



Tropospheric Emissions:
Monitoring of Pollution



Hourly Measurement of Pollution

60 minutes

Application of Synthetic TEMPO Products to Investigate Air Quality Impacts on Community-Level Public Health

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HAQAST5 meeting

Phoenix, AZ

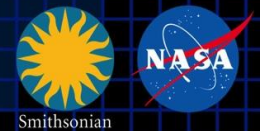


Smithsonian

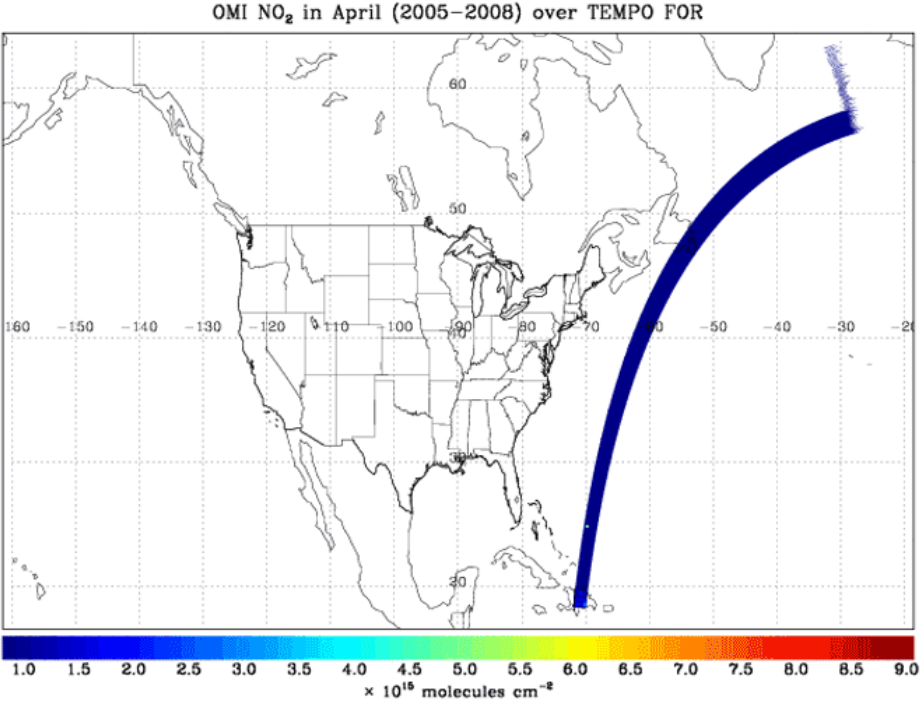




TEMPO measurements

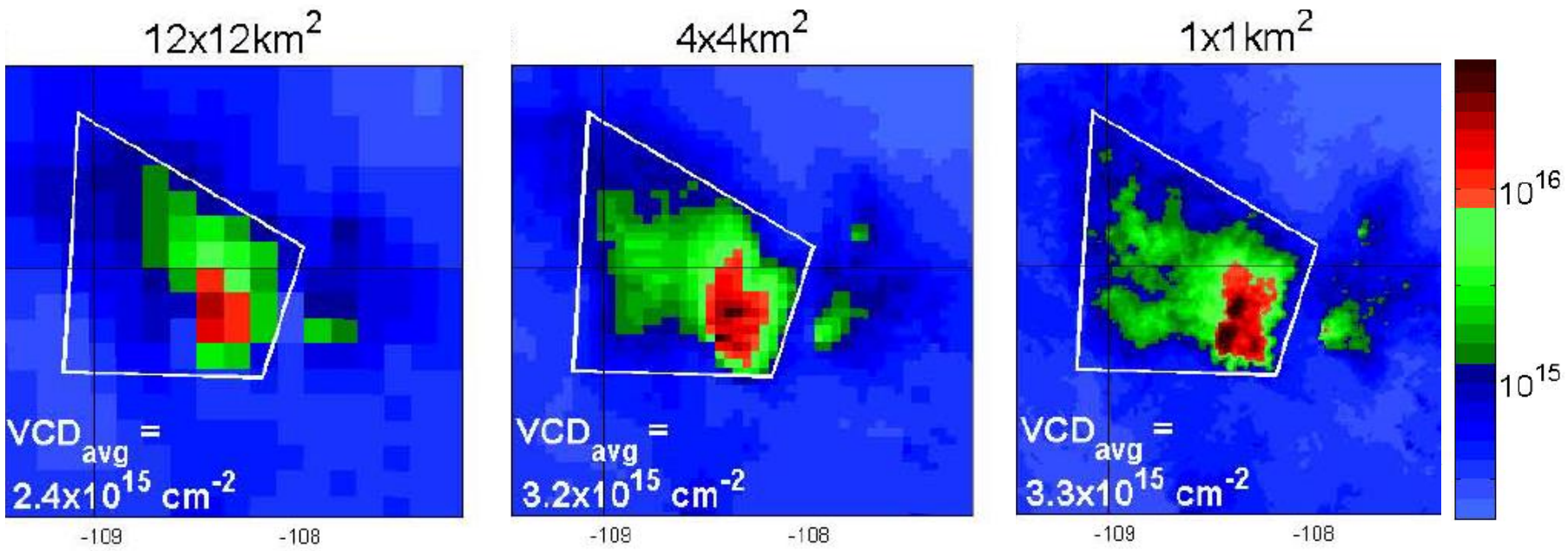
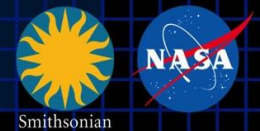


