Why is VIIRS Aerosol Detection Product (Smoke/Dust Mask) Important?

VIIRS Aerosol Detection Product (ADP), also called the Smoke/Dust Mask, is a **qualitative** indicator of the presence and relative thickness of smoke and blowing dust aerosols in the atmosphere. It uses a simple identification scheme of smoke with lavender-pink colors and dust with yellow-brown colors; the darker the color, the thicker the smoke or dust. This product can help operational users who provide warnings, watches and advisories for dust, smoke, and haze related to visibility and air quality. Data can be accessed online via the AerosolWatch and JSTAR Mapper websites.
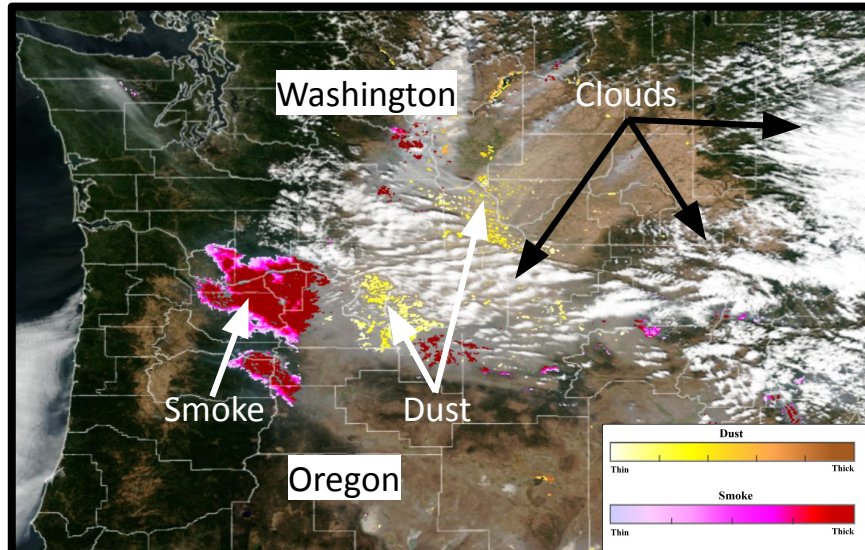
SNPP VIIRS Smoke/Dust Mask detected smoke & dust in Oregon and Washington at 21:37 UTC, 7 September 2020. Image from the JSTAR Mapper website.

VIIRS ADP (Smoke/Dust Mask) Algorithm and Specifications

Algorithm	Product Accuracy	Resolutions / Latency
• Spectral and spatial threshold tests separate smoke and dust from clouds and clear sky. • 15 VIIRS Moderate (M) bands used as inputs. • Absorbing Aerosol Index (AAI) uses VIIRS bands M1 (0.41 μm) and M2 (0.45 μm) to identify absorbing aerosols, including smoke and dust. • Dust Smoke Discrimination Index (DSDI) uses VIIRS bands M1 (0.41 μm) & M11 (2.25 μm) to separate smoke from dust.	**Dust:** 80% Probability of Correct Detection (POCD) over Land and Water **Smoke:** 80% POCD over Land, 70% POCD over Water	**Spatial:** 750m **Temporal:** 1-2 observations per day per JPSS satellite at mid-latitudes; more at higher latitudes **Latency:** ~1 hour

Impact on Operations

Primary Application

Smoke and Dust Monitoring: Identifies the geographic location, movement, and relative thickness of smoke and blowing dust plumes. Darker colors indicate thicker plumes. Most accurate for thick smoke and dust plumes over dark surfaces.

Complements RGB Imagery: While RGB imagery must be interpreted by a human forecaster, the VIIRS Smoke/Dust Mask automatically identifies smoke and dust using its retrieval algorithm. Use the VIIRS Smoke/Dust Mask in conjunction with RGB imagery, such as True Color RGB, Dust RGB, and Day Fire RGB, to quickly highlight areas of smoke or blowing dust.

Limitations

Daytime Only: Since the VIIRS Smoke/Dust Mask algorithm uses reflected sunlight, the product is only available during the daytime.
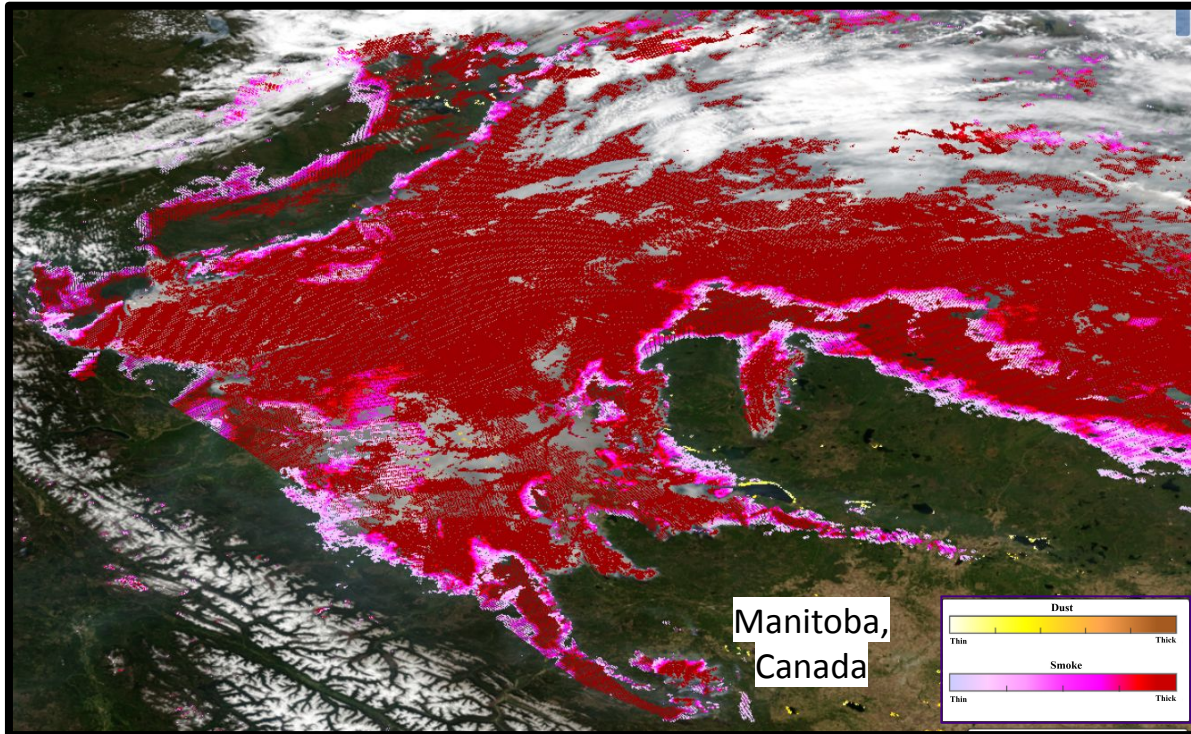
Clouds, Snow, and Ice: VIIRS Smoke/Dust Mask is not available for areas covered by clouds, snow, or ice.

Where in the atmosphere? The ADP product does not identify where smoke and dust aerosols are located within the vertical profile.
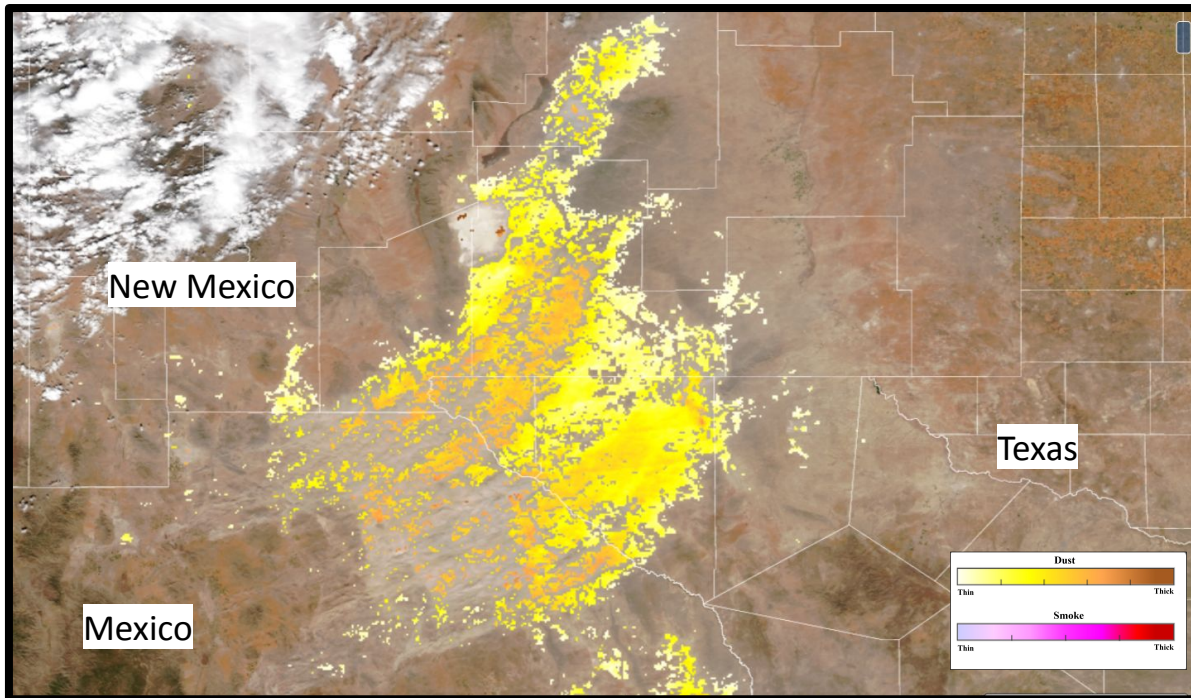
Contributors: CSU/CIRA, NOAA/NESDIS/STAR, GINA, and CIMSS.

Image Interpretation

- **Thick smoke** (dark red)
- **Moderate smoke** (magenta)
- **Thin smoke** (light purple)
- **Thick dust** (dark gray)
- **Moderate dust** (brown)
- **Thin dust** (yellow)

Daytime only

NOAA-20 VIIRS Smoke/Dust Mask detected wildfire smoke on 15 May 2023. Image from the JSTAR Mapper website.

Manitoba, Canada

New Mexico

Texas

Mexico

NOAA-20 VIIRS Smoke/Dust Mask detected blowing dust on 16 March 2021. Image from the JSTAR Mapper website.

Resources

NOAA NESDIS/STAR
VIIRS ADP Algorithm Theoretical Basis Document (ATBD)

VIIRS ADP Users' Guide

AerosolWatch Website
Near Real-Time & Archived VIIRS Aerosol Imagery

JSTAR Mapper Website
Near Real-Time & Archived Global VIIRS Aerosol Imagery

STAR Atmospheric Composition Product Training
Aerosol, Fire, and Trace Gas Satellite Products from ABI, VIIRS, TROPOMI & TEMPO

Hyperlinks not available when viewing material in AIR Tool