20th ANNUAL CMAS Conference
Nov 1-5 | Virtual

Impact of the COVID-19 Lockdown Period in Surface Ozone, PM2.5, and SOA in the Mexico Megalopolis

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1. INTRODUCTION

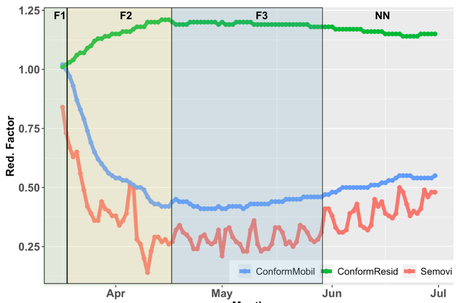
- The COVID19 pandemic in Mexico
  - Unique opportunity for the development and evaluation of public policies and mitigation measures
  - The lockdown coincided with periods of high temperature, intense solar radiation and biomass burning emissions.
  - Some emission sectors were considered as priority activities

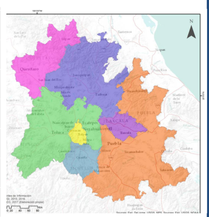
2. OBJECTIVE

- To estimate the regional contribution of emissions reductions for both the 3 main stages of the lockdown period (**F1, F2, F3**) and the first month of the so-called "new normal" (**NN**), over the Megalopolis area (**CAMe**) → Mexico Megacity and the 5 surrounding states in Central Mexico.

3. METHODS

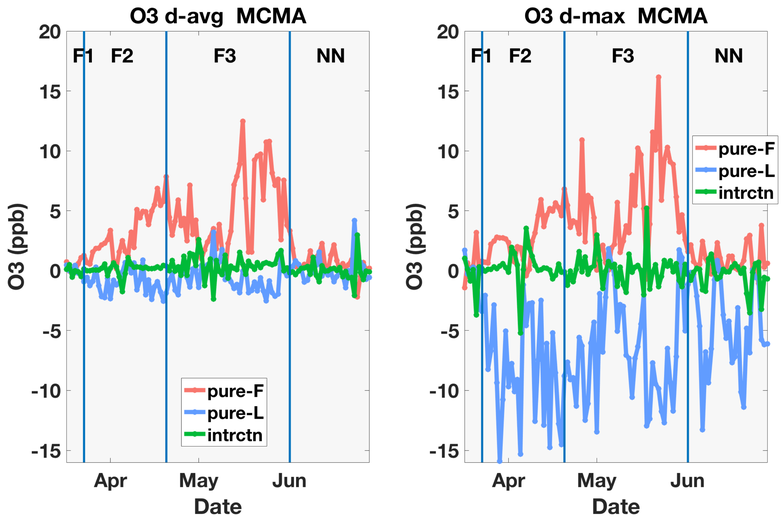
- Models: WRF-chem v4.2.1; 2 nested domains (25, 5 km) with cycled chemistry
- Simulation Period: **March 16 to June 30 2020**; divided in **27 slots of 5 days** long. One day of spin-up.
- Estimate of contribution:
  - Method: **Factor Separation Technique** (FST) [Stein & Alpert, 1993; Li et al, 2014] to estimate the contributions and the interaction (f_{LF})
- Emissions Inventories: Mexico National Emissions Inventory 2016, adjusted to 2020. **FINN** EI for biomass burning; US and Edgar EI.
- Emissions Reductions:
  - **CONFORM** global dataset [1] adjustment factors for the COVID-19 lockdown (5 surrounding states of the Mexico Megacity and at the national level) → **area and mobile sources only.**
  - **SEMOVI** official Mexican government data for reductions in mobility for the MCMA only.



