IN21B: Visual Communication in Science: New Ideas, Best Practices, Great Tools, Awesome Examples eLightning

Highlighting Recent Uses of the NASA Worldview Mapping Application

Abstract

NASA’s Worldview (https://worldview.earthdata.nasa.gov/) web mapping application from the Earth Observing System Data and Information System (EOSDIS) provides a low friction solution for users of different scientific backgrounds to access satellite imagery and data products. Worldview uses imagery from the Global Imagery Browse Services (GIBS), which has an increasing catalog of 800+ products serving global, full-resolution satellite imagery from NASA’s Earth observing fleet.

NASA promotes the open sharing of all data with researchers, private industry, academia, and the general public. Worldview encourages this open data policy. Numerous general news publications feature Worldview for its unique imagery. Worldview also helps scholarly research in identifying field research locations, mapping thermal hotspots of active burning fires, and visualizing theoretical models of weather storm systems amongst other uses. This presentation shares some recent uses of Worldview which highlight its capabilities.

Proposed Structure

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In Media

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- Article, journal links

In Research

- Overview and uses
- Article, journal citations

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- Mission link

Hurricane Dorian

- Geostationary GIF
- Geostationary Description
- 3 geostationary satellites and products

Slide Show

Cool Picture Show

CAMP2EX Airbone Mission Support

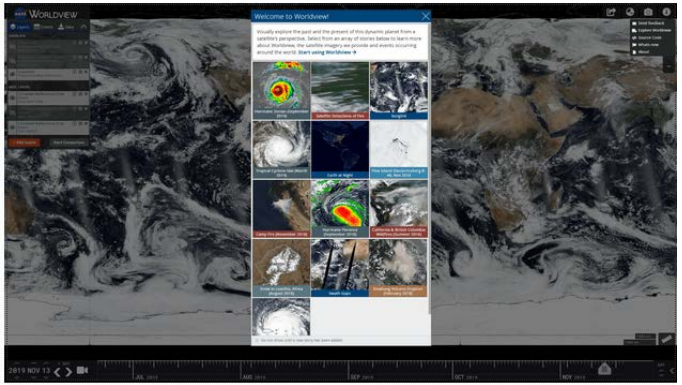
- Overview of how Worldview was used
- CAMP2Ex WV screenshot

What is Worldview?

Worldview (worldview.earthdata.nasa.gov) is a web application from NASA's Earth Observing System Data and Information System (EOSDIS) that provides a low friction solution for users of different scientific backgrounds to access full-resolution satellite imagery and download the underlying data. The Worldview interface capabilities include viewing near real-time and historical satellite imagery layers, downloading full-resolution multi-format images and animations, and accessing data from the ever growing NASA Global Imagery Browse Services (GIBS) collection of over 900 products.

Worldview has an extensive user base spanning government, academia, industry, and general public. These users have goals ranging from casual observation of a single day's imagery to time-critical application areas such as wildfire management, air quality measurements, and flood monitoring or long-term scientific research using the numerous available layers and data products.

Use the Worldview app here:



Access the Free and Open Source Software (FOSS) code on GitHub here:

github.com/nasa-gibs/worldview

In Media

One of Worldview's user communities is the news media. The app is a regularly used tool to quickly access downloaded imagery or create animations of natural events to share in news articles, social media, and scientific journals. In addition to imagery, permalinks can also be shared to connect users directly to specific dates, map coordinates, and customized layers for a more interactive user experience which helps explore content from their stories and in turn empowers the end user to explore the data more in depth.

Here is a diverse selection of recent news articles and stories that have used GIBS imagery and NASA data discovered through the Worldview application:

- Yulsman, T. "**Spectacular spiraling cloud formations spotted from space — at night**." Discover Magazine, 19 April 2019. https://www.discovermagazine.com/environment/spectacular-spiraling-cloud-formations-spotted-from-space-at-night

- Bigelow Laboratory for Ocean Sciences. "**Algae**

In Research

Worldview is also focused to serve the academic community by providing details related to captured imagery like satellite bands, instrument product information, orbital overpass times, and additional external links to layer resources. Depending on your research goals and target results, Worldview can be used as a great first step to identify a study area, create reference imagery, validate historical data trends, and compare different layers. If a more custom solution is required, researchers can host and modify their own custom version of Worldview using our open source code(https://github.com/nasa-gibs/worldview).