- Hourly daylight measurements from TEMPO will effectively monitor the air quality conditions over North America
- Monitoring will be accomplished at sub-urban scales due to spatial resolution of 2.1 x 4.7 km
- Multi-spectral capabilities (ultraviolet & visible channels) will help distinguish between BL, free tropospheric, and stratospheric O₃





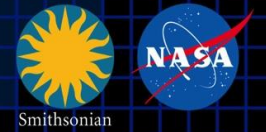
OMI vs TEMPO resolution



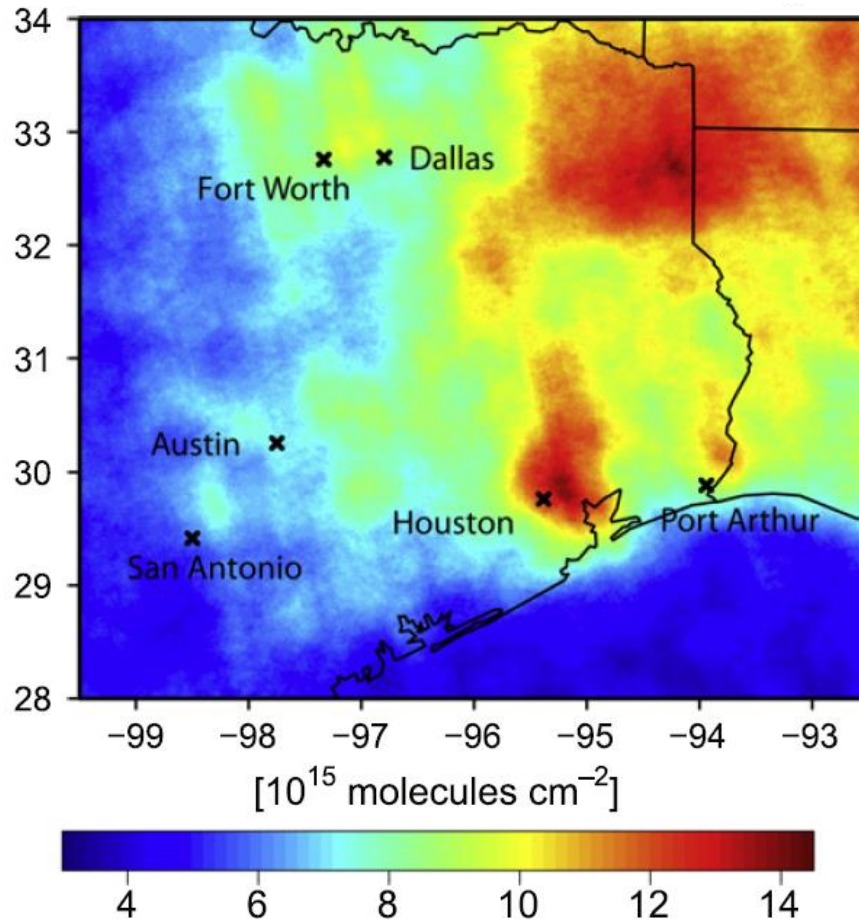
- Current spatial resolution of satellite sensors are too coarse for resolving emission source regions
- TEMPO's high spatial resolution will lead to a drastic improvement in monitoring emission source regions



