2016 Winter

ASF News & Notes

Winter 2016, Volume 11:1

ALASKA SATELLITE FACILITY

Get SAR Data

- 2005 Winter
- 2005 Fall
- 2005 Summer
- 2005 Spring
- 2004 Winter
- 2004 Fall
- 2004 Summer
- 2004 Spring
- 2003 Fall

June extravaganza!

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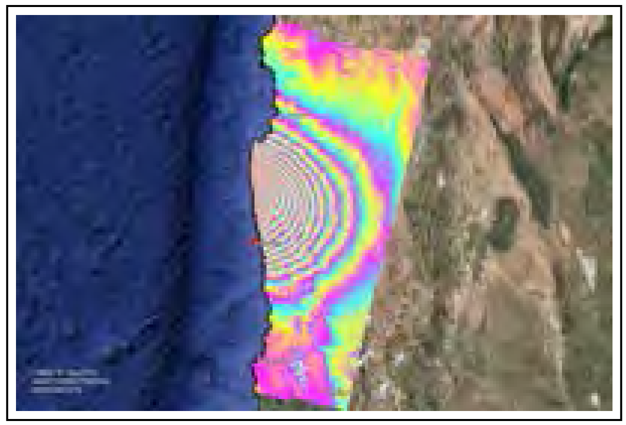
UAF UNIVERSITY OF ALASKA FAIRBANKS

Sentinel-1A Data Now Available from ASF DAAC

Download Sentinel-1 Data



Within days after the 16 September 2015, 8.3 M earthquake in Chile, ASF DAAC scientists used Sentinel-1A acquisitions before and after the quake to create the image at right. The interferogram was unwrapped and rewrapped to a lower fringe rate to improve visual analysis. One fringe (one complete color cycle) corresponds to a relative line-of-sight motion of 8.5 cm. The image is combined with a Landsat image in Google Earth (© 2015 Google). Image credit: F. Meyer, W. Gong 2015; contains modified Copernicus Sentinel data 2015.

The complete historical archive of Sentinel-1A synthetic aperture radar (SAR) data processed by the European Space Agency (ESA) is now available through the ASF DAAC.

As part of the Earth-observation Copernicus program, the Sentinel mission will provide scientists with accurate, timely, and easily accessible information to help shape the future of our planet. The mission facilitates services that include monitoring and mapping of sea-ice; surveillance of the marine environment (including oil-spill monitoring and ship detection for maritime security); monitoring land surface for motion risks; mapping for forest, water and soil management; and mapping to support humanitarian aid and crisis situations.

The Sentinel mission continues decades of radar imagery. This archive is not only essential for practical applications that need long time series of data, but also for understanding the long-term impacts of climate change and planning for a sustainable future.

European Space Agency (ESA)

Sentinel-1A data are available from ESA from a Rolling Archive that delivers data within 24 hours of acquisition and maintains recent months of data. Registration required, and terms & conditions apply.

Alaska Satellite Facility (ASF) DAAC

ASF maintains a complete archive of processed Sentinel-1A data, available with three days of acquisition. Registration required, and terms & conditions apply. Da feeds are available.

Announcement on Sentinel Data Availability

On October 16, 2015, the United States of America (U.S.) Department of State and the European Commission (EC), signed a Cooperation Arrangement on Earth Observation data. Following this, the National Aeronautics and Space Administration (NASA) and the European Space Agency (ESA) signed a Technical Operating Arrangement that provides access to data from the Sentinel satellites, the dedicated space component of the European Copernicus programme.

NASA, working in conjunction with ESA, has implemented a Sentinel data mirror archive in the U.S. for re-use and re-dissemination of Sentinel products. The NASA mirror will increase distribution capacity, maximizing the benefits to Earth Science research and applications. As per the agreement, NASA will make the Sentinel core products available to users who register for Earth Observing System (EOS) Data and Information System (EOSDIS) user accounts and who have agreed to the terms and conditions set by the European Union to access Sentinel data. Sentinel data archived by NASA will be provided to all science data users without further access conditions or restrictions.

To access the NASA mirror of Sentinel 1A data, please visit Vertex, ASF's data portal.
For more information on the Copernicus Programme, please visit http://copernicus.eu/.
For more information on the Sentinel missions, please visit http://sentinels.copernicus.eu/

ASF Launches Data Feeds

Data Feeds

Sentinel-1A and UAVSAR

data feeds are now available from ASF.

The Sentinel feeds include six geohazard Supersites collaboratively identified by the geohazard scientific community in the Group on Earth Observations (GEO): Hawaii, Iceland, Marmara Sea, Mt. Etna, Mt. Vesuvius, and the San Andreas Fault.