Imagery obtained using the Worldview app can be seen in numerous published research articles and journals. Some recent, notable examples of Worldview being used in academic research helps highlight the application's wide range of utility:

- Hrbáček, F. H., Smolíková, J., Nývlt, D., Kavan, J., Engel, Z. (2018). **Observation of the Emperor penguins Aptenodytes forsteri in the Prince Gustav Channel related with unusual sea-ice decline in north-western Weddell Sea**. Revista de

What is CAMP2Ex?

The Cloud, Aerosol, and Monsoon Processes Philippines Experiment (CAMP^{2}Ex) is a response to the need to deconvolute the fields of tropical meteorology and aerosol science at the mesoβ to cloud level. The NASA Earth Science Division operated NASA's P-3 research aircraft and the SPEC, Inc. Learjet 35A out of Clark Airport in the Philippines from August 20th to October 10th 2019.

The scientific questions that are being addressed by CAMP2Ex are:

- To what extent are aerosol particles responsible for modulating warm and mixed phase precipitation in tropical environments?
- How does the aerosol and cloud influence on radiation co-vary and interact?
- To what extent do aerosol induced changes in clouds and precipitation feedback into aerosol lifecycle?
- How does land use change affect cloud and precipitation change?
- Is land use change a confounder for aerosol impacts?

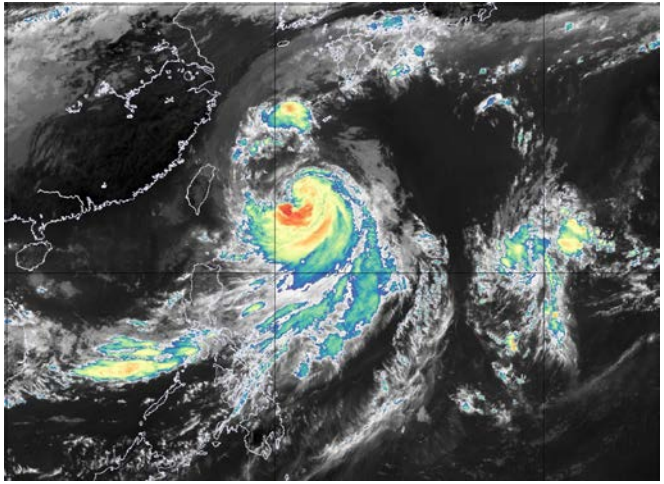
Learn more about CAMP2Ex

here: https://espo.nasa.gov/camp2ex

CAMP2Ex Airborne Mission Support

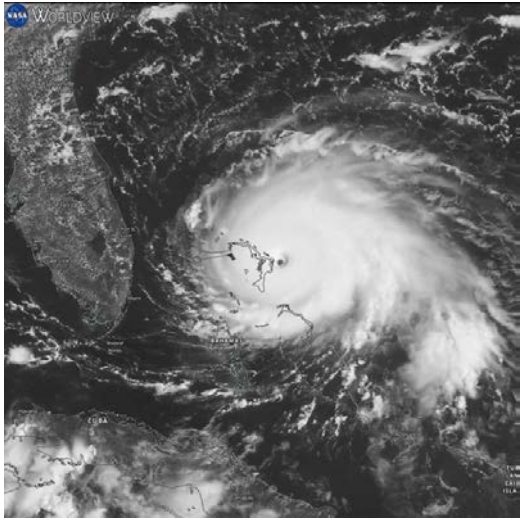
The mission research aircraft were flown primarily over and the ocean in the vicinity of the Philippines. The flights included flying over, under, and through convective cloud systems. As flight safety was a major concern, up-to-date weather briefings were crucial.

A custom deployed version of Worldview was the main interface used for flight planning, inflight support, and post flight analysis. Worldview served as a tool for the identification of rapid changes in cumulus build up for determining flight paths by providing an interface to visually interact with geostationary imagery from the Advanced Himawari Imager (AHI) aboard the Himawari 8 satellite. The Himawari 8 imagery used for this mission is collected at 10 minute intervals making it invaluable for constant, up-to-date weather analysis.



