# Astronaut Earth Observations—Earth's Dynamic Events and Twitpics

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***Fig. 1.*** *View from the International Space Station cupola centered at 34°N 77°W of the mid-Atlantic coast of the United States, with Cape Lookout included as the cape on the right.*

***Fig. 2.*** *Eruption of Sarychev Volcano, Kuril Islands, northeast of Japan, in June 2010.*

***Fig. 3.*** *Hurricane Earl, Atlantic Ocean, on August 27, 2010—5 days after it formed in the Eastern Atlantic—approaching the Caribbean Islands.*

Almost every week, images of some "dynamic event" are requested from orbiting International Space Station (ISS) crews. Dynamic events include hurricanes, floods, tsunami damage, volcanic eruptions, and forest/bush fires. When immediacy is important, NASA can get an image from the astronaut camera to a public website in less than 24 hours. Dynamic and other images are made available on the Crew Earth Observations website, *http://eol.jsc.nasa.gov/*, which is known as the Gateway to Astronaut Photography of Earth.

Other "tools" for quick viewing of dynamic events from orbit include the use of social media in the form of the first Twitter feeds from the ISS, and the installation of the cupola on the ISS in 2010, with its 360-degree viewing capability. Figure 1 is a "fish-eye" view, acquired from the cupola, of the mid-Atlantic coast of the United States.

## Volcanoes

Amazing as it may seem, astronauts have sometimes been close to volcanoes at the moment of the first major explosive activity. Astronaut Jeffrey Williams captured the first explosion of Cleveland Volcano in the Aleutian Islands before the science world was even aware of the incident (*http://earthobservatory.nasa.gov/IOTD/view.php?id=6592*). Crews on board ISS Expedition 20 captured an even more amazing plume of ash rising from Sarychev Volcano, Kuril Islands, northeast of Japan. The image is cataloged at *http://earthobservatory.nasa.gov/IOTD/view.php?id=38985* and illustrated in figure 2. The upward

blast incorporates a white, strikingly bulbous pileus cloud that may be water condensing as air is forced to rise in the plume, and ground-hugging ash, known as a pyroclastic flow, streams down the hillside to the lower right. The origin of the circular, cloud-free zone around the island raised interesting questions in the science community and were discussed at the catalog link. Through a computerized smoothing of a sequence of still images, the movement of the astronaut as well as the billowing plume as it surges upward is illustrated, thereby allowing a desk-bound observer to experience both of these movements. This sequence can be found at: *http://earthobservatory.nasa.gov/images/imagerecords/38000/38985/sarychev_oblique_final_H264.mov*.


***Fig. 4.*** *The Arnica fire in Yellowstone National Park, September 2009. Other fires are visible near Jackson Lake (left) and on the flanks of the Grand Tetons Mountains (top center). NASA ID no. ISS20-E-43017.*

## Hurricanes

Major storms last for many days, and their cloud bands rise up to the top of the troposphere—the weather layer of the atmosphere. The storms are therefore easily photographed and usually evoke much public interest. Images of any hurricane that approaches land are candidates for fast downlink so the public can see the views from space. Hurricane Earl (figure 3) was a long-lived, powerful storm that formed on August 25, 2010, and finally dissipated 10 days later. Interestingly, Hurricane Earl interacted with Hurricane Danielle, which crossed the Atlantic Ocean behind Earl. Traveling just off the East Coast of the United States, Earl was blamed for six fatalities, and became the first major hurricane to threaten New England since Hurricane Bob in 1991. Earl caused power outages for hundreds of thousands of people in Nova Scotia, Canada.

## Fires

The Arnica fire in the Yellowstone National Park (figure 4) was imaged on September 24, 2009—the day after the fire began—when it grew to 101 acres in area (*http://earthobservatory.nasa.gov/IOTD/view.php?id=40681*). Astronauts have observed even small fires giving rise to enormous smoke palls. Here, smoke can be seen streaming southwest toward the Grand Tetons Mountain Range. Oblique images such as this give a powerful sense of three dimensions to fire images and many other phenomena: the smoke rises over Yellowstone Lake, casting an orange reflection in the lake and dark shadows on West Thumb embayment of the lake.

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### Social Media

Social media have promoted the immediacy of astronaut photography, sometimes with images of dynamic events. Astronaut Soichi Noguchi was the first to downlink Twitpics on a regular basis. An example of one of his dynamic Twitpic images include the May 2010 floods in Central Poland. Figure 5 compares one of Soichi Noguchi's images of the Vistula River floods in Poland with a Landsat image of the same region in 2011. The entire area of low country where the Vistula River meets a major tributary is inundated by brown muddy water.

Another example of social media used to share dynamic events observed from the ISS is Soichi Noguchi's Twitpic posting of the Gulf of Mexico following the Deepwater Horizon oil rig disaster on April 20, 2010. Figure 6 captures sun glint patterns of oil on the surface of the Gulf of Mexico on May 4, 2010, several days after the start of the disaster (*http://earthobservatory.nasa.gov/IOTD/view.php?id=43897*).

***Fig. 5.*** *Flooded Vistula River valley, Poland, (left) as captured by Astronaut Soichi Noguchi in May 2010 and centered at 50.6N 21.8E as compared to Landsat image (right) of the same area in 2011.*

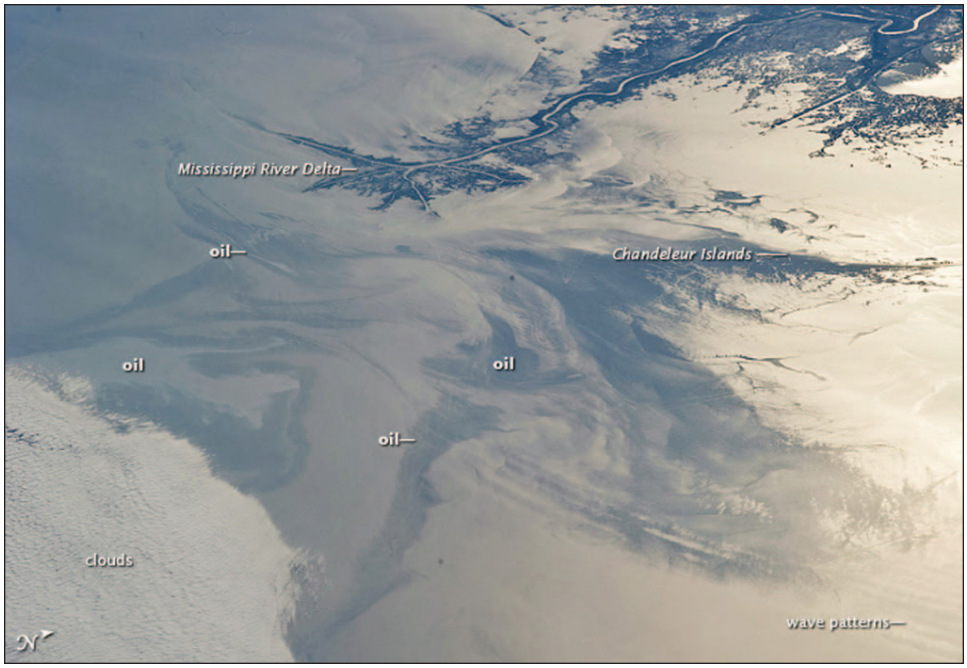


***Fig. 6.*** *Deepwater Horizon oil spill in the Gulf of Mexico, as captured by International Space Station astronauts on May 4, 2010, and subsequently shared with the public via Twitpic posting.*