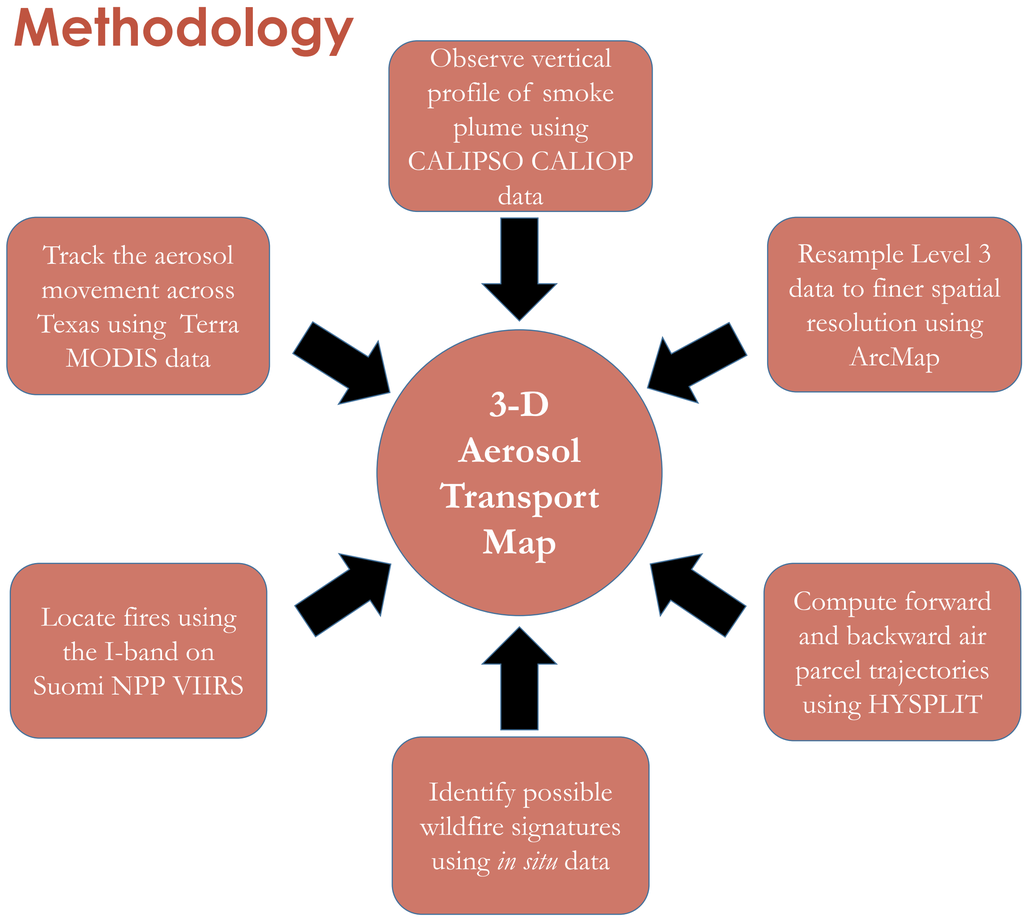
Utilizing NASA Earth Observations to Monitor Exceptional Air Pollution Events in Texas

Abstract

Wildfires in Texas have the potential to impact not only the areas of origin but also the entire state. Smoke plumes from wildfires travel across the state with trajectories that are greatly influenced by meteorological conditions. The plumes transport pollutants, which include those present in the ambient atmosphere, like volatile organic compounds and nitrous oxides, as well as those produced by wildfires, like aerosols. Aerosols have several negative effects on the environment and human health. Smoke plumes have the potential to negatively impact numerous lives when meteorological conditions allow them to reach highly populated metropolitan areas. For these reasons, the U.S. Environmental Protection Agency (EPA) has set standards to regulate the levels of these pollutants in the atmosphere. Observations from field monitors assist the Texas Commission on Environmental Quality (TCEQ) in ensuring that these standards are met. When these standards are exceeded, the TCEQ can claim an exceptional event, but it is often difficult to use *in situ* data alone to trace the origins of the pollutants that caused this. This project used data from Terra MODIS and CALIPSO CALIOP to observe the aerosol optical thickness and vertical composition of plumes, respectively, and to perform 3-D spatial temporal plume tracking. Thermal anomaly maps from Suomi NPP VIIRS were used for fire detection. The products of this project helped the TCEQ observe wildfire smoke plumes and monitor the origin, transport, and deposition of wildfire aerosols.

Methodology



Conclusions

- A combination of *in situ* ozone and PM 2.5 measurements, HYSPLIT backward and forward trajectories, and Suomi NPP VIIRS thermal anomalies facilitates identification of wildfires that cause air pollution events.
- School fire and Black Range Complex fires in Arizona and agricultural biomass burning in Mexico are potential contributors to the air pollutant exceedance in El Paso, TX on July 16, 2016.
- The 3-D aerosol transport map produced can be used by the TCEQ in exceptional event reporting for El Paso, TX on July 16, 2016.
- Terra MODIS and CALIPSO CALIOP, while limited in their spatial and temporal resolution, provide a basis for creating 3-D maps to track aerosol transport from wildfires to cities.
- The restricted spatial and temporal resolution of Terra MODIS and CALIPSO CALIOP data prevent definitive conclusion that these fires caused the exceedance. Additional *in situ* and meteorological datasets should be consulted for more certainty in exceptional event reporting.