Himawari 8/AHI Brightness Temperature (11 μm, Band 14, 10 minute) Imagery of the Philippines region viewed on the University of Wisconsin-Madison Space Science and Engineering Center (SSEC) CAMP^{2}Ex custom "Geo-Worldview" instance of Worldview

Geostationary Visualizations



Geostationary Operational Environmental Satellites (GOES)-East/Advanced Baseline Imager (ABI) Red Visible (0.64 µm, Band 2, 10 Minute) compiled GIF Animation (2019-01-10:00Z to 2019-01-23:40Z) of Hurricane Dorian approaching the Florida coast

One of Worldview's most recent and exciting enhancements to its interface is the ability to now view geostationary satellite imagery layers in which the satellite is always in the same position with respect to the rotating Earth. With the support of these "sub-daily" geostationary layers collected within 20 minutes of satellite observation, it is now possible to view near real time weather, volcano, and fire events as they are happening in 10 minute interval coverage between each collected image.

With the help of the NASA Short-term Prediction Research and Transition Center (SPoRT), Worldview was able to add near worldwide geostationary layer coverage that includes:

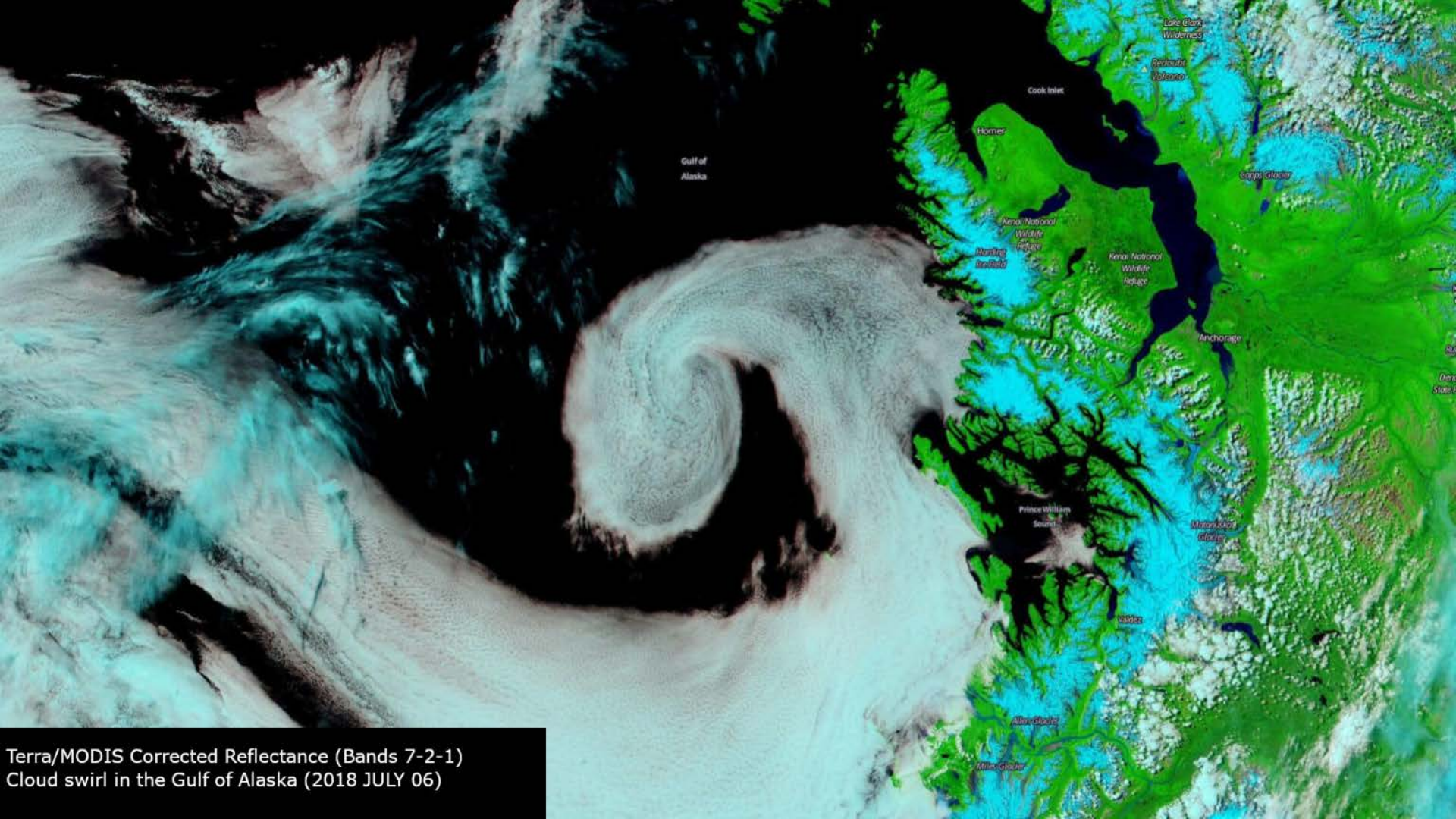
- **GOES-EAST** (*GOES-R/GOES-16*)
- **GOES-WEST** (*GOES-S/GOES-17*)
- **Japan Meteorological Agency (JMA) Himawari-8**

Red Visible, Clean Infrared, and Air Mass are now available to use within the app for all three of these satellites.

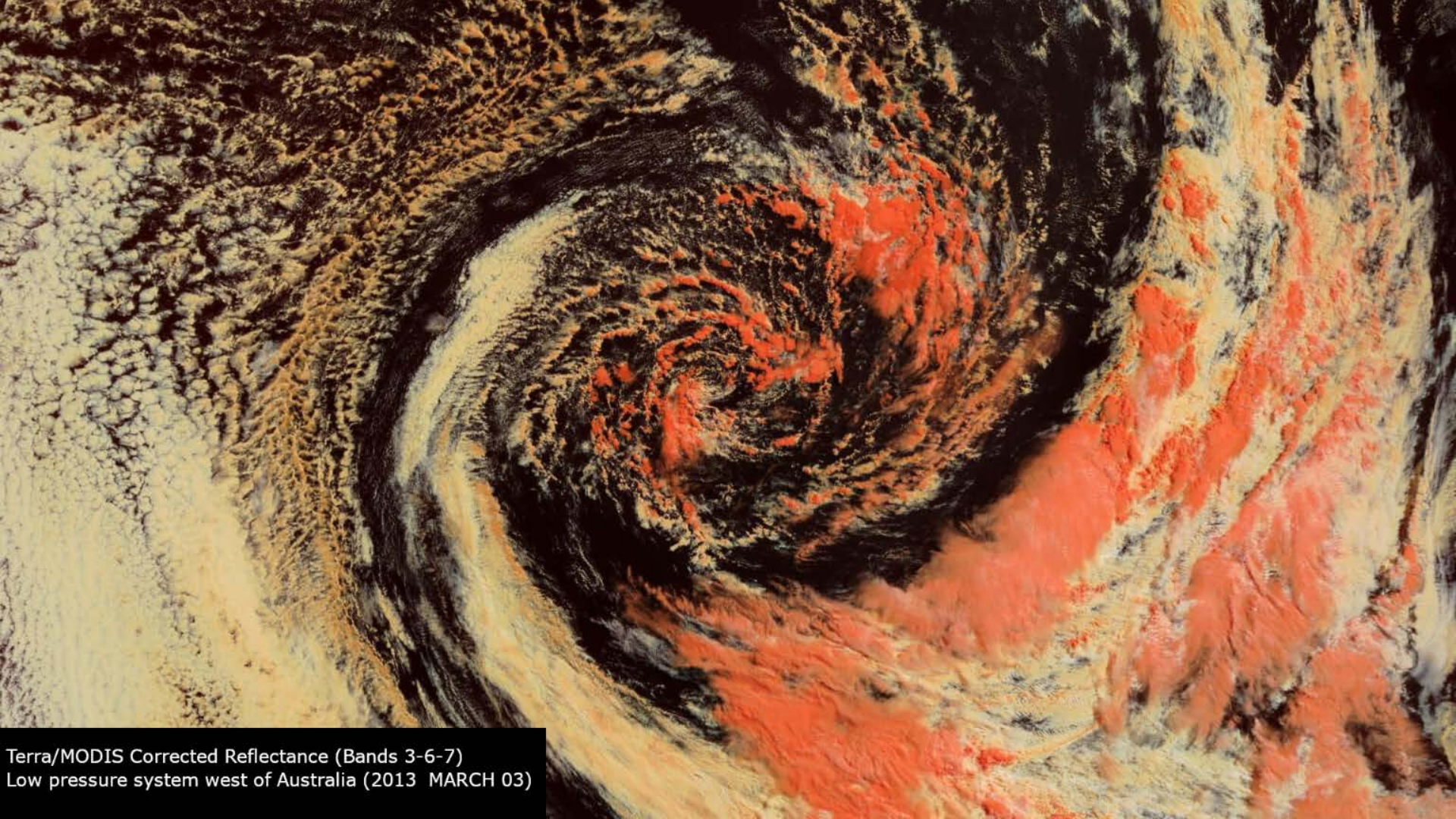
Slide Show

WORLDVIEW

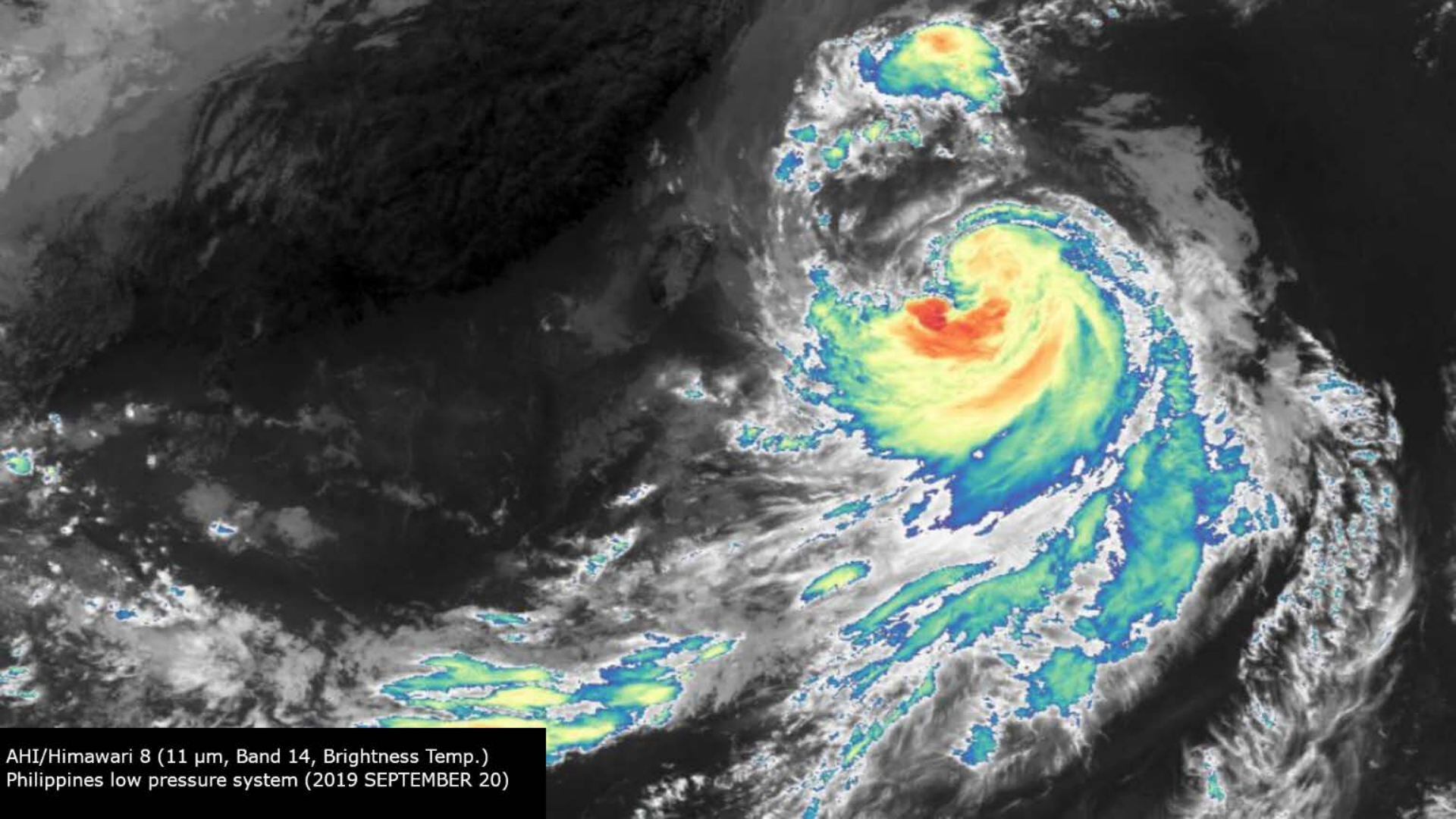
ADVANCING
EARTH AND
SPACE SCIENCE