Developing a Great Lakes coastal-wetlands map using three-season PALSAR & Landsat imagery:

Six questions

- Sarah Endres, Laura Bourgeau-Chavez, Michael Battaglia, Mary Ellen Miller; Michigan Tech Research Institute, Michigan Technological University

Figure 1. Land use land cover map of the coastal Great Lakes with a total accuracy of 94%. Click here for link to full map (http://geodjango.mtri.org/coastal-wetlands/). Bourgeau-Chavez et al. 2015. Includes Material © JAXA/METI 2008, 2010; JPL/NASA Landsat imagery.

Real-world application and data fusion are two of the most intriguing frontiers in the world of synthetic aperture radar (SAR). So when Michigan researchers reported this year in Remote Sensing that they had used PALSAR and Landsat imagery to create a Great Lakes wetlands map (Figure 1), ASF News & Notes followed up with questions.

1. Why the Great Lakes, and why wetlands?

As part of Earth's largest surface freshwater system, holding almost one fifth of the planet's freshwater, the wetlands of the Great Lakes play critical roles. Their many ecosystem services including water filtration, flood control and habitat for many rare flora and faunal species[1]. Monitoring at the regional scale, starting with a baseline map, is necessary to effectively understand and mitigate the pervasive risk posed to these wetlands by climate and anthropogenic change (e.g. dredging, shoreline modification, water level regulation, nutrient enrichment, invasive species, and road development)[2].

In 2010, the EPA funded the production of a baseline map of wetland type and extent for the bi-national coastal Great Lakes (9,056,410 ha within 10 km shoreline buffer) to aid in resource management[3].

2. How did you select mapping methods?

Previous research has shown it is difficult to accurately classify wetland types based solely on optical characteristics [4, 5]. Fusion with a complementary sensor type, such as SAR, enables detection of a larger set of wetland characteristics. We selected moderate-resolution SAR (20-30 m resolution) and cloud-free Landsat TM data for their cost, accuracy, and reproducibility.

SAR data detect flooding beneath a vegetation canopy, changes in water levels and soil moisture, and other biophysical vegetation characteristics (e.g. biomass and structure). ALOS-1 PALSAR data, made available through the Alaska Satellite Facility (ASF), allowed for multiple seasons of complete Great Lakes coverage. Landsat was important for distinguishing the upland and land use classes. It also provides verification of the cover types that SAR predicts in the mapping.

The mapping approach integrated satellite datasets with high-resolution air photo interpretation and extensive field data collection (2,000 wetland field locations) for training and validation. Mapping occurred by areas of interest (AOI) that were defined by intersecting PALSAR 70-km-x-70-km footprint with Landsat scenes. Field data were collected on wetland types within each footprint. Broad land cover classes were mapped, with a focus on the wetland ecosystem classes (e.g. emergent wetland, shrub wetland, and forested wetland). The mapping approach allowed for distinguishing forested, shrub, and open peat lands from inundated shrub and forested wetlands. It also allowed for delineation of monocultures of wetland plant species including invasive and non-invasive.

3. Did you take seasons into account?

The timing of data collections is critical to wetland detection. The mapping approach utilized multi-season (spring, summer, and fall) datasets of PALSAR (L-HH and L-HV) and Landsat TM (bands 1-7 and NDVI) in a Random Forests (RF) classifier. Using seasonal data captures phenological and hydrological changes throughout the growing season to allow for improved differentiation among wetland classes [6, 7].

In the case of the Great Lakes, spring data when water levels are typically high were crucial, as well as summer data when vegetation was at its peak. Some wetland types are wet in fall, making the third season of imagery useful as well. An example of the sensor and seasonal differences in the PALSAR and Landsat TM data can be seen in Figure 2 of Lake St. Clair, Michigan.

4. What accuracy did you achieve?

The overall accuracy for the map of all five lake basins was 94% (Figure 1), with a range of 86% to 96% by individual lake basin (Huron, Ontario, Michigan, Erie, and Superior). The mapping approach allowed us to meet our target overall map accuracies of 90% or better for all of the Great Lakes except Ontario which had a map accuracy of 86%. In addition, most individual class accuracies (e.g. forested wetland or Typha spp.) were greater than the targeted 70%.

