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Tropospheric Emissions: Monitoring of Pollution (TEMPO) – Status and Potential Science Studies

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TEMPO is the first NASA Earth Venture Instrument, to launch between 2019 and 2021. It measures atmospheric pollution from Mexico City and Cuba to the Canadian oil sands, and from the Atlantic to the Pacific, hourly at high spatial resolution, ~10 km^2. It measures the key elements of air pollution chemistry. Geostationary (GEO) measurements capture the variability in the diurnal cycle of emissions and chemistry at sub-urban scale to improve emission inventories, monitor population exposure, and enable emission-control strategies. TEMPO measures the UV/visible spectra to retrieve O_3, NO_2, SO_2, H_2CO, $C_2H_2O_2$, H_2O, aerosols, cloud parameters, and UVB radiation. It tracks aerosol loading. It provides near-real-time air quality products. TEMPO is the North American component of the global geostationary constellation for pollution monitoring, with the European Sentinel-4 and the Korean GEMS. TEMPO studies may include: Solar-induced fluorescence from chlorophyll over land and in the ocean to study tropical dynamics, primary productivity, carbon uptake, to detect red tides, and to study phytoplankton; Measurements of stratospheric intrusions that cause air quality exceedances; Measurements at peaks in vehicle travel to capture the variability in emissions from mobile sources; Measurements of thunderstorm activity, including outflow regions to better quantify lightning NO_x and O_3 production; Cropland measurements follow the temporal evolution of emissions after fertilizer application and from rain-induced emissions from semi-arid soils; Measurements investigate the chemical processing of primary fire emissions and the secondary formation of VOCs and ozone; Measurements examine ocean halogen emissions and their impact on the oxidizing capacity of coastal environments; Spectra of nighttime lights are markers for human activity, energy conservation, and compliance with outdoor lighting standards intended to reduce light pollution.