OMI vs TEMPO resolution



OMI H₂CO columns oversampled to 0.02° resolution

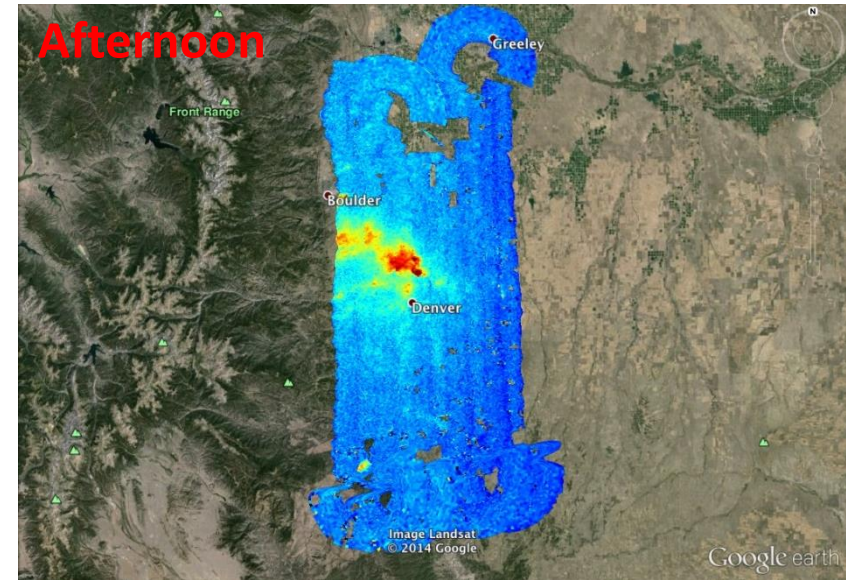
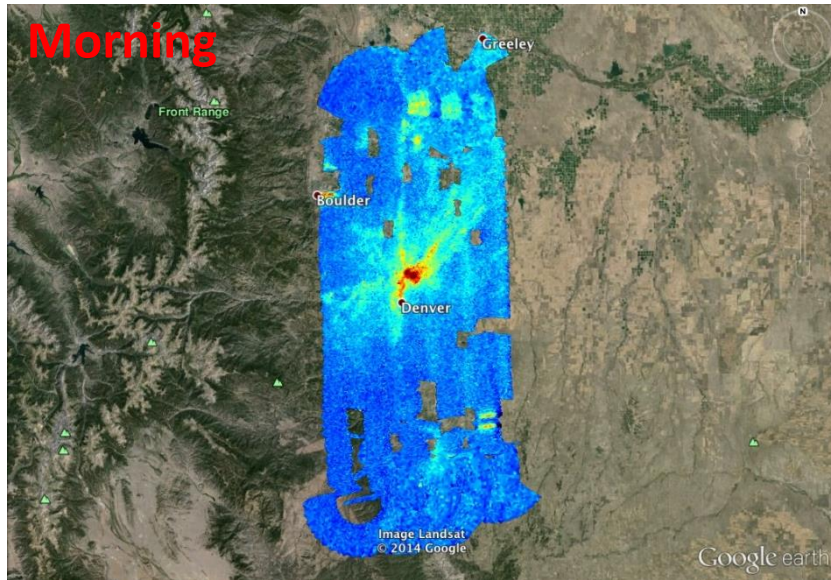
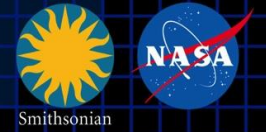


- TEMPO's high spatial resolution will allow it to resolve emission sources, including urban areas
- TEMPO will provide constraints on inventory emission magnitudes, spatial allocation, and possibly even sector partitioning

Zhu et al. (*Environ. Res. Lett.*, 2014)