Team Members

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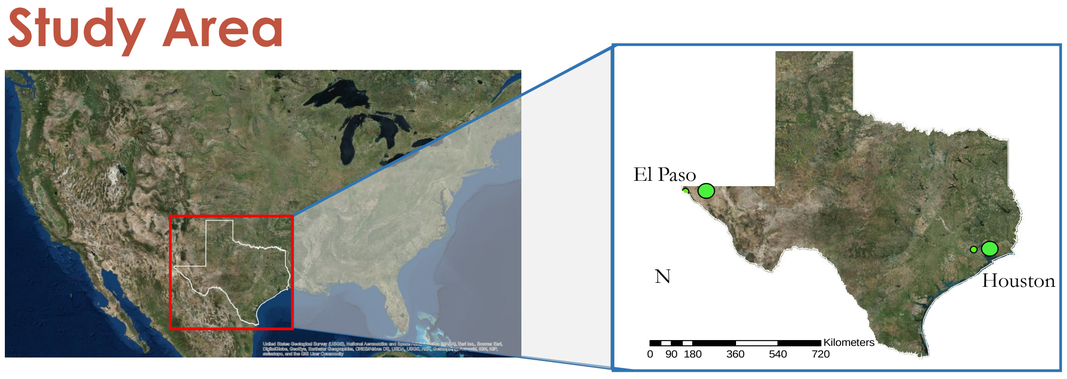
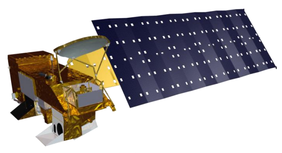
Objectives

- **Use** Terra MODIS, CALIPSO CALIOP, and Suomi NPP VIIRS to track aerosols from wildfire smoke plumes around dates specified by the TCEQ
- **Monitor** aerosol concentration and distribution within the plumes as they move from source to destination
- **Provide** a 3-D aerosol transport map to track aerosol deposition in Houston and El Paso, Texas
- **Assist** the TCEQ in locating the origins of aerosols that cause air pollution events

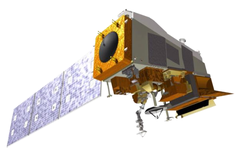
Study Area



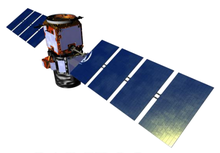
Earth Observations



Terra



Suomi NPP

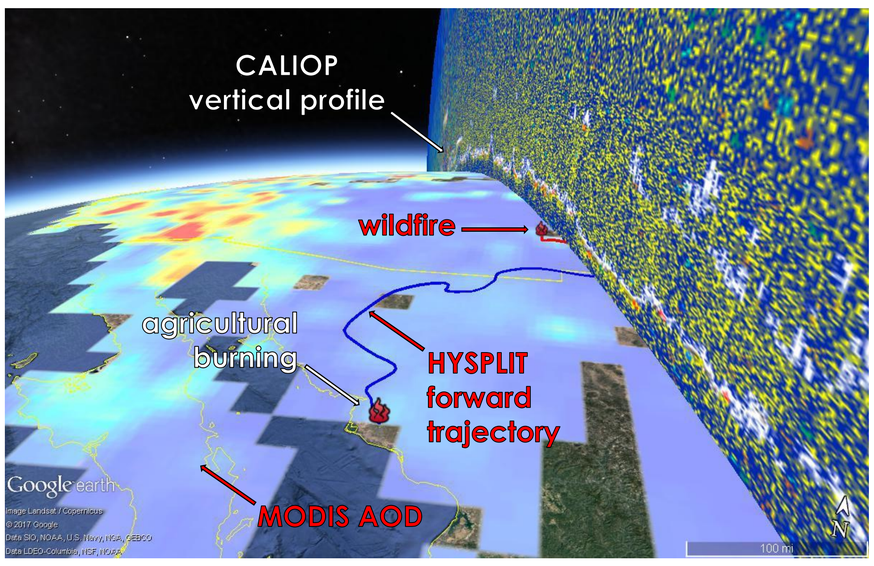


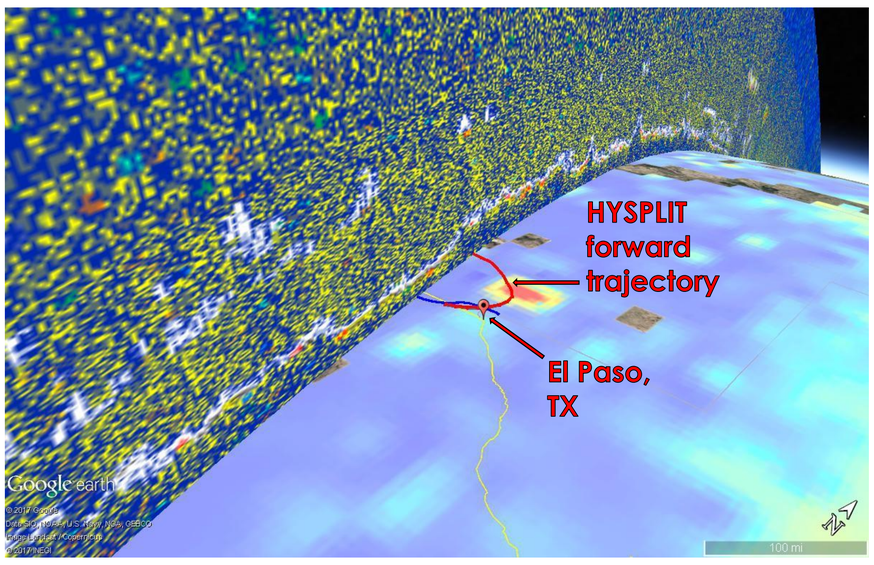
CALIPSO

Project Partner

Texas Commission on Environmental Quality (TCEQ), Air Quality Division

Results





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