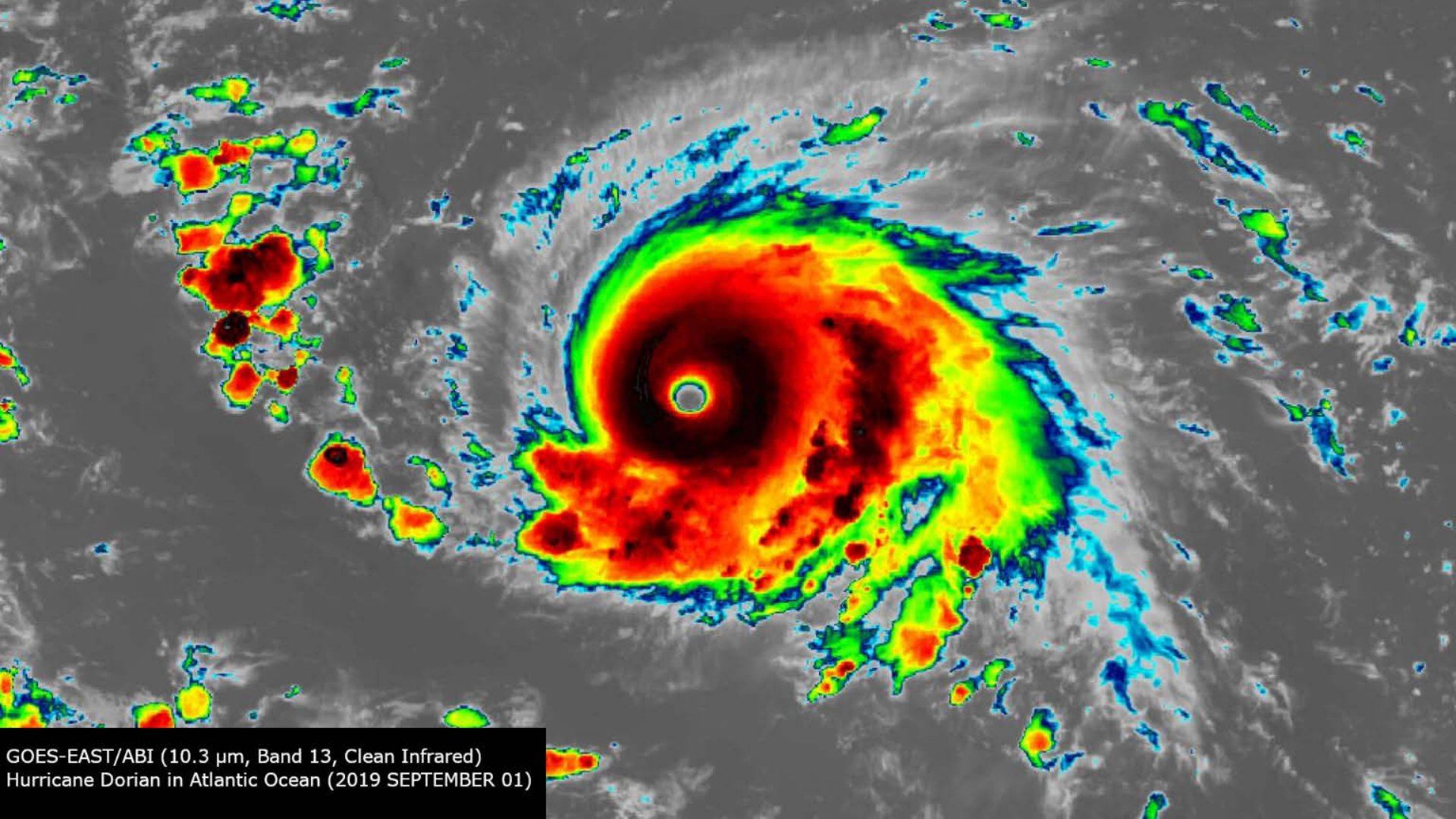
Terra/MODIS Corrected Reflectance (Bands 7-2-1)
Cloud swirl in the Gulf of Alaska (2018 JULY 06)

