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Introduction: ASDC & TEMPO

The Atmospheric Science Data Center (ASDC) is in the Science Directorate located at the NASA Langley Research Center (LaRC), in Hampton, Virginia. The ASDC is one of NASA's Distributed Active Archive Centers (DAAC), supports over 60 projects, and provides access to more than 1,000 archived collections (Fig. 1).



Fig. 1: ASDC Servers

The collections archived at the ASDC were created from satellite measurements, field experiments, and modeled data products. ASDC projects focus on the following Earth science disciplines: Radiation Budget, Clouds, Aerosols, and Tropospheric Composition.

The ASDC is the DAAC of record for the upcoming "Tropospheric Emissions: Monitoring of Pollution" (TEMPO) instrument. TEMPO will be situated on a geostationary satellite positioned at a longitude near the center of the conterminous United States and focused on North America, making hourly swaths of its field of regard from east to west (Fig. 2). ASDC's data products are currently hosted locally, and services (e.g., spatial & temporal subsetting and bundling) are managed on premises. In the future, the ASDC plans to provide TEMPO data and services locally, as well as remotely through NASA's Earthdata Search platform.



Fig. 2: TEMPO Field of Regard

ASDC DAAC Highlights

Ingest and Archive entire missions' worth of data and derivative products

ASDC has two ingest and archive systems (Dark Horse and CUMULUS) that push and pull data from respective science data providers. A transition is underway to utilize NASA's Cumulus system, a relatively new, native cloud-based ingest, archive, and distribution system.

Customization and Delivery of data products

ASDC provides users access to terabytes of orderable data for satellite missions and field campaigns alike. Datasets from select missions and campaigns can be subset temporally, spatially, and by variable.

Easy access tools to discover new or pertinent datasets

ASDC is part of the larger ESDIS system that utilizes a central search-capable website, allowing users of all skills and backgrounds to discover and obtain data.

Imagery services to view specialized products and parameters

ASDC provides Global Imagery Browse Service (GIBS) processing support used by NASA Worldview and the Earthdata Search web applications.



TEMPO Measurements

The Tropospheric Emissions: Monitoring of Pollution instrument is a grating spectrometer with the ability to gather spectra of ozone, nitrogen dioxide, and other atmospheric gases every sunlit hour of the day (Fig. 3). TEMPO will be attached to the earth-facing side of a commercial tele-communications satellite in geostationary orbit, providing for a constant view of North America.

TEMPO launched on April, 2023.

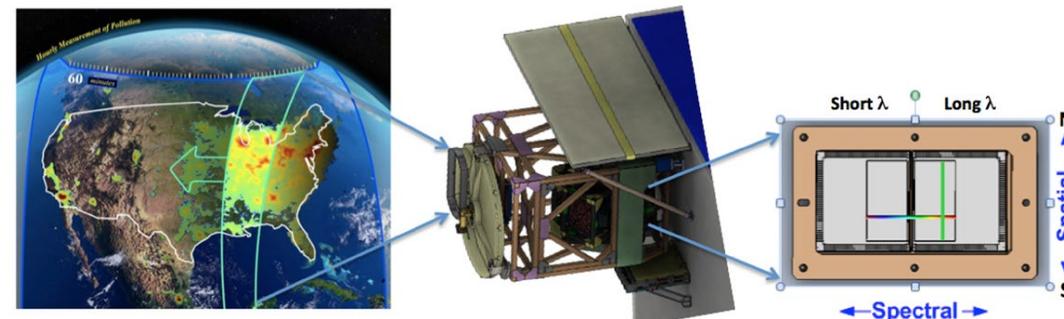


Fig. 3: Schematic of the TEMPO Spectrometer

With its light-collecting mirror, the TEMPO instrument makes a full longitudinal scan of North America every hour. By measuring the sunlight reflected and scattered from the Earth's surface and atmosphere, TEMPO's datasets will show daily and hourly fluctuations of atmospheric pollutants locally, regionally, and across the continent.

TEMPO Service Development

The ASDC has provided data subsetting capabilities for previous science missions, with subsetters for TEMPO currently in development. The first TEMPO subsetter will be hosted on-premises at the ASDC, and the second will live in the cloud. With the on-premises subsetter, TEMPO users will be able to subset datasets temporally, spatially or by variable. This subsetter is operational and undergoing end-to-end testing. The TEMPO cloud subsetter is currently being developed and tested using the Physical Oceanography Distributed Active Archive Center's (PO.DAAC) Level 2 Subsetter in conjunction with Harmony, which is NASA's Earthdata Cloud Services System. Compared to the on-premises subsetter, the cloud subsetter aims to be safer, reliable and more convenient. Data visualization, distribution and analysis are likely to occur through GIBS-enabled interfaces, such as NASA Worldview and Earthdata Search.

Data & Metadata

DATA TYPE	COLLECTION DESCRIPTION
TEMPO_DRK_L1	Level 1 calibrated CCD dark current
TEMPO_IRR_L1	Level 1 calibrated irradiance
TEMPO_IRRR_L1	Level 1 CCD irradiance frames (reference)
TEMPO_RAD_L1	Level 1 calibrated geo-located radiance
TEMPO_CLDO4_L2	Level 2 derived geophysical product for cloud pressure and fraction
TEMPO_HCHO_L2	Level 2 derived geophysical product for formaldehyde
TEMPO_NO2_L2	Level 2 derived geophysical product for nitrogen dioxide
TEMPO_O3TOT_L2	Level 2 derived geophysical product for total ozone
TEMPO_O3PROF_L2	Level 2 derived geophysical product for ozone vertical profile
TEMPO_CLDO4_L3	Level 3 gridded derived geophysical product for cloud pressure and fraction
TEMPO_HCHO_L3	Level 3 gridded geophysical product for formaldehyde
TEMPO_NO2_L3	Level 3 gridded geophysical product for nitrogen dioxide
TEMPO_O3TOT_L3	Level 3 gridded geophysical product for total ozone
TEMPO_O3PROF_L3	Level 3 gridded geophysical product for ozone vertical profile

Societal Impacts

Air quality has a direct effect on human health, and disease risks can increase in relation to the duration and intensity of exposure to air pollutants. TEMPO will revolutionize air quality forecasts by collecting high-resolution measurements of pollutants. Its measurements will help address climate forcing uncertainties by measuring pollution pathways, particularly the details of tropospheric ozone and aerosol production, transport, and relation to sources. This will allow scientists, forecasters, decision-makers, and the public to better monitor air quality in their area and recognize trends.

Learn more about TEMPO & ASDC here:

