ECOSTRESS Observation of the Nishinoshima Eruption Plume

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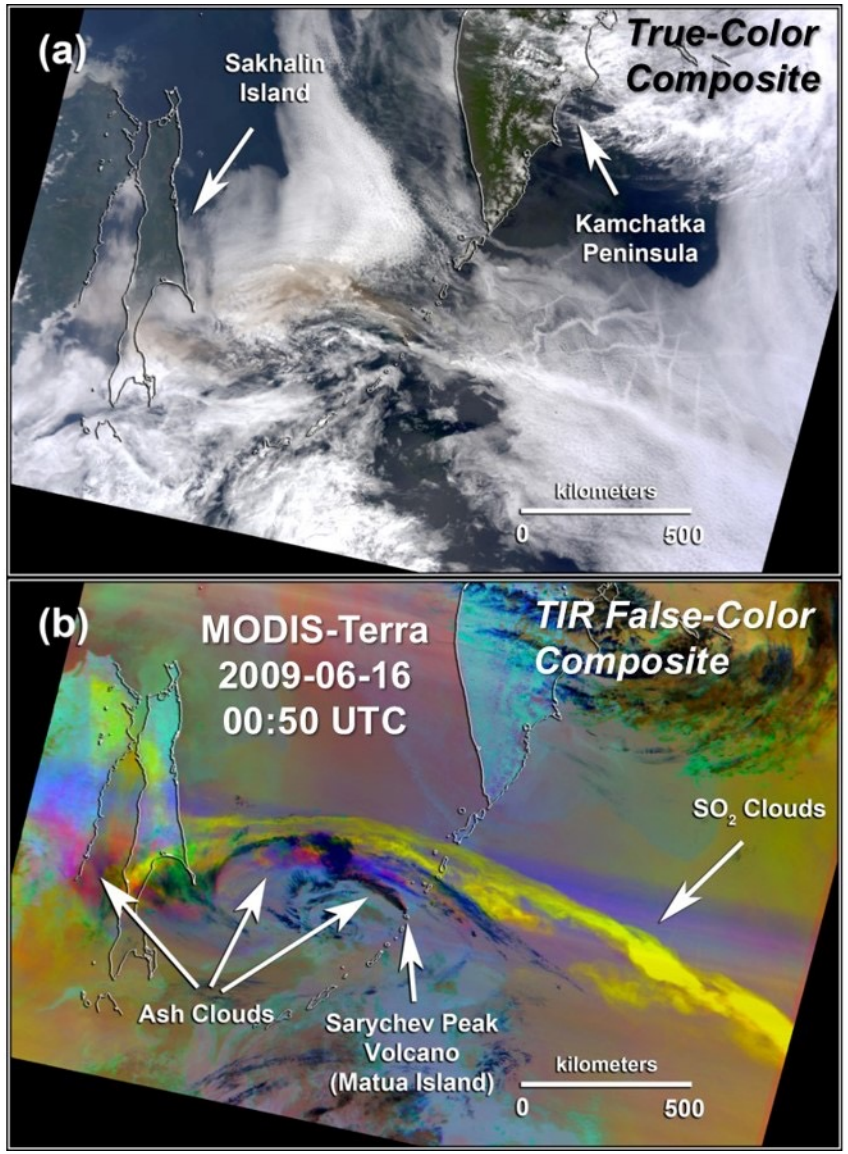
Government sponsorship acknowledged.

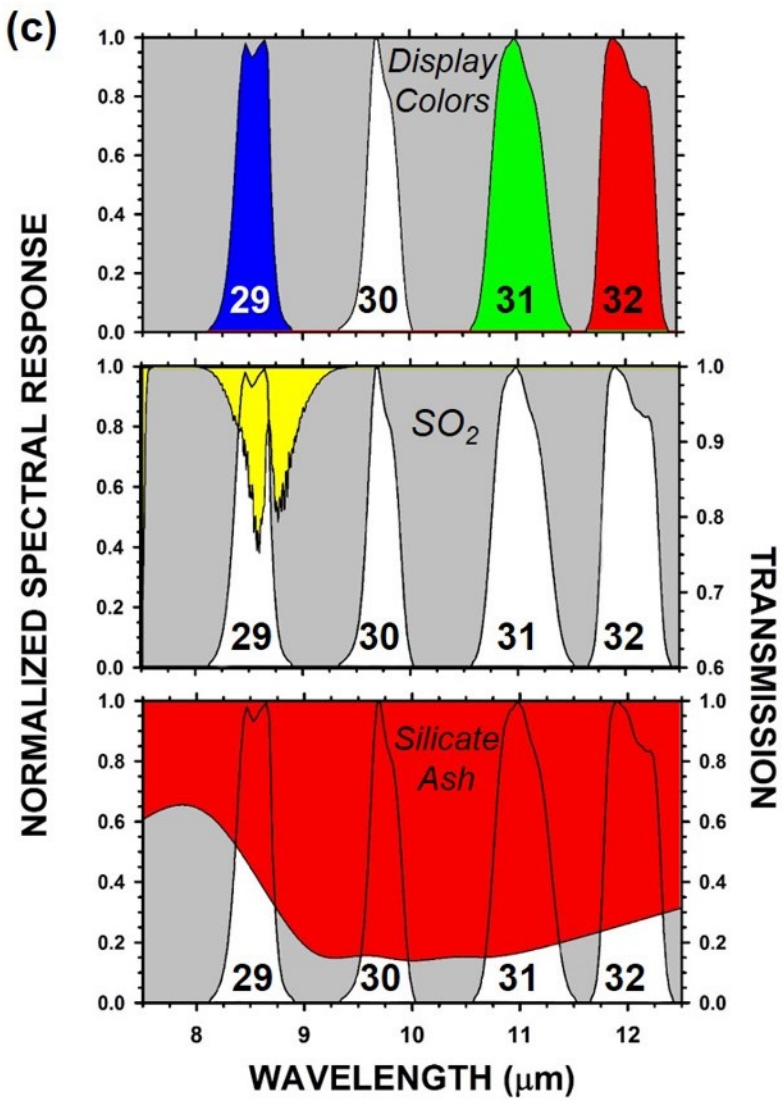
Plume Spectroscopy: Sarychev Peak Volcano

a) MODIS-Terra True-color composite. Volcanic plumes and meteorological clouds have similar appearance at visible wavelengths

b) False-color composite of TIR data from Channels 32, 31, and 29, displayed in red, green, and blue. SO_2 plumes appear yellow, while the display colors of ash plumes range between red and magenta

c) Transmission spectra of SO_2 (middle) and silicate ash (bottom), superimposed on the spectral response of MODIS Channels 29, 30, 31, and 32





Advanced Spaceborne Thermal Emission and Reflectance Radiometer (ASTER): 90 m IFOV, 830 X 700

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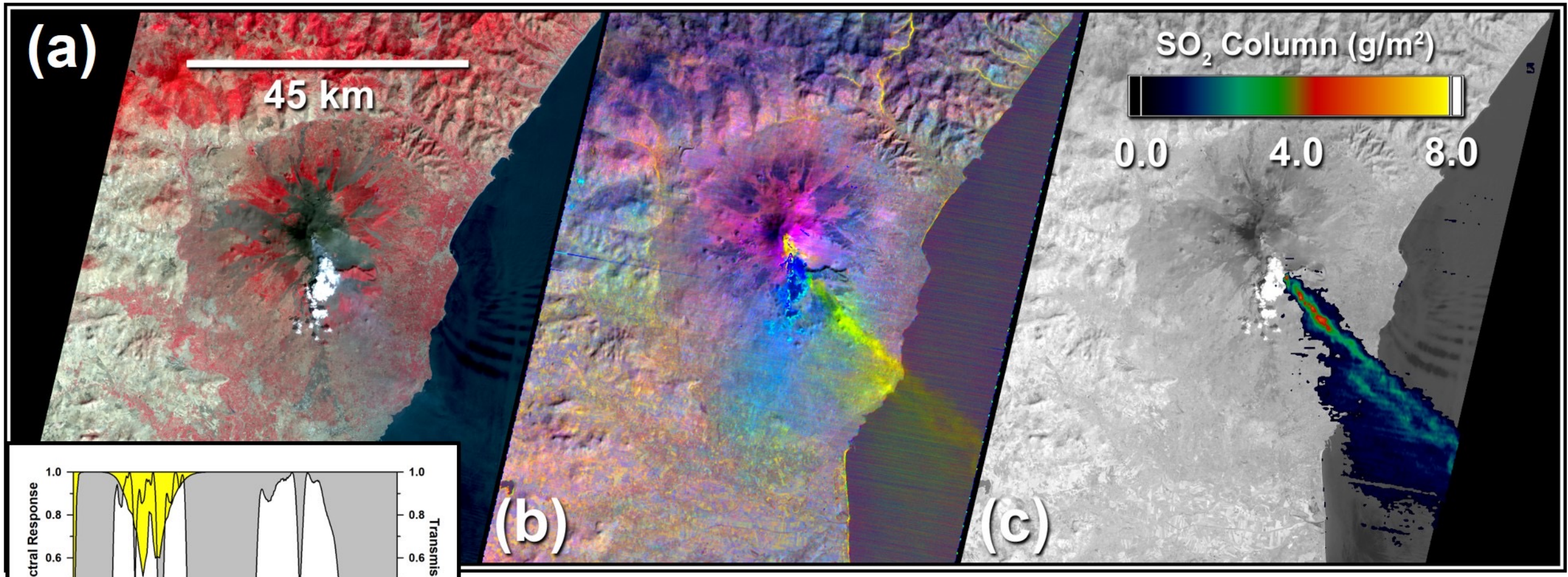

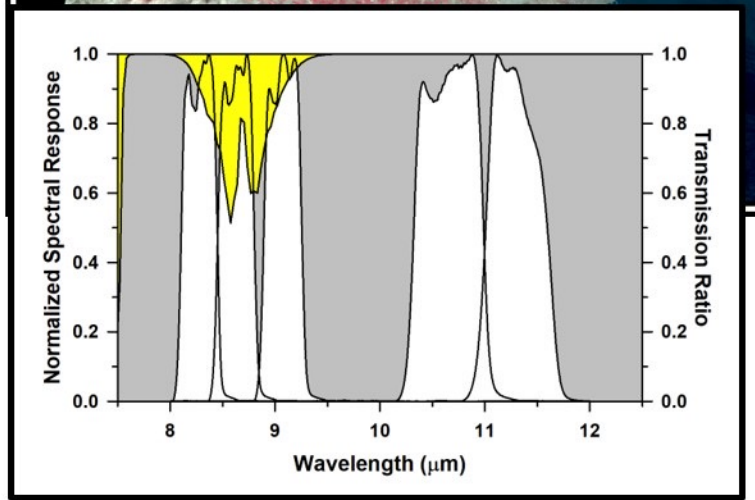

Mount Etna, 2011-07-29, 10:01 UTC

(a) VNIR Composite, (b) TIR Composite,
(c) SO_2 Column Density Map

Moderate-Resolution Imaging Spectrometer (MODIS): 1 km IFOV, 1354 X 2030

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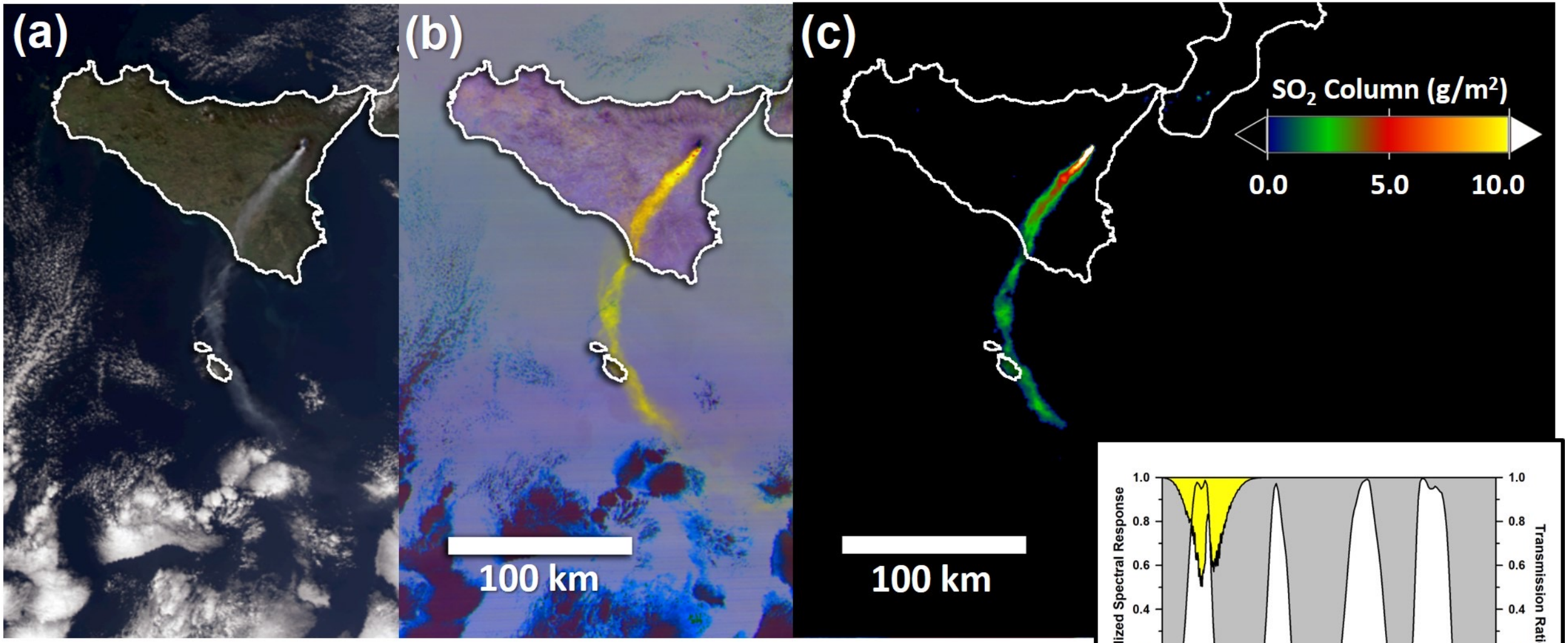

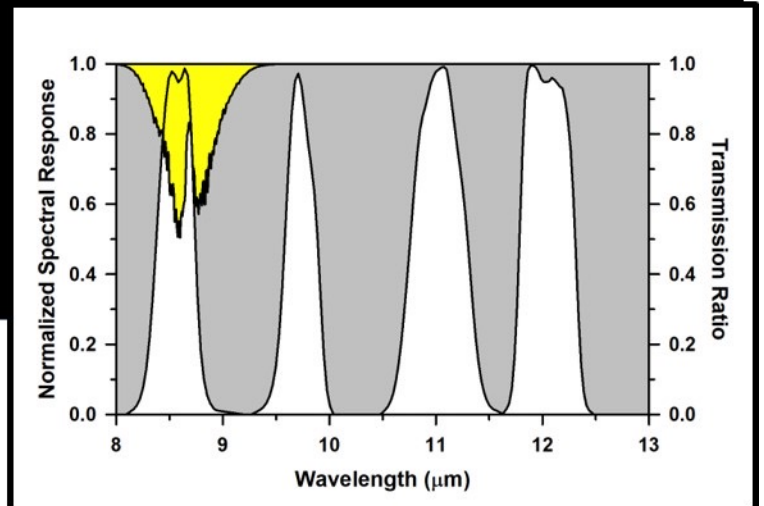

Mount Etna, 2018-12-27, 12:20 UTC

(a) RGB Composite, (b) TIR Composite, (c) SO_2 Column Density Map

Visible Infrared Imaging Radiometer Suite (VIIRS): 750 m IFOV, 3200 X 3232

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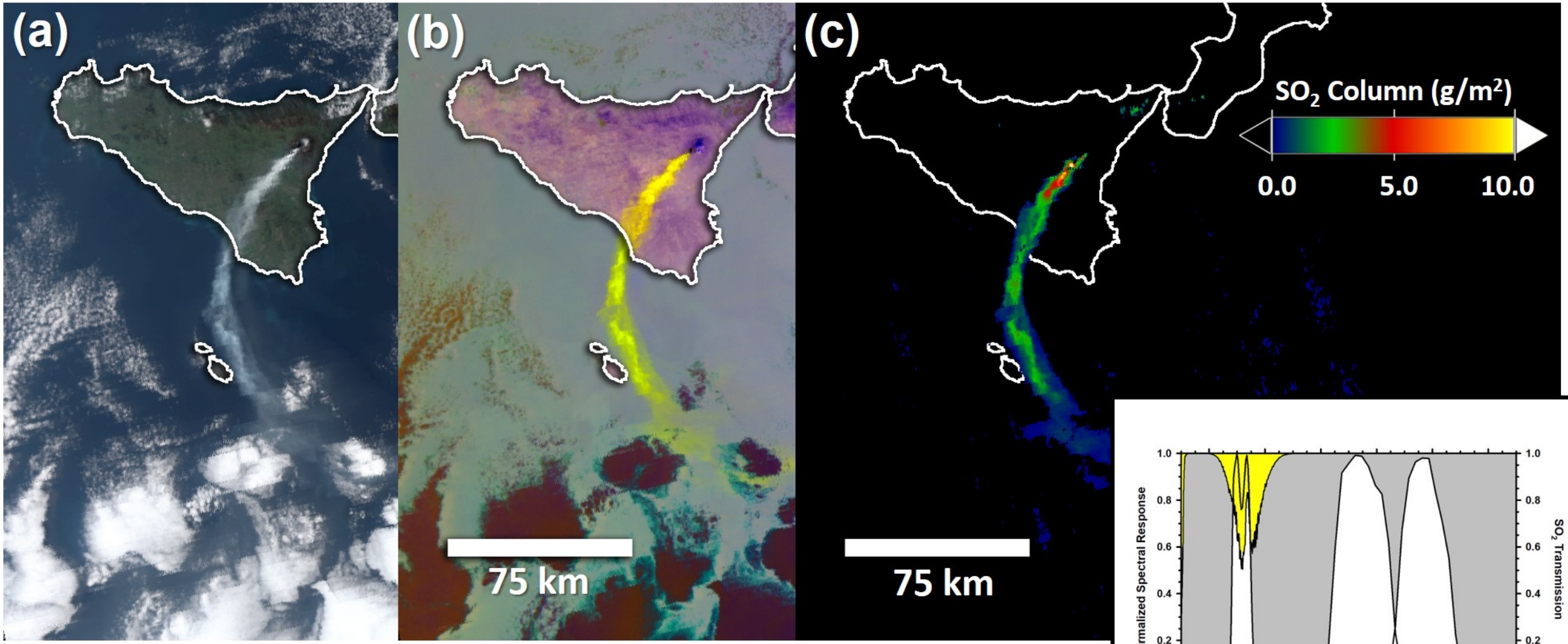

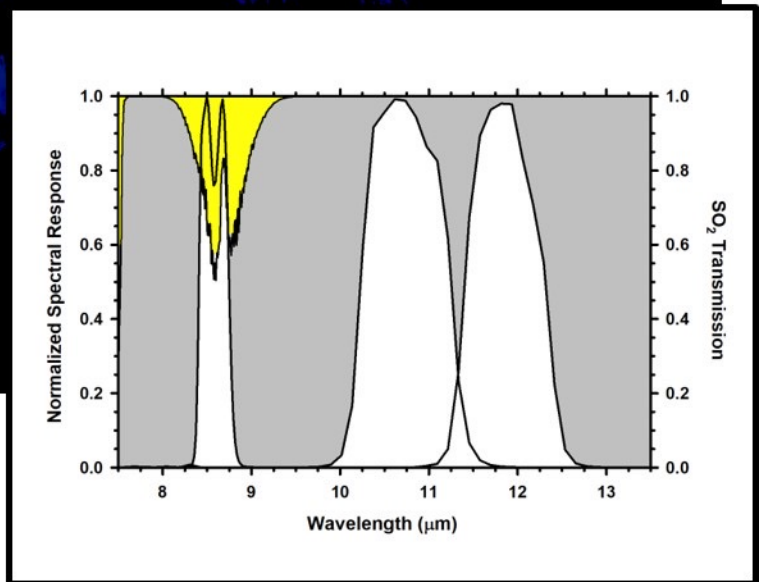

Mount Etna, 2018-12-27, 11:00 UTC

(a) RGB Composite, (b) TIR Composite, (c) SO_2 Column Density Map

ECOSTRESS Volcano Targets: 125 Sites in Target Database

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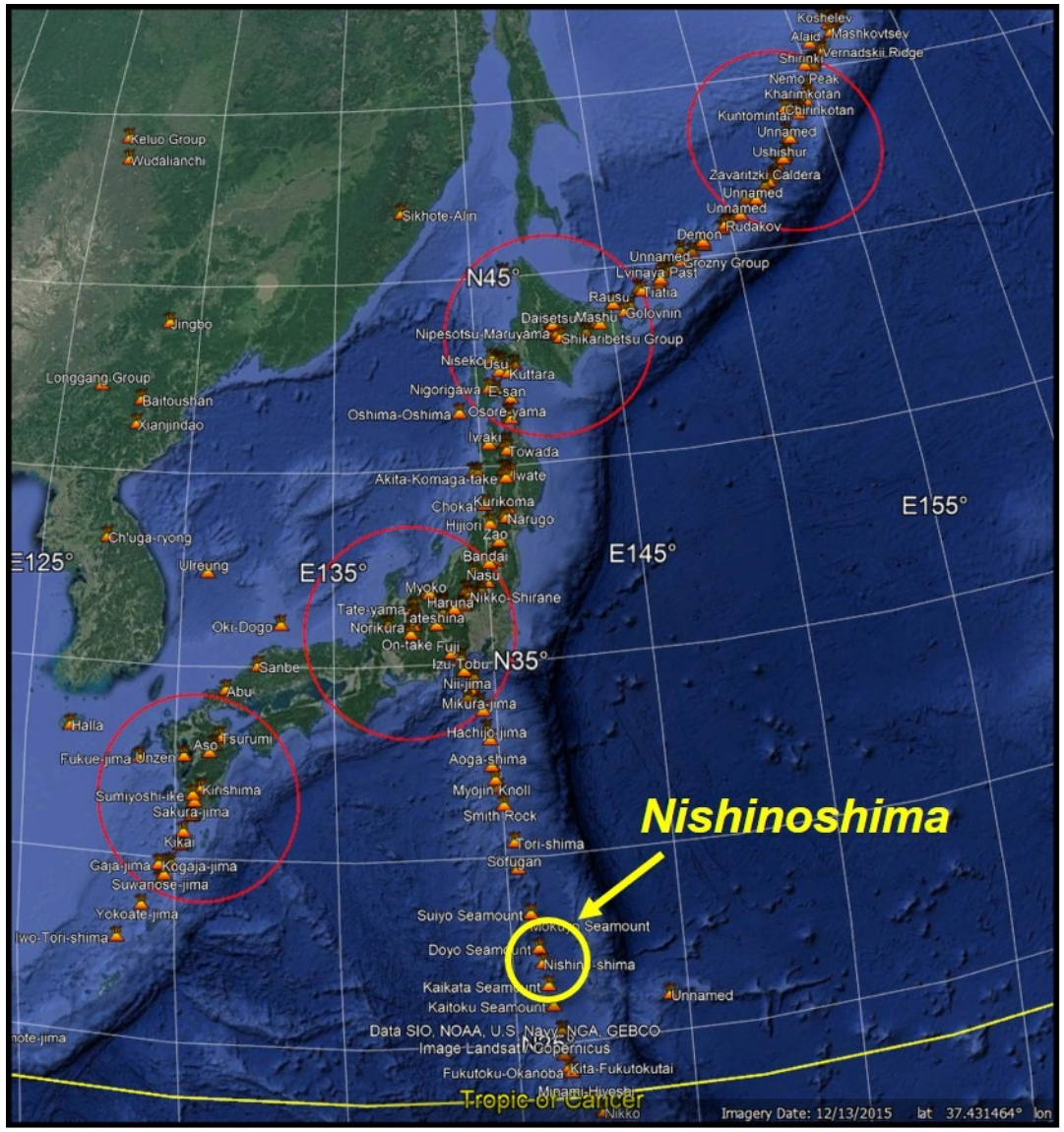

Nishinoshima Eruption: 5 Dec 2019 – 27 Aug 2020
1 July – 14 July: Multiple Explosions, Eruption Columns to Altitudes 3 – 8 km

Nishinoshima Plume Chronology: 8 July 2020

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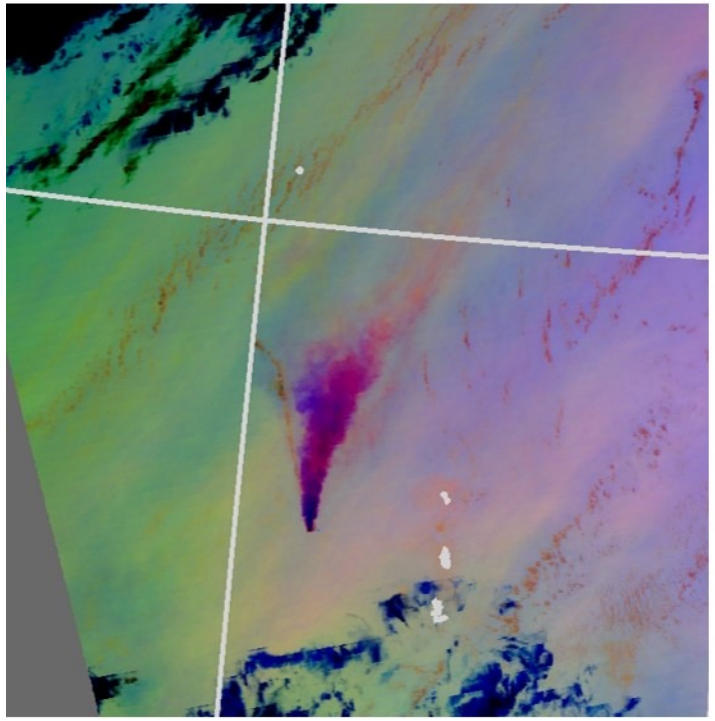
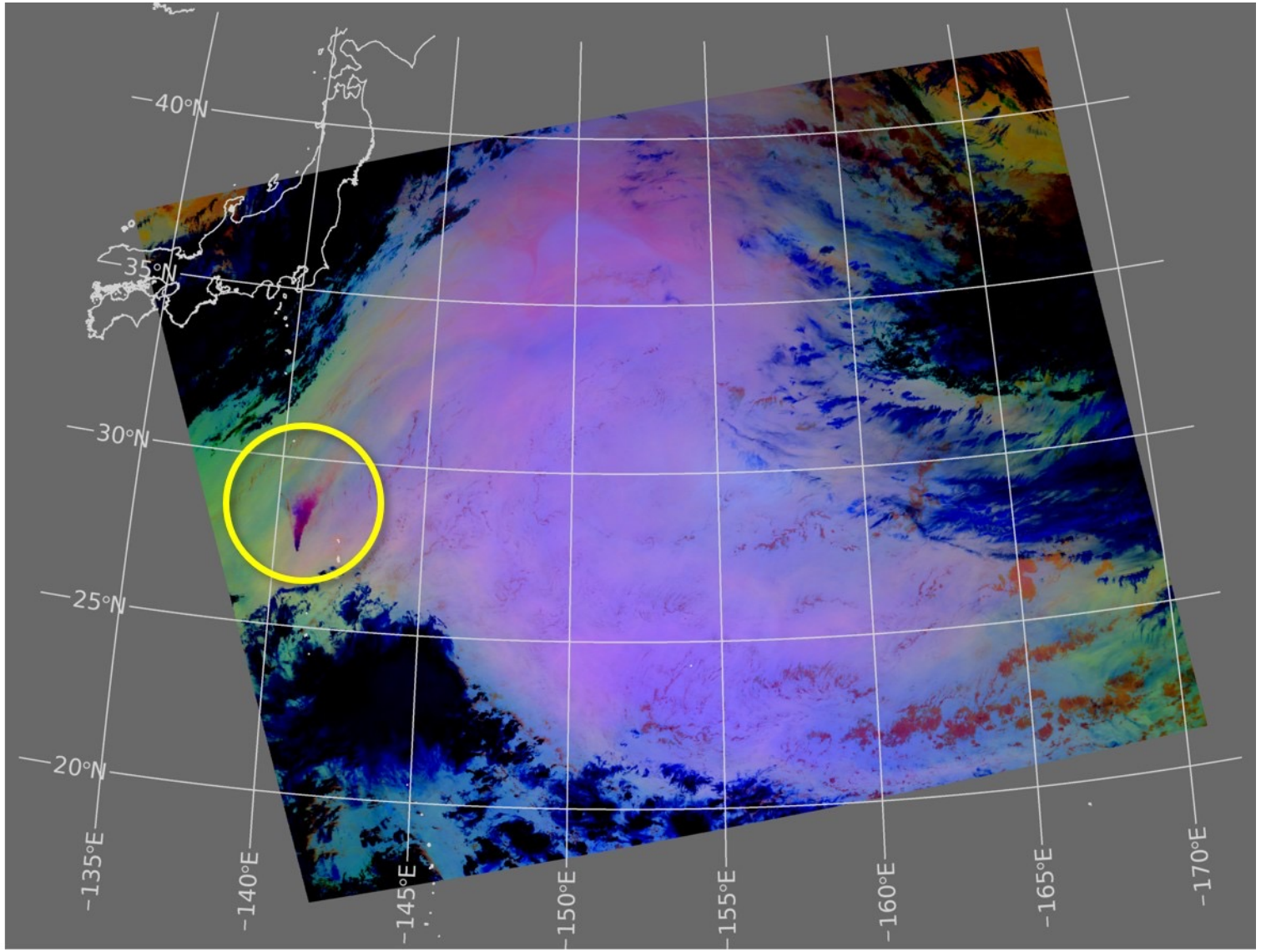
VIIRS - SNPP
02:48:00 UTC





Nishinoshima Plume Chronology: 8 July 2020

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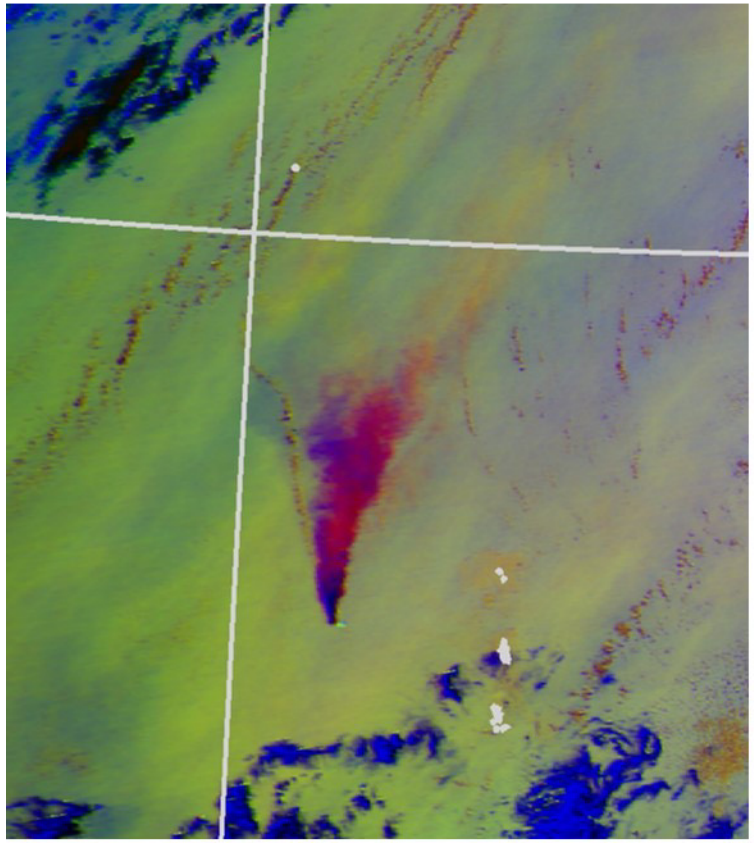
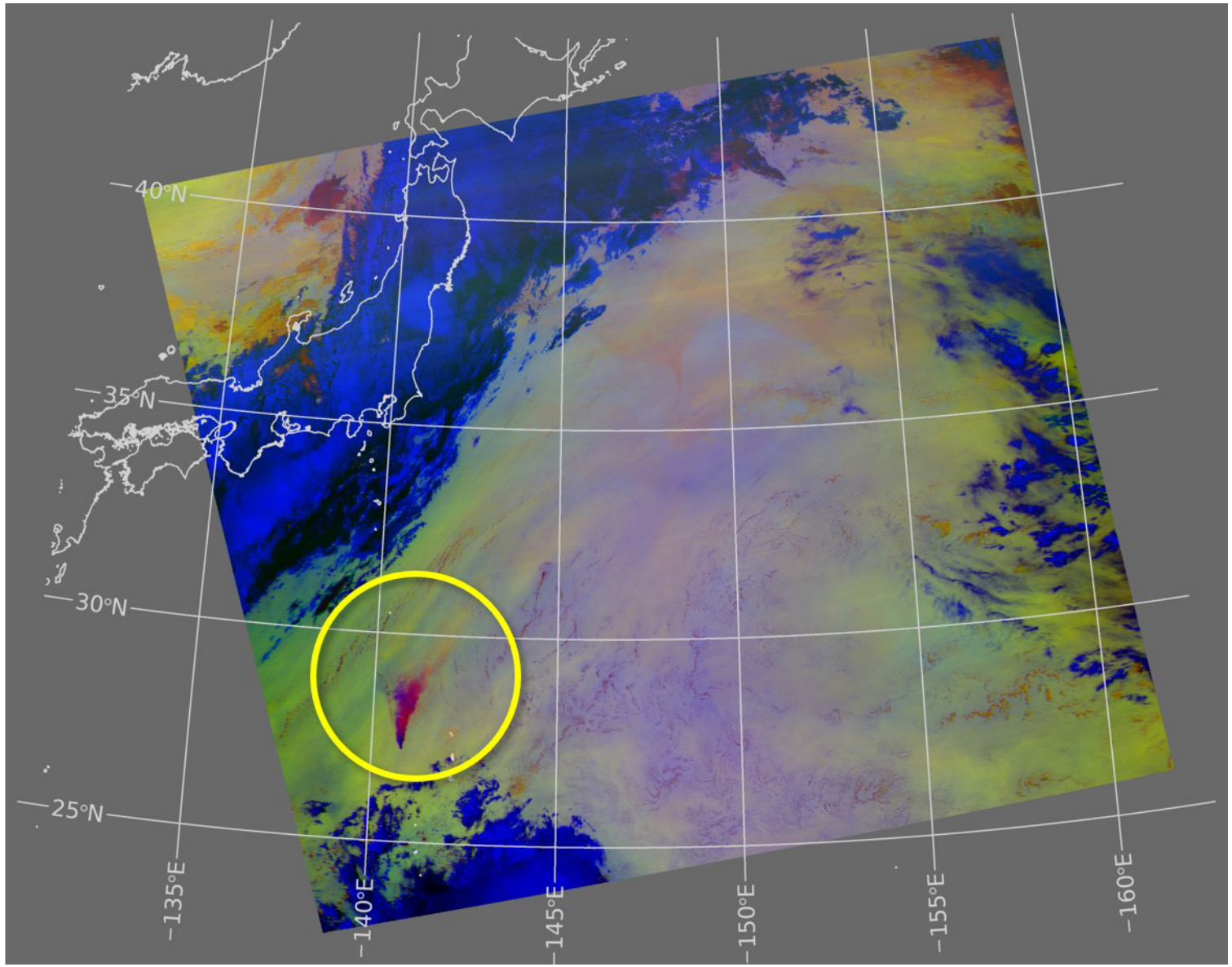
MODIS-Aqua
03:20:00 UTC





Nishinoshima Plume Chronology: 8 July 2020

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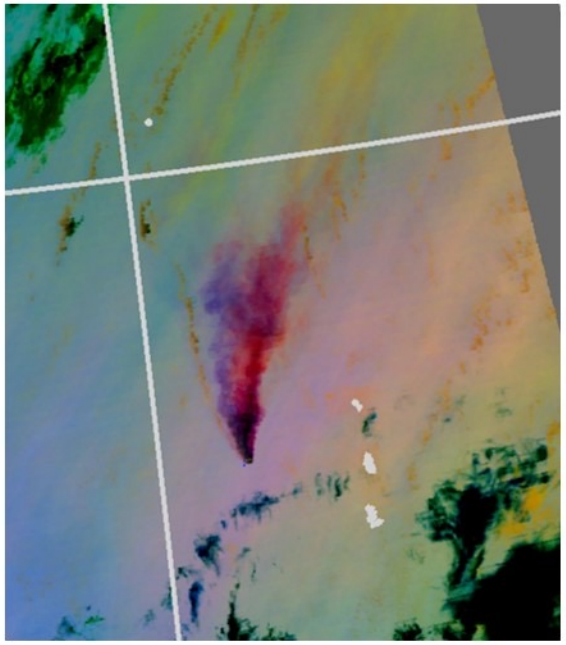
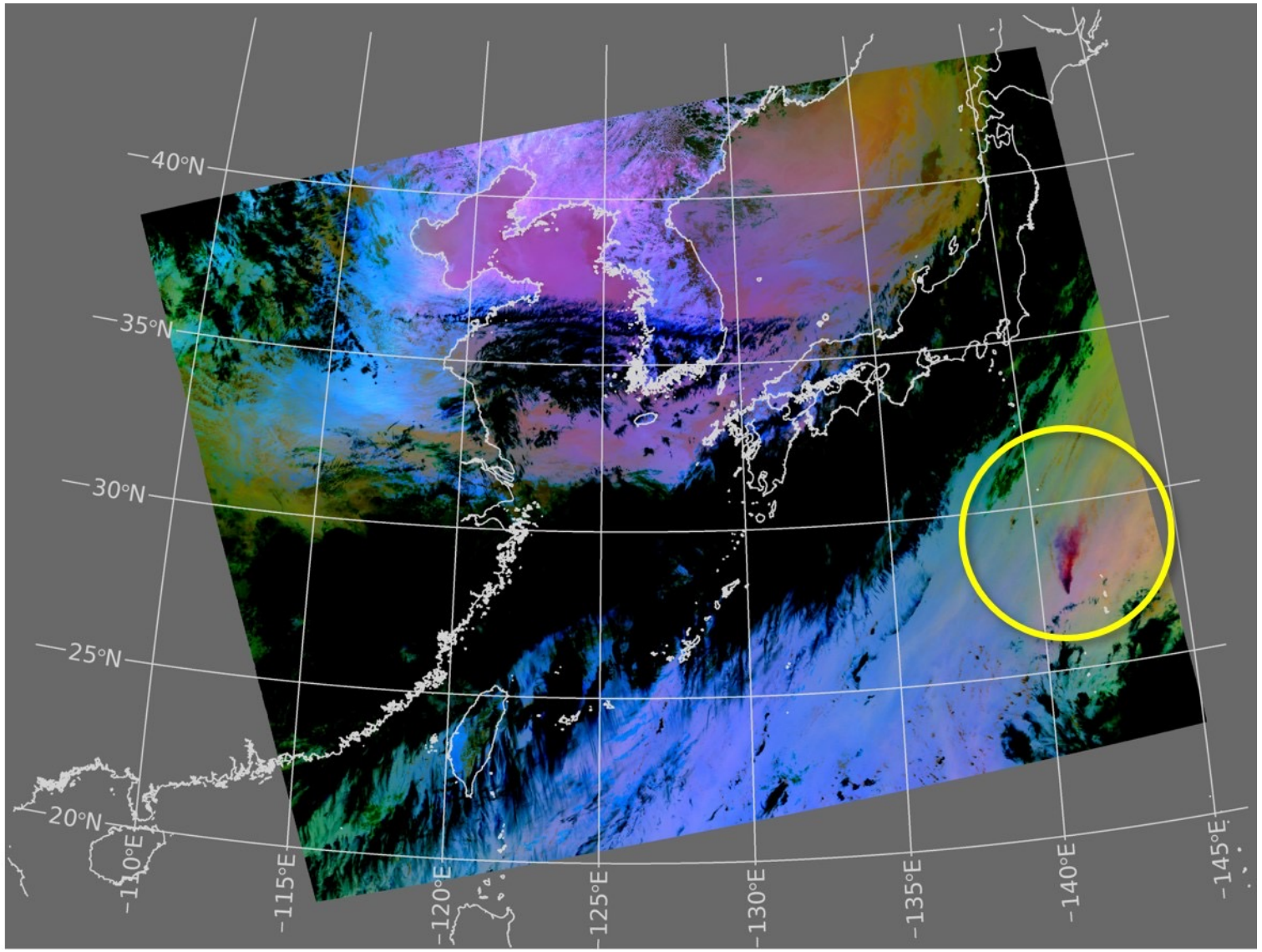
VIIRS-SNPP
04:30:00 UTC





Nishinoshima Plume Chronology: 8 July 2020

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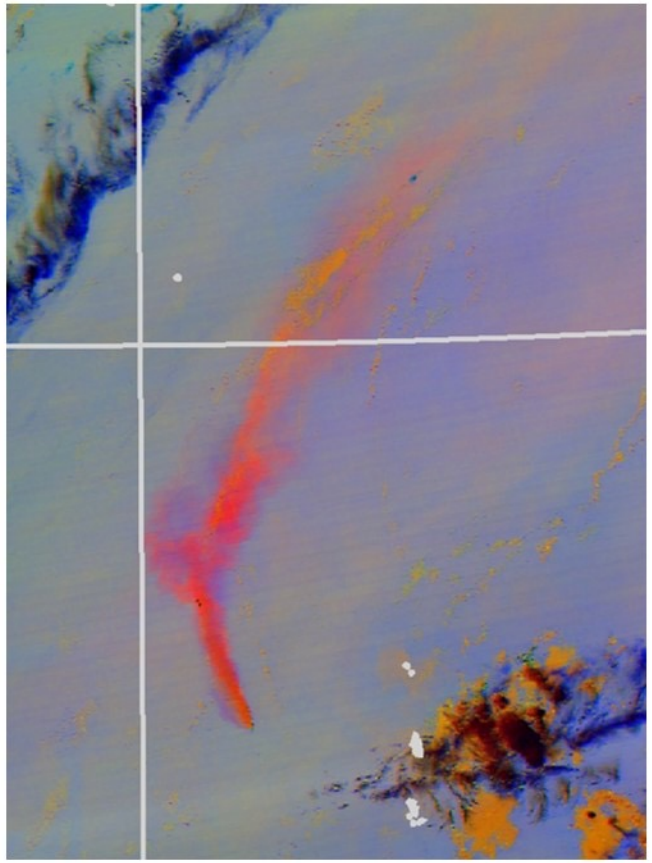
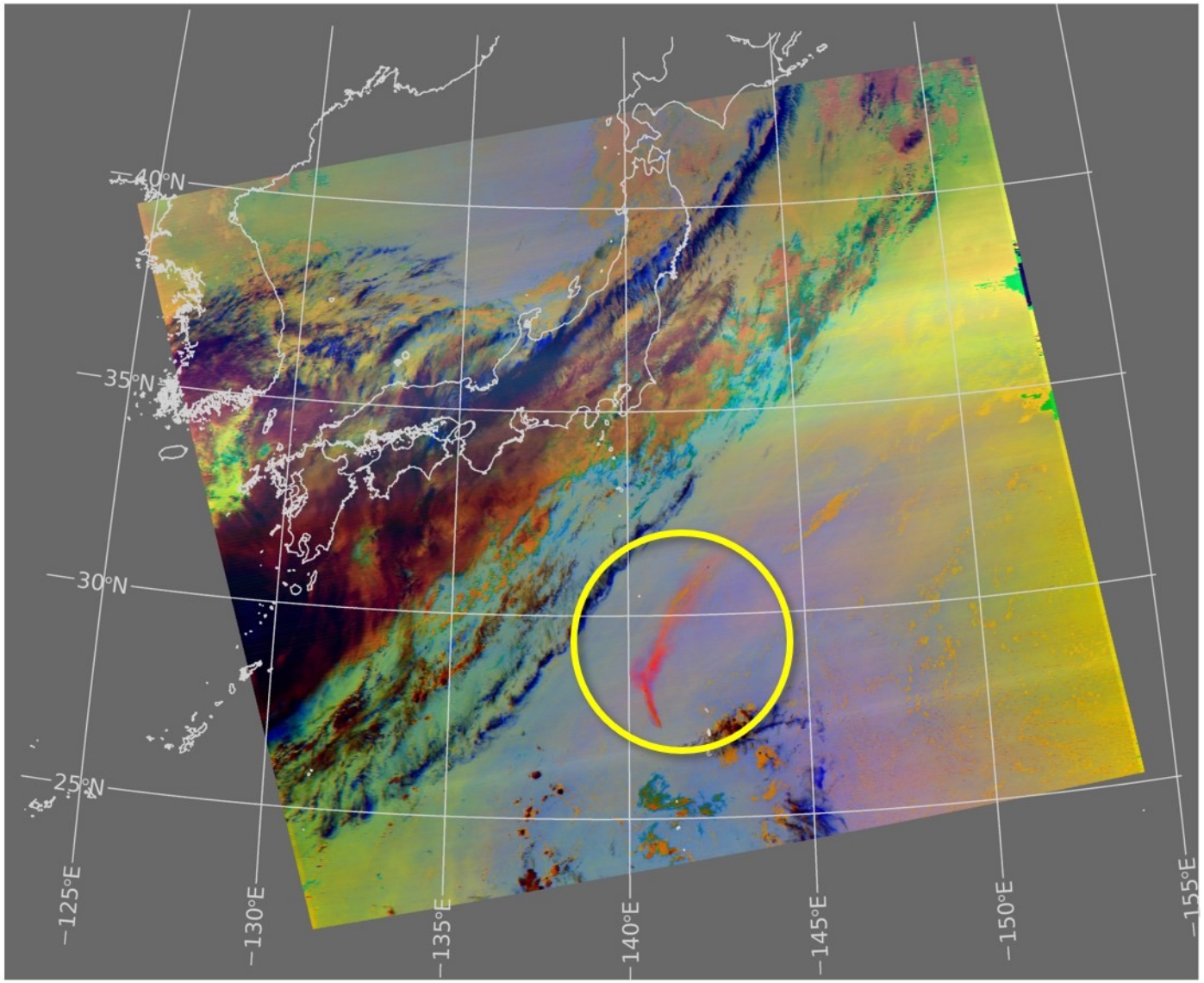
MODIS-Terra
12:45:00 UTC





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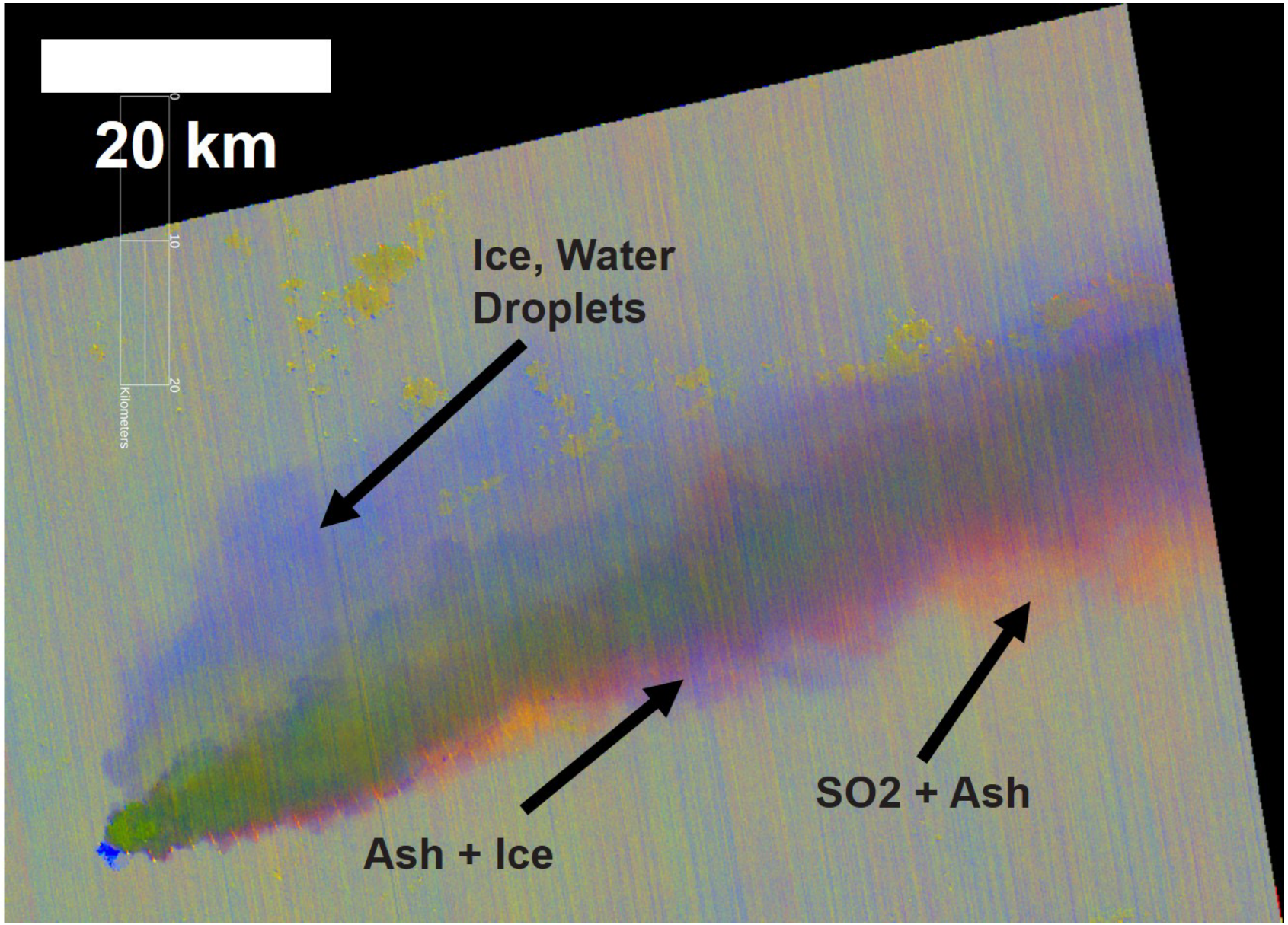
ASTER
12:46:02 UTC

Fine Spatial Resolution (90 m) Resolves Changes in Composition of Plume

Spatial Coverage Limited to Opaque, Near-Vent (Proximal) Portion of Plume

**Williams and Ramsey (2022), J. Volc. Geotherm. Res., doi: 10.1016/j.jvolgeores.2021.107424*



Nishinoshima Plume Chronology: 8 July 2020

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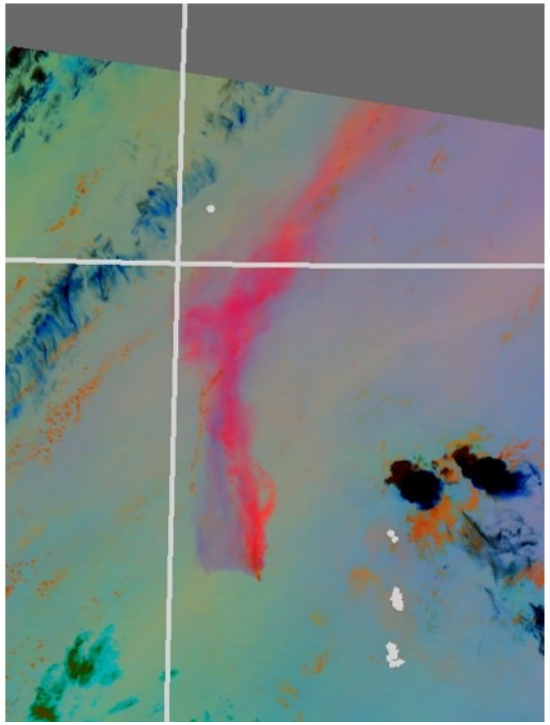
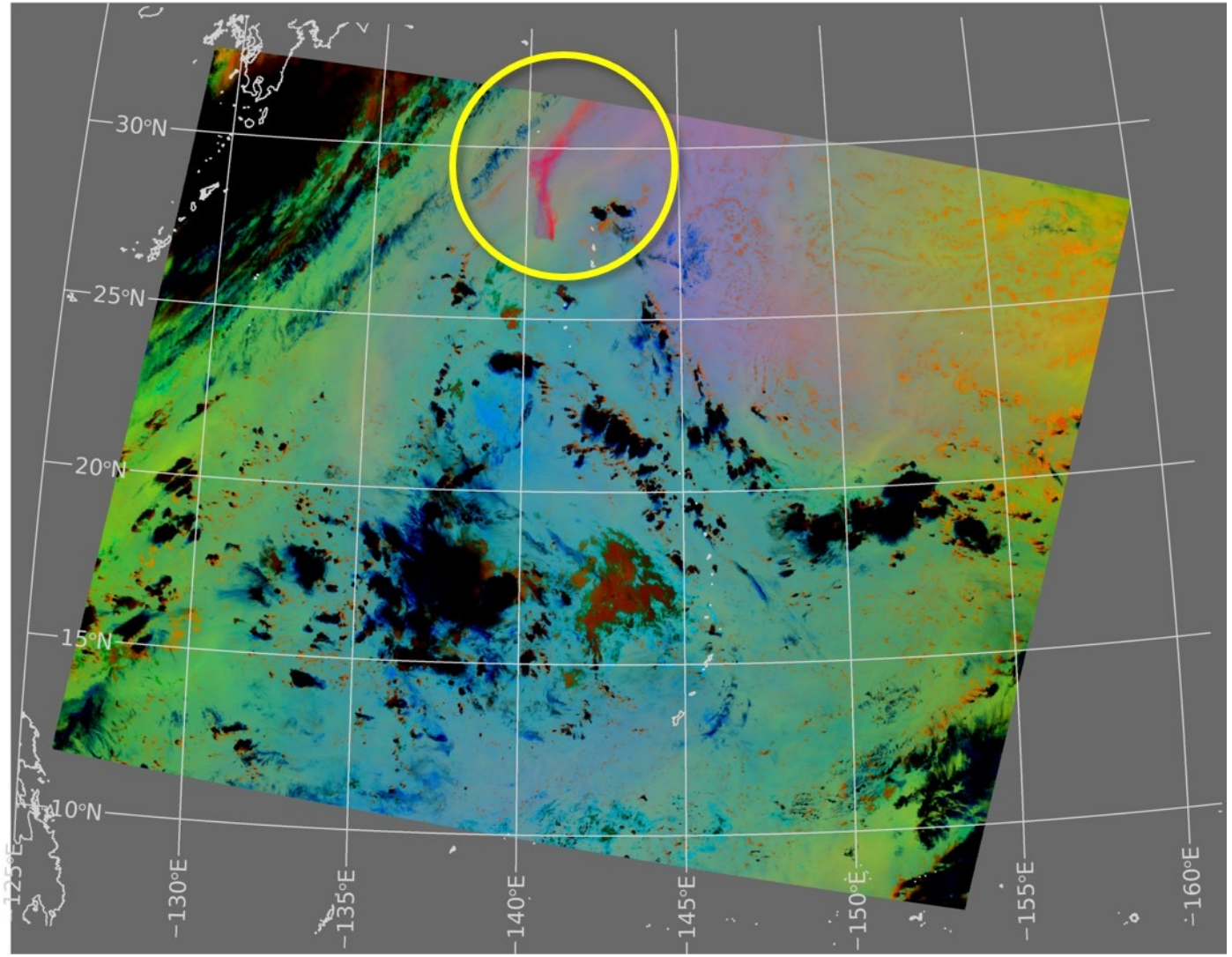
VIIRS-N20
16:06:00 UTC





Nishinoshima Plume Chronology: 8 July 2020

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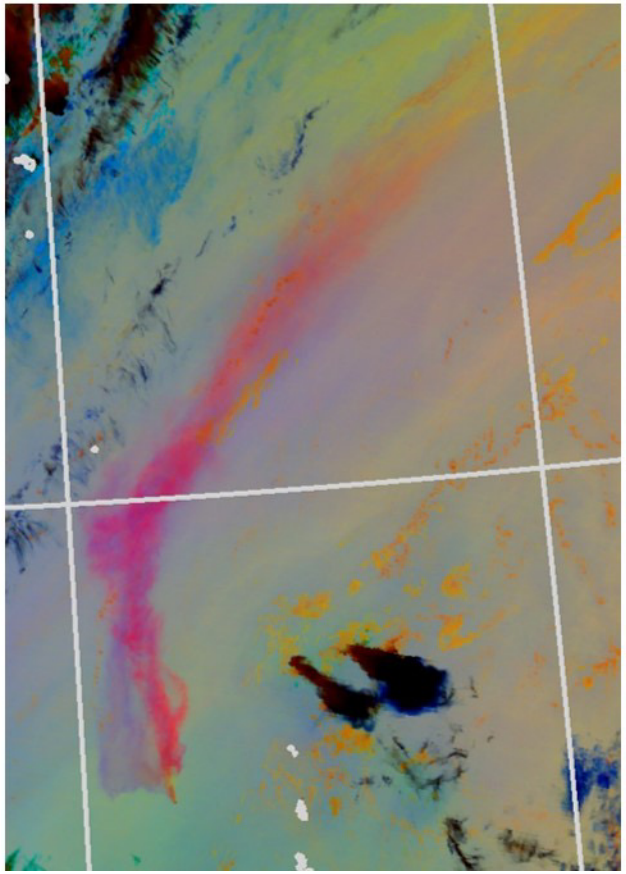
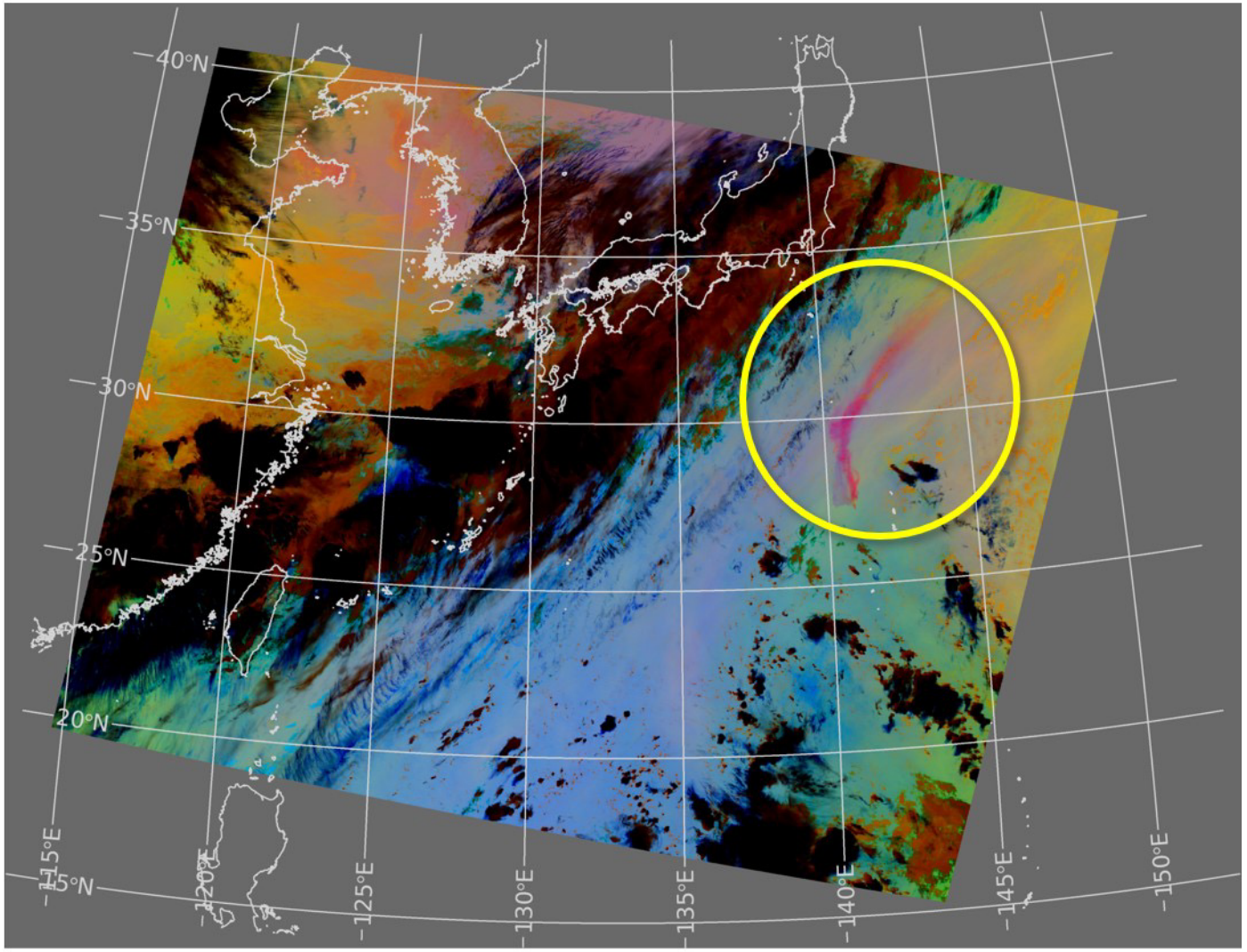
VIIRS-SNPP
16:54:00 UTC





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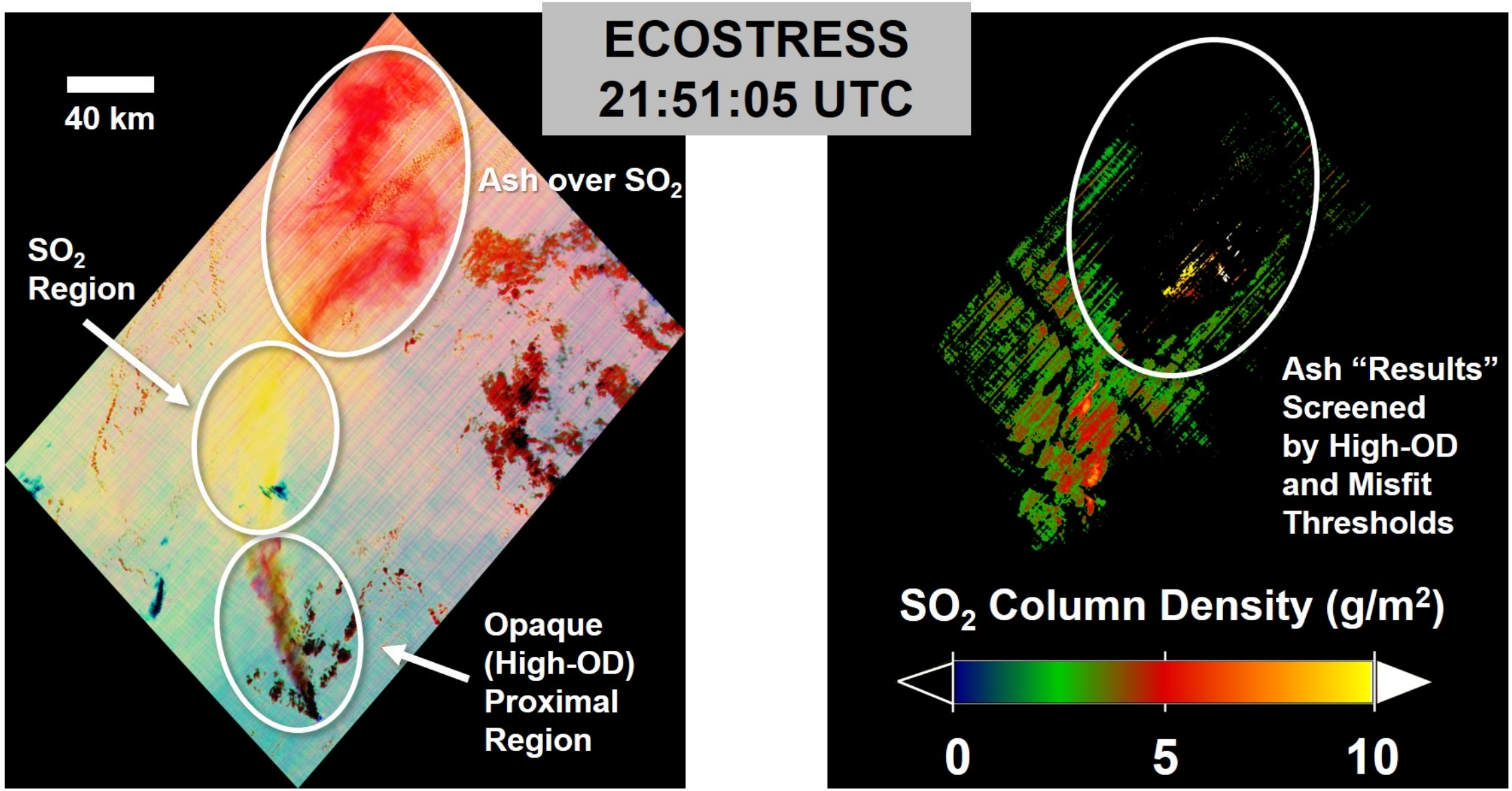

Summary Comments

Unique Combination of Fine Spatial Resolution (~ 70 m) and Wide Field-of-View (440 X 390 km) is Invaluable for Mapping Composition of Volcanic Plumes

SO_2 “Signals” are of Similar Magnitude as Focal Plane “Artifacts,” and Artifacts are Mapped into Retrievals. Pre- and/or Post-Retrieval Filtering is Required

ECOSTRESS as Pre-Cursor for SBG-TIR Data Volumes: Nishinoshima Analysis of ~ 7 X 10^6 Pixels Equivalent to ~ 2.5 MODIS Scenes!
Retrieval Algorithms Require Further Optimization to Accelerate Processing

Thanks for Your Attention!