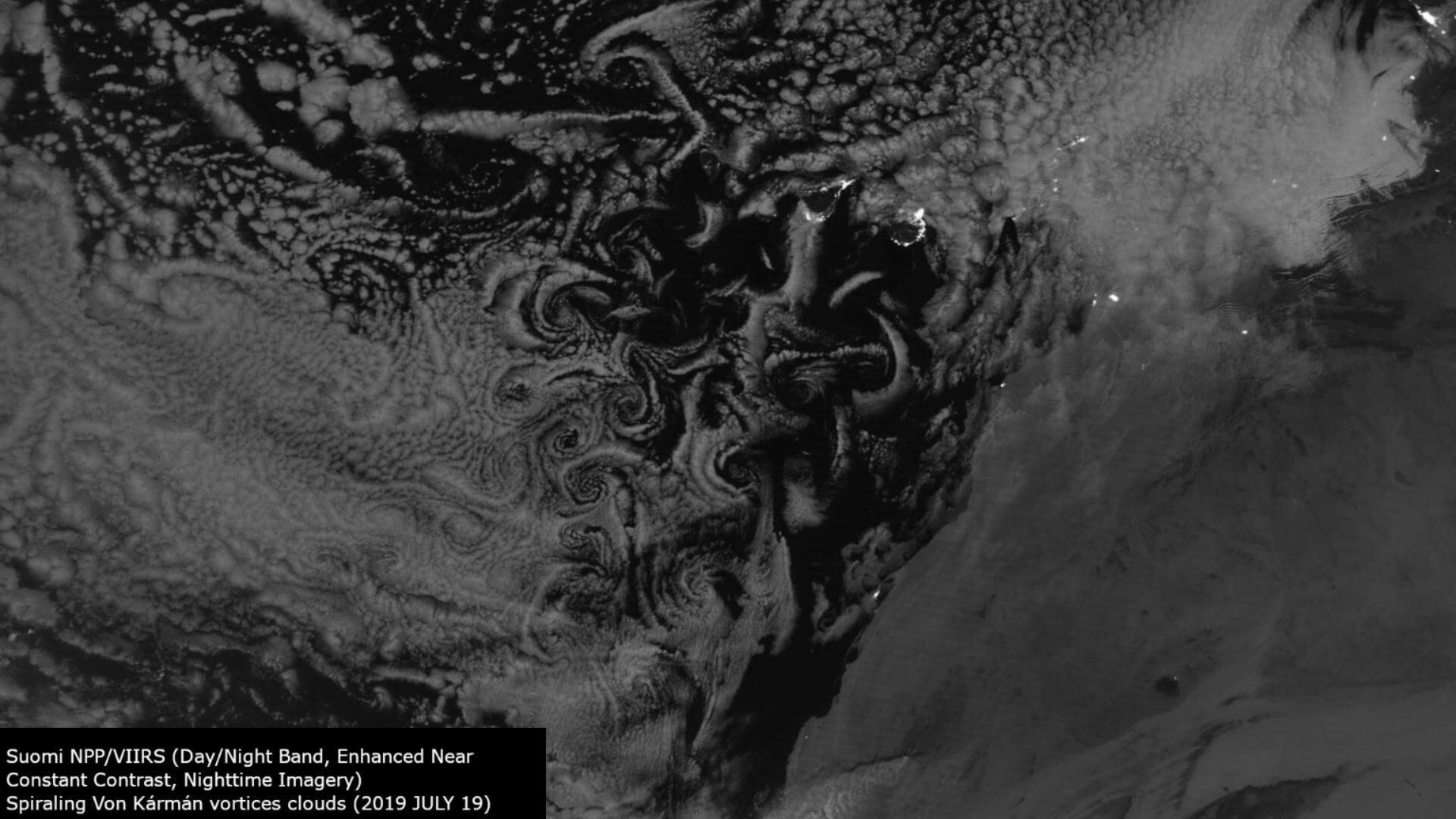

Terra/MODIS Corrected Reflectance (Bands 3-6-7)
Low pressure system west of Australia (2013 MARCH 03)


Terra/MODIS Corrected Reflectance (True Color)
Arctic seasonal ice melt in Beaufort Sea (2019 MAY 22)



