Evaluating CMAQ in different spatial resolutions: A study case in Brazil

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INTRODUCTION

The Community Multiscale Air Quality (CMAQ) simulates the photochemical transport of atmospheric pollutants in multiple scales, including secondary chemical species. In Brazil, important studies evaluated the performance of the CMAQ mainly in the South-East region, however, the evaluation on a large spatial scale comparing different grid resolutions is still welcome.

Goal of this study: comparison the performance of CMAQ at two spatial resolutions in Southern Brazil.

MODELING SETUP

MODEL INPUT

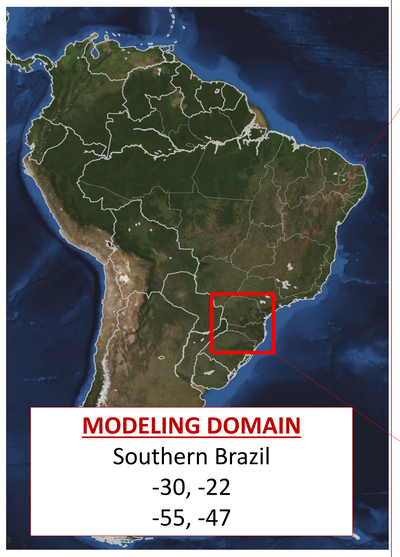
- Meteorology (WRF)
- Vehicular emission (BRAIN)
- Industrial emission
- Fire emission (FINN)
- Biogenic emission (MEGAN)
- Sea aerossol emission

COVER PERIOD

- 01/01/2019 – 12/31/2019

SPATIAL RESOLUTIONS

- 20x20km
- 4x4km

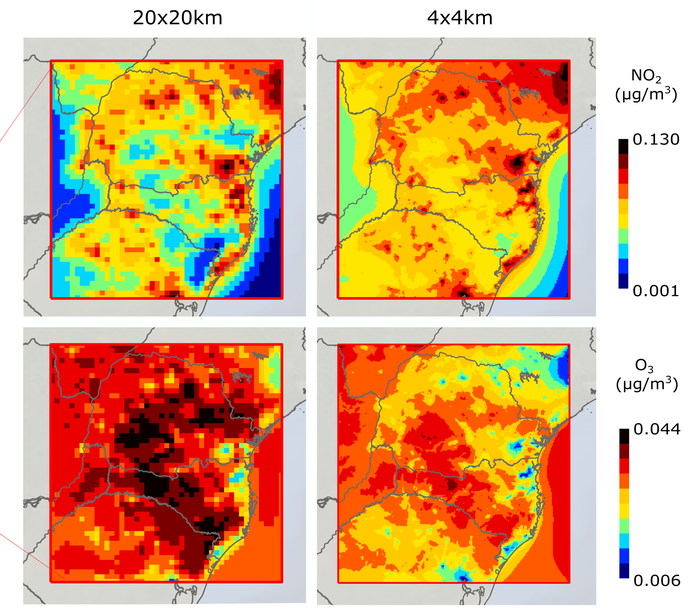


RESULTS: comparison with monitoring stations

CMAQ x 8 air quality monitoring stations

- Smaller bias for O_3 at the 4x4km grid (0.06 to 33.9 µg.m³);
- The bias for O_3 at the 20x20km grid ranged from 4.9 to 19.6 µg.m³;
- Best correlations for NO_2 and O_3 at the 4x4km grid (0.40 and 0.58, respectively);
- The best correlations for NO_2 and O_3 at the 20x20km grid correspond to 0.27 and 0.52, respectively.

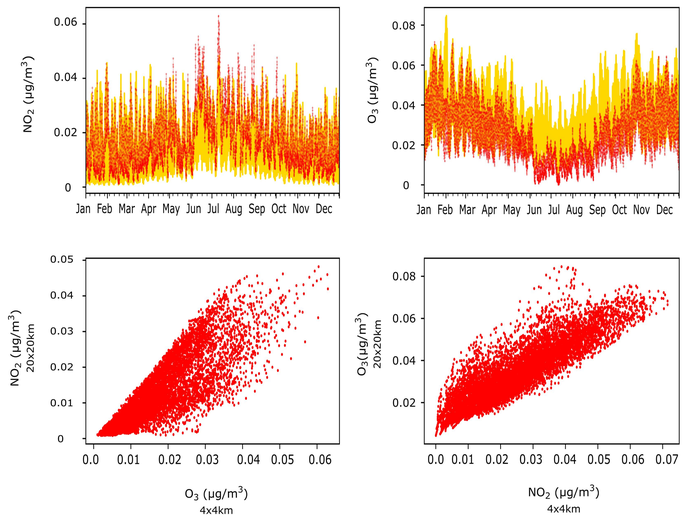
RESULTS: spatial comparison of CMAQ simulations



Coldspots well captured at 20x20km grid

Hotspots well captured in 20x20km.

RESULTS: temporal comparison of CMAQ simulations



CONCLUSION

- Best prediction for O_3 levels at both resolutions;
- NO_2 concentrations estimated on the 4x4km grid are slightly higher;
- O_3 concentrations estimated on the 20x20km grid are slightly higher;
- High correlation between simulations within the domain for both pollutants;
- Small bias between simulations within the domain for both pollutants.

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