TEMPO Aircraft-simulator data



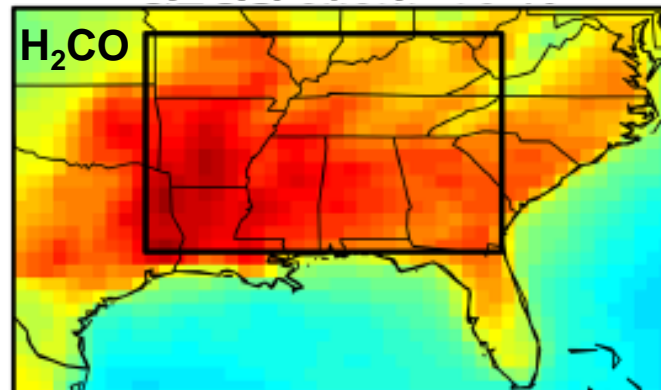
GeoTASO data (Credit: Caroline Nowlan, SAO)

- Quality of TEMPO data will be similar to GeoTASO, albeit with lower spatial resolution than the 250 x 250 m² pixel size of GeoTASO
- NO₂ slant columns from TEMPO data will be able to monitor the rapidly varying emissions from source regions across North America

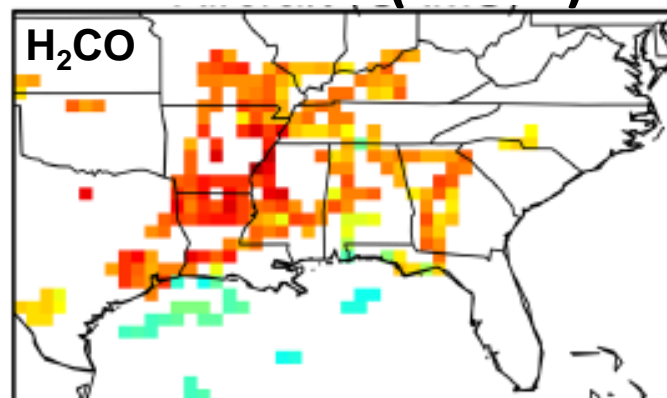


- Synthetic TEMPO observations generated using simulated gaseous and aerosol composition from GEOS-NR
- GEOS-NR spatial resolution of $\sim 12 \times 12 \text{ km}^2$ spatiotemporally interpolated to finer TEMPO grid
- Profiles and vertical column amounts of species obtained from interpolation

GEOS-Chem

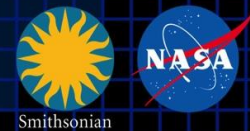


Aircraft (CAMS)