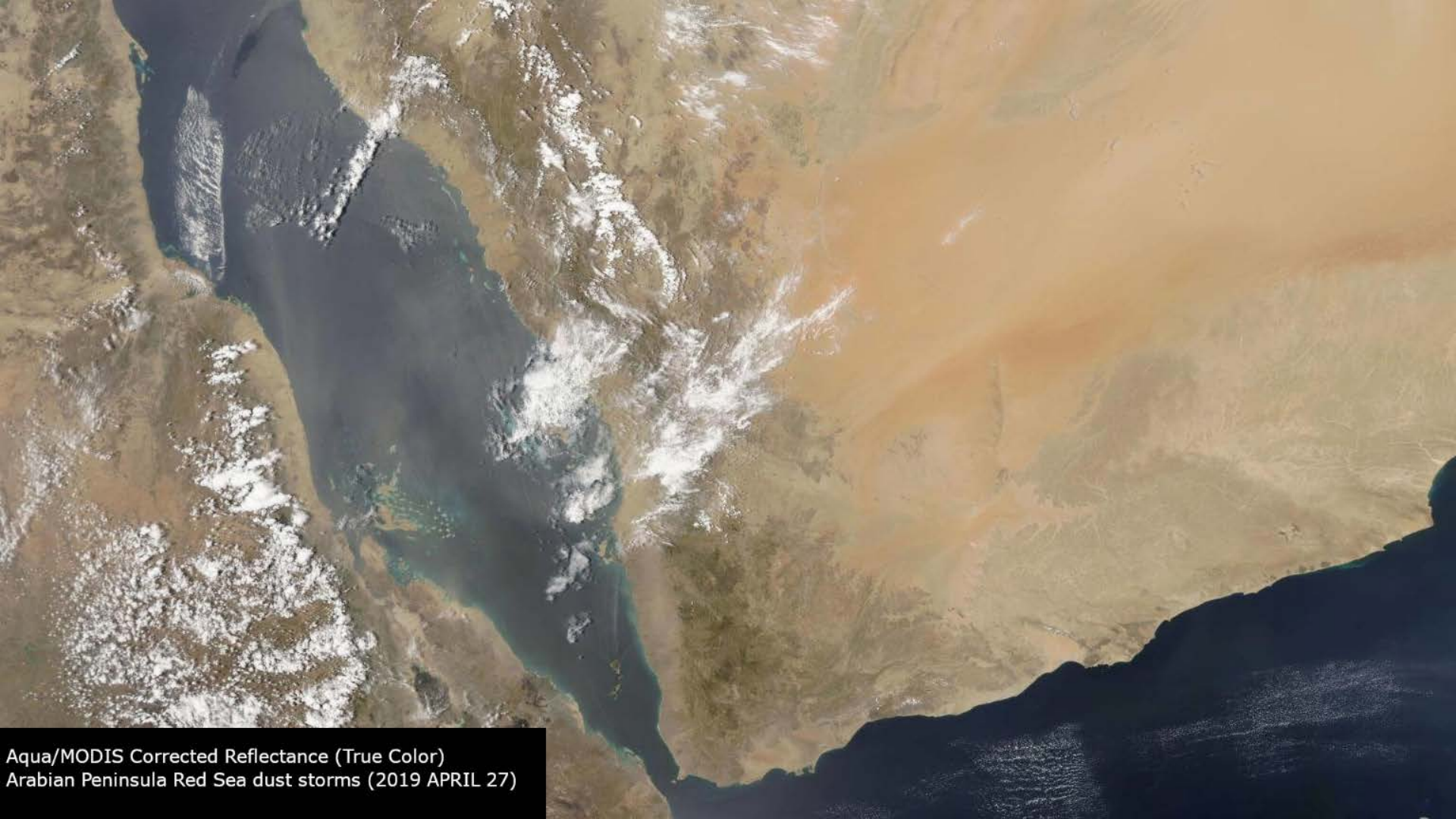
AHI/Himawari 8 (11 μm, Band 14, Brightness Temp.)
Philippines low pressure system (2019 SEPTEMBER 20)


GOES-EAST/ABI (10.3 µm, Band 13, Clean Infrared)
Hurricane Dorian in Atlantic Ocean (2019 SEPTEMBER 01)



Suomi NPP/VIIRS (Day/Night Band, Enhanced Near Constant Contrast, Nighttime Imagery)
Spiraling Von Kármán vortices clouds (2019 JULY 19)

Terra/MODIS Corrected Reflectance (True Color)
Saudi Arabia oil field fires (2019 SEPTEMBER 14)


Aqua/MODIS Corrected Reflectance (True Color)
Arabian Peninsula Red Sea dust storms (2019 APRIL 27)


Aqua/MODIS Corrected Reflectance (True Color)
Aqua/MODIS Fires and Thermal Anomalies (Day)
Russian wildfires (2019 JULY 18)