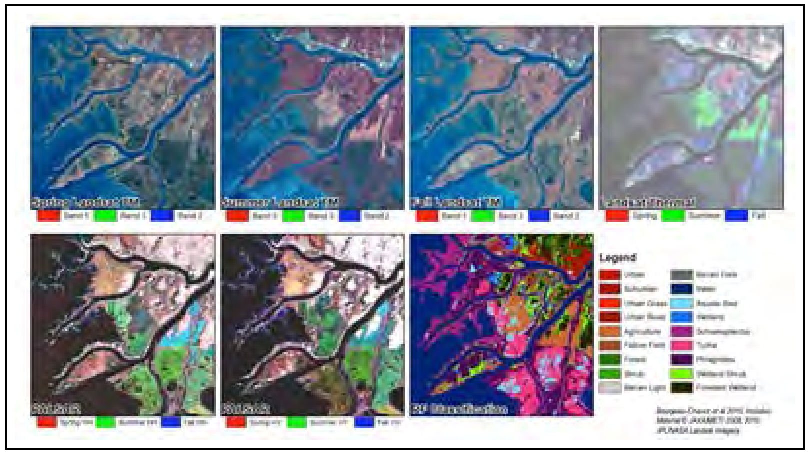


Figure 2. Multi-temporal and multi-sensor depiction of a large wetland complex on the St. Clair River Delta bordering the U.S. and Canada. Top row shows spring, summer, and fall Landsat 5 TM imagery (bands 5, 3, 2). Bottom row shows the following false-color composites: Landsat TM thermal (spring, summer, and fall); PALSAR spring, summer, and fall HH; and PALSAR spring, summer, and fall HV. Image dates: Landsat 5/5/2011, 8/7/2011, 9/10/2010; PALSAR 5/26/2008, 17/7/2010, 17/10/ 2010. Bourgeau-Chavez et al. 2015; Includes Material © JAXA/METI 2008, 2010; JPL/NASA Landsat imagery.

5. How useful was SAR in mapping wetlands?

By analyzing the importance of each input variable (band) from Landsat and PALSAR, we found that SAR was most useful in mapping wetlands and less useful in mapping areas that were dominated by upland cover. For example, for the St. Clair area, which is dominated by wetlands, we determined that the following bands (Figure 2) were most important: spring Landsat NDVI, spring Landsat thermal, and spring PALSAR L-HH backscatter, followed by summer PALSAR L-HV and fall PALSAR L-HH.

Some researchers have reported that PALSAR was of low importance for mapping wetlands (e.g. Margono et al. 2012), when in fact they were evaluating overall band importance from broad areas with a large proportion of upland. Any conclusions about the lack of importance of SAR in such a case would be unfounded.

Clewey et al. 2015 acknowledges this disparity in reporting overall band importance for mapping the state of Alaska with PALSAR, static DEM, and geographic data. In their case, PALSAR was of less importance overall than positional information. When they evaluated the efficacy of their input variables, they found that PALSAR was most important for detecting emergent wetlands. We found that the statistics for band importance should be evaluated with context of the dominant landscape feature to avoid inaccurate conclusions about the utility of SAR.

6. What did you accomplish using these different sources of data?
The SAR-optical data fusion method used for mapping the coastal Great Lakes demonstrated a repeatable, accurate, and timely method for mapping large areas while integrating image interpretation, field data, and moderate-spatial-resolution remote sensing in a machine-learning approach.

The Great Lakes coastal wetland map represents the first comprehensive wetland map of the bi-national coastal Great Lakes using a consistent mapping technique. Although the map represents a static point in time, it serves as a baseline for future mapping of change.

The maps can be viewed and requested for download (http://geodjango.mtri.org/coastal-wetlands/). A full description of the research and mapping are provided in the open source journal article http://www.mdpi.com/2072-4292/7/7/8655 and on the website http://www.mtri.org/coastal_wetland_mapping.html.

References, Great Lakes Wetlands

International remote-sensing researchers gain new access to PALSAR data through ASF DAAC

Download Data

An agreement between the United States and Japan gives international researchers unrestricted access to ALOS-1 PALSAR data archived at the ASF DAAC.

The data represent a significant collection of L-band synthetic aperture radar (SAR) data captured during the Japanese Aerospace Agency's ALOS-1 mission, which operated from 2006 to 2011. PALSAR's L-band wavelength provides information for a broad range of applications, including tree-species classification, forest-canopy studies, interpretation of geologic structures, land-surface information, analysis of soil moisture, detection of topographical change, detection of oil slicks, and the monitoring of sea ice.

ASF has distributed ALOS-1 PALSAR data since 2006. The initial agreement with Japan, owner of the PALSAR data, required that scientists register and submit a proposal in order to obtain the information. Non-U.S. researchers also paid a fee. The new agreement mirrors NASA's free-and-open data policy, asking users simply to register.

SAR bounces a microwave beam off the Earth's surface, resulting in detailed images of surface properties. "It's a true 24/7 data set," says Franz Meyer, Chief Scientist for ASF and associate professor in the Geophysical Institute. "It can observe the planet regularly no matter if it's day or night, and no matter what the weather conditions are. This makes it very useful for analyzing changes over time."