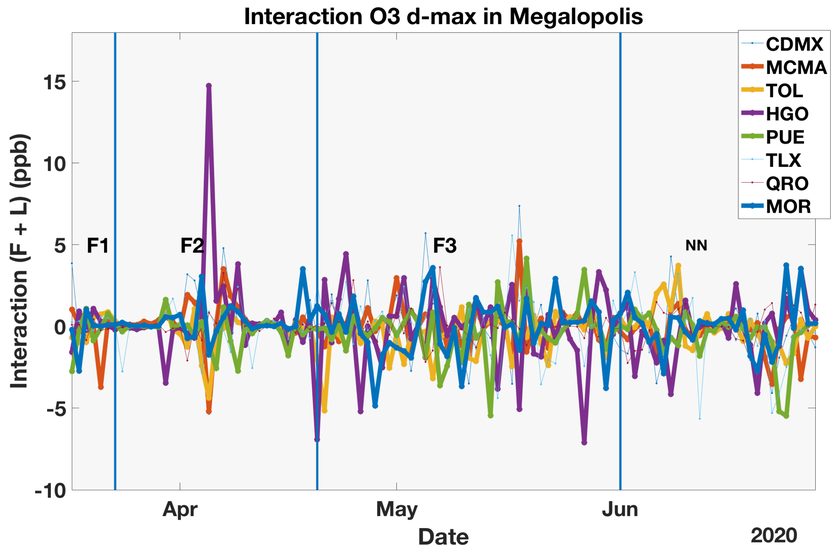


Mexico Megalopolis CAMe (MCMA: yellow + green)

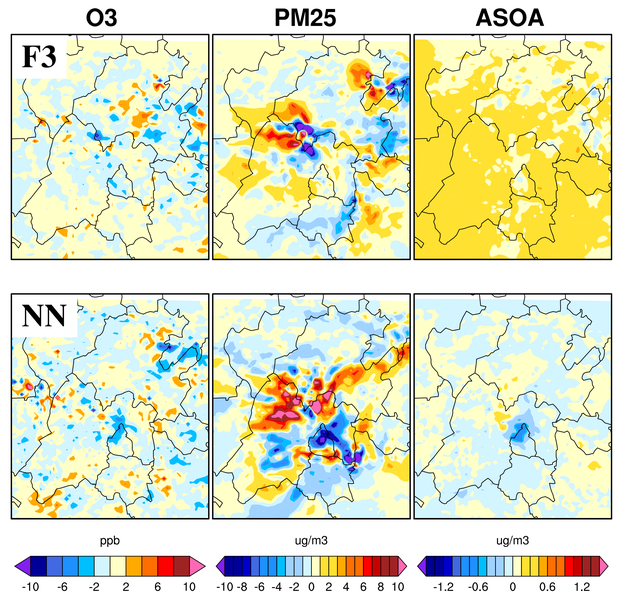
4. RESULTS



The lockdown period (**pure-L**) impacted more on decreasing the daily peaks of ozone. The biomass burning (**pure-F**) tended to increase ozone levels mainly in Phases 1,2 and 3. The combined effect (**intrctn**) tended to increase surface ozone levels more on Phase 3.



The complex interaction of fires and urban plumes increased ozone levels. **Changes in VOC/NOx regimes** could be stronger in the Metropolitan Areas of Puebla (PUE), Mexico City (MCMA) , Morelos (MOR) and State of Mexico (TOL).



Biomass burning had a significant regional impact in all of the Megalopolis during F2 and F3. The New Normal had a dramatic decrease in BB emissions; the highest impact was on fine particles levels

5. CONCLUSIONS

- **Averaging the results might mask important contributions**
- The adjustment emissions factors for the mobile sources from the CONFORM inventory might be biasing low the impacts in the 5 surrounding states.
- **The effect of emissions reduction during lockdown tended to impact more on the daily peaks of all species.** Small changes in average levels.
- The contribution from fires tended to be higher in Morelos and Puebla in most of F2 and F3 phases.
- Changes in Biogenic SOA were not significant in all phases of the lockdown.
- **Frequent changes on the VOC/NOx ratios over all the Megalopolis are suggested**

References

[1] CONFORM data set, https://eccad3.sedoo.fr/#CONFORM (sep 10 2021)

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[3] Li, G., et al.,: Ozone formation along the CaliforniaeMexican border region during Cal-Mex 2010 field campaign, Atmos. Env., 88, 370-389, 2014.

Acknowledgements

The support from computing resources from CCA (ometeotl) and DGTIC (Miztli) for the project LANCAD-UNAM-DGTIC-395 are gratefully acknowledged.