1 and 2 are presented here.

3. Results
Figs 2 and 3 show the mean concentrations of NOx and O3 during 5-20 August 2012, respectively. Please note the difference between model resolutions and emission inventories in parts a, b and c in each figure. Fig 4 shows the NOx emissions in MC and SP inventories. Please note that SP includes diurnal cycle whereas MC has no diurnal cycle.

4. Evaluation
As explained above, for domain 2, two simulations are done: 1) with MC and 2) with SP emissions. Fig 5 shows the comparison of both runs with the observations at Ibirapuera station, Sao Paulo. It can be seen that the SP emissions significantly improves the model prediction concerning O3 peaks. However, NOx is underestimated. Fig 6 shows an example of the diurnal cycle of NOx and O3 concentration in domain 2 using SP emissions.

5. Take-home message
• Anthropogenic emissions mainly affect the coastlines of SA while the fire and biogenic emissions affect the in-land areas.
• High-resolution anthropogenic emissions are necessary to capture the pollution episodes.

6. Outlook
• Using MOSAIC as the aerosol scheme
• Using filed campaign data concerning PM10 and PM2.5
• Simulating other domains shown in Fig 1
• Including the volcanic emissions

7. References
[1] Greil et al. 2006. Fully coupled “online” chemistry within the WRF model:Atmos. Env. 39: 6957-6975