"Basically, before you even started doing some work you had to know enough about what you wanted to do to be able to write a proposal or to convince yourself to spending enough money to get these SAR data sets," says Meyer. "Now, it is more likely that scientists who are not used to using SAR data are going to jump into this field, download these data sets, analyze these data, and find interesting information in the data."

The National Oceanic and Atmospheric Administration (NOAA) originally brought the ALOS data to the U.S. by establishing a partnership with the Japan Aerospace Exploration Agency and ASF prior to the ALOS-1 launch. NASA has been working with the Japanese government to increase the amount of data available and to make these data unrestricted.

As ASF Director Nettie La Belle-Hamer notes, the success of this current effort is due to the strong collaboration between NASA and NOAA. "It's not just one agency; it's U.S. government agencies working together," she says. "NOAA and NASA did a lot to help make this happen."

> "This has a huge impact on the remote sensing community. Now the process for getting these data becomes much easier, making them available to a much broader international crowd than could access them before."
> — Nettie La Belle-Hamer, Director, Alaska Satellite Facility

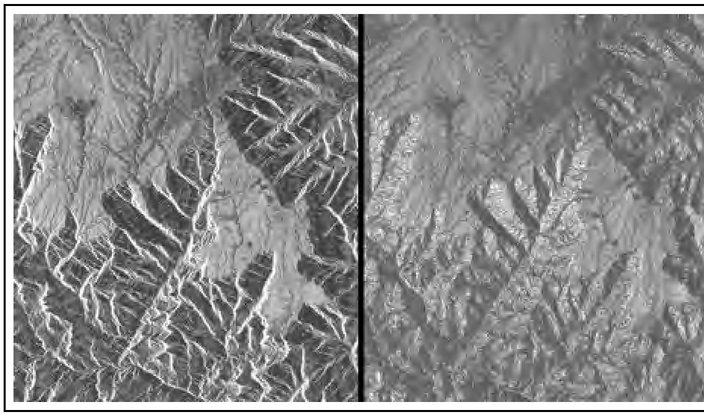
For La Belle-Hamer, the significance of having these data unrestricted goes beyond agencies and governments. "This is about research. This is about basic science," she says. "This is what NASA does, and this is why we do what we do."

More information is available at www.asf.alaska/edu/sar-data/palsar/.

Complete:

Radiometric Terrain Correction of ALOS-1 PALSAR Data

Download Data



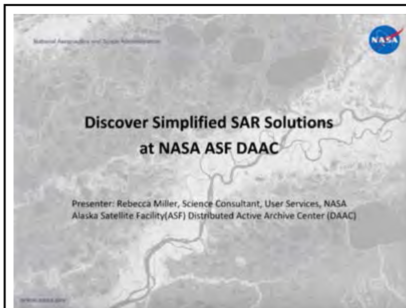
These two images of part of the Grand Canyon are processed from the same PALSAR data. In the uncorrected image on the left, the sides of the canyon appear to be stretched on one side and compressed on the other side. The image on the right is terrain corrected. ASF DAAC 2014; Includes Material © JAXA/METI 2008.

All ALOS-1 PALSAR data archived at ASF is now radiometrically terrain-corrected (RTC) is now complete, making SAR data accessible to a broader community of users.

The one-year project corrected SAR geometry and radiometry and made the data available in the GIS-friendly GeoTIFF format. Data included in the RTC project are Fine Beam and Polarimetric scenes in all global land areas except Antarctica, Greenland, Iceland, and northern Eurasia.

See the ALOS-1 PALSAR RTC web page for more information and RTC resources.

Webinar Available for Viewing: Discover Simplified SAR Solutions at NASA ASF DAAC



Now available online, an ASF-produced, NASA Earthdata Webinar titled "Discover Simplified SAR Solutions at NASA ASF DAAC" features information about available SAR datasets at the ASF DAAC, SAR data discovery, and data access tips/tutorials.

The webinar was presented in September 2015 as part of NASA's Earthdata webinar series.

ASF 25th-Anniversary Celebration Slated for June

Join the celebration of ASF's quarter-century milestone at an open house in early June 2016. The day will feature an art show, scientific poster sessions, and activities for all ages linking varied Earth sciences to the data and services provided by ASF. If you would like to be notified of the date, please send an email to uso@asf.alaska.edu.

Since 1991, ASF has provided synthetic aperture radar (SAR) data and imagery from key Earth-observing satellite sensors to a growing community of international researchers. As one of 12 NASA Distributed Active Archive Centers, ASF archives and distributes more than 2.5 petabytes of SAR data to scientists studying subjects that include ecology, earthquakes, volcanoes, glaciers, permafrost, oil spills, climate change, and more.

Name

Email