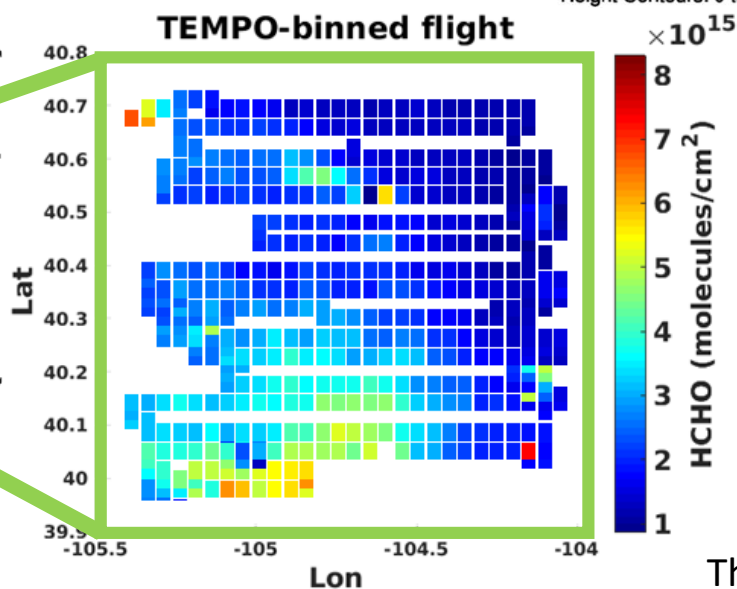
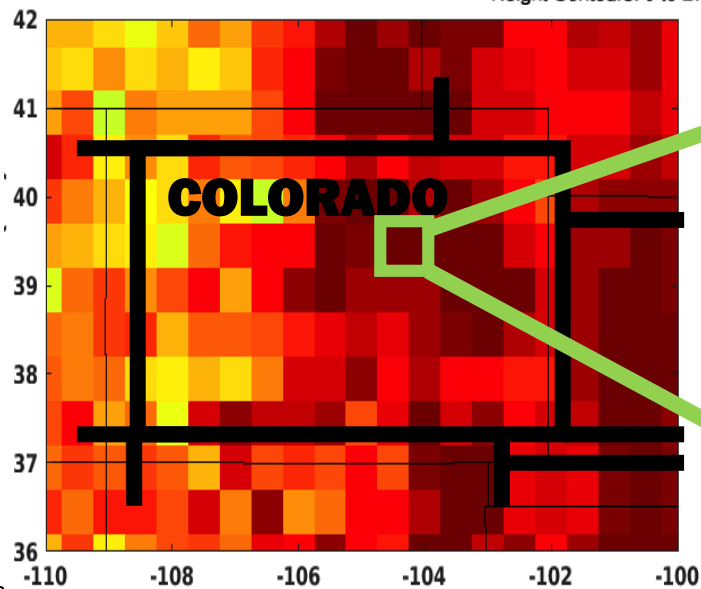
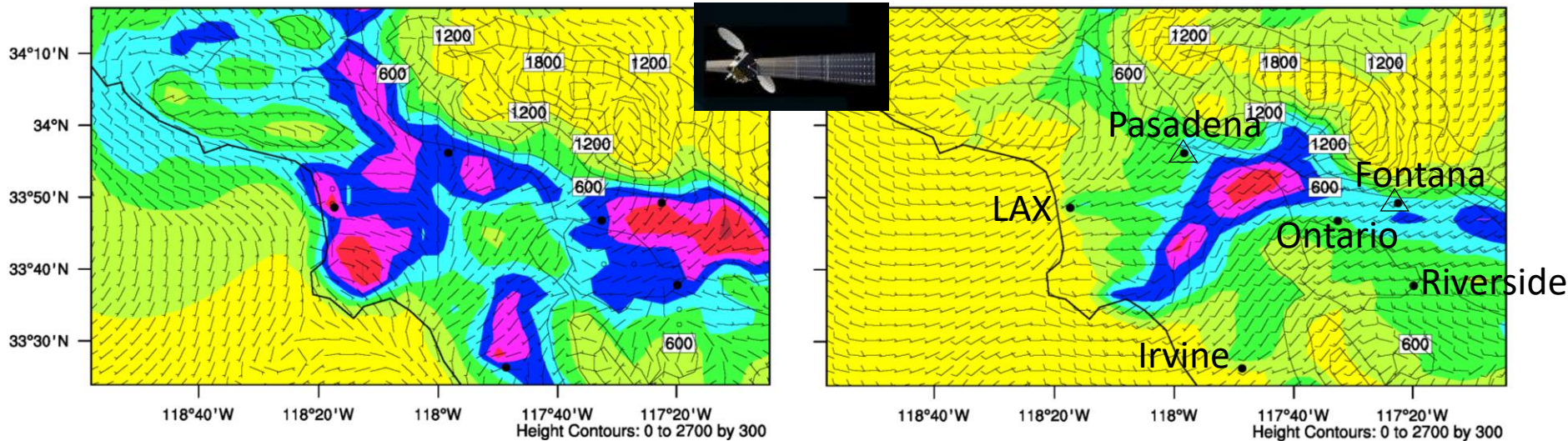


TEMPO synthetic observations



Si-Wan Kim et al.

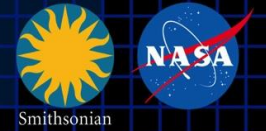
NO₂ columns modeled at approximate TEMPO resolution



Frank Keutsch, Mitchell Thayer, et al.



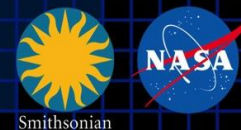
Pilot Project: Public Health



- How can TEMPO be used to assess the impact of air pollutant exposure on hospital readmission rates for cardiopulmonary disorders?
- Collaboration with Alabama Department of Public Health and Alacare Home Health & Hospice
- TEMPO proxy products will be used to build the readmission rate prediction model
- The spatial/temporal resolution of air pollutants from TEMPO offer the capacity to assess environmental risk factors on health and provide critical time and space information to healthcare end users for mitigation actions



Short-term Prediction Research and Transition (SPoRT)



- Over the past 15 years, SPoRT has successfully transitioned unique observations from more than 40 satellite datasets to operational end users
- Established research-to-operations/operations-to-research paradigm that engages in solving specific forecast problems
- SPoRT plans to use this successful approach to prepare the user community for TEMPO data

