

SAR-BASED ESTIMATION OF GLACIAL EXTENT AND VELOCITY FIELDS  
ON ISANOTSKI VOLCANO, ALEUTIAN ISLANDS, ALASKA

by

NASA DEVELOP National Program  
Ames Research Center  
2012

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SCENE 1 – INTRODUCTION PPT SLIDE

*NASA DEVELOP National Program*

*Ames Research Center*

2012

*\*NASA Logo\**

SCENE 2 –INTERVIEW, BLDG. 242 AMES RESEARCH CENTER

*DANIEL SOUSA*

“Glaciers are losing mass at alarming rates.  
It’s something we simply cannot ignore.”

SCENE 3 – TEAM WALKING AT AMES RESEARCH CENTER, “5 YOUNG SCIENTISTS”  
TEXT

*OWEN PARKER*

“We chose to study the Aleutian Islands  
because glaciers flanking volcanoes are  
particularly interesting.”

SCENE 4 – IMAGE ISANOTSKI VOLCANO, “5 ALEUTIAN GLACIERS” TEXT

*OWEN PARKER*

“Volcanic activity and climate fluctuations  
increase the rate of glacial melt...”

SCENE 5 – CODE RUNNING CLIP, “123456 LINES OF CODE” TEXT

*OWEN PARKER*

“...then sea level rise, leading to a whole slew  
of global repercussions.”

SCENE 6 – TEAM MEETING AROUND WHITEBOARD IN OFFICE AT AMES, “10  
WEEKS” TEXT

*OWEN PARKER*

“We’ve got to find a consistent way to  
monitor these glaciers.”

SCENE 7 – ALASKA SATELLITE FACILITY WEBSITE ZOOM

*OWEN PARKER*

“By teaming up with the Alaska Satellite  
Facility...”

SCENE 8 – GLOBAL LAND AND ICE MEASUREMENTS FROM SPACE WEBSITE ZOOM

*OWEN PARKER*

“...the Global Land and Ice Measurements from Space project...”

SCENE 9 – UNIVERSITY OF ALASKA FAIRBANKS WEBSITE ZOOM

*OWEN PARKER*

“...and the University of Alaska Fairbanks...”

SCENE 10 – SPACE BACKGROUND, “ONE OPPORTUNITY” TEXT

*OWEN PARKER*

“...we were able to do just that.”

SCENE 11 – STUDY AREA ZOOM ANIMATION

*OWEN PARKER*

“The Aleutian Islands lie right between the Pacific Ocean and the Bearing Sea. We are specifically studying Unimak Island’s Isanoski Volcano because its glaciers have not been well monitored.”

SCENE 12 – CREEK FLOWING, VIDEO COURTESY AUDREY LEE

*OWEN PARKER*

“The local community relies on these glaciers for freshwater resources like drinking water and hydropower.”

SCENE 12 – UNIMAK AREA WEBSITE PHOTOS AND CLIMATE GRAPHS

*OWEN PARKER*

“Their climate is affected by both the Aleutian Low and what’s known as the Pacific Decadal Oscillation. As a result, the islands are wet, cold and cloudy year-round making it difficult to use traditional optical remote sensing techniques to monitor these glaciers.”

SCENE 13 – INTERVIEW, BLDG 242 AMES RESEARCH CENTER

*AUDREY LEE*

“But, we have a solution. Synthetic aperture radar. We can use this radar data to find the size of the glaciers and track their velocity every year.”

SCENE 14 – NASA UAVSAR FOOTAGE, JAXA ALOS PALSAR FOOTAGE

*OWEN PARKER*

“Two Earth observing sensors proved the most useful. We used NASA-JPL UAVSAR, an airborne sensor flown over areas of interest, to track glacial movements and determine yearly velocities. Then, we found the boundaries of each glacier using JAXA ALOS PALSAR and ESA ERS 1&2, spaceborne sensors that continuously collect data around the globe.”

SCENE 15 – FEATURE TRACKING ANIMATION

*OWEN PARKER*

“For the feature tracking technique we compared two images that were acquired a year apart. With an image correlation algorithm we determined the direction and magnitude of movement of each individual pixel between the two images. In this image, red areas are moving faster, while white areas have slower velocities. The black arrows represent the direction of glacial movement.”

SCENE 16 – TEAM WORKING AROUND COMPUTER IN OFFICE, BLDG 242 AMES RESEARCH CENTER

*OWEN PARKER*

“Once we knew how fast they were moving, we needed to find their extent.”

## SCENE 17 – COHERENCE MAPPING ANIMATION

*OWEN PARKER*

“We were able to compare two consecutive radar images to generate coherence images.

As you can see, the radar data is shown along a color gradient from white to blue. White represents areas that didn’t change much between the two images. We assume glaciers are moving significantly each year, and therefore our glaciers can be found in these dark blue areas. After removing slopes that were too steep to harbor glaciers, and cleaning up the image with common image filters, we isolated four glaciers on Isanotski Volcano.”

## SCENE 18 – RESULTS INTERVIEW, BLDG 242 AMES RESEARCH CENTER

*SUNG-YEE GUO*

“Our results show the glaciers have a surface area between 3 to 7 km<sup>2</sup> and are moving at approximately 30 m/yr. Our methods confirmed that these two SAR techniques can be successfully applied to small mountain glaciers and areas that cannot be modeled by optical imagery.”

## SCENE 19 – TEAM COLLABORATING IN OFFICE, BLDG 242 AMES RESEARCH CENTER

*OWEN PARKER*

“So what did we do in just 10 weeks? We created information that can be used to...”

## SCENE 20 – BENEFITS MONTAGE: CONSTRUCTION SITE, MOUNTAINVIEW PARK, MOUNTAINVIEW CA

*OWEN PARKER*

“Equip local resource managers, community members and decision makers with a better means of implementing risk assessment and hazard mitigation.”

SCENE 21 – BENEFITS MONTAGE: OFFICE, BLDG 242 AMES RESEARCH CENTER

*AUDREY LEE*

“Establish a system to improve spatio-temporal glacial data for use by the climate modeling community.”

SCENE 22 – BENEFITS MONTAGE: GLOBE POSTER, BLDG 242 AMES RESEARCH CENTER

*SUNG-YEE GUO*

“And to update the existing glacial outlines for Unimak Island”

SCENE 23 – BENEFITS MONTAGE: LAKESIDE, MOUNTAINVIEW PARK, MOUNTAINVIEW CA

*YAMINA PRESSLER*

“Not to mention, we created a repeatable methodology to determine the extent and velocity fields of all glaciers on Earth.”

SCENE 24 – BENEFITS MONTAGE: HALLWAY, BLDG 242 AMES RESEARCH CENTER

*DANIEL SOUSA*

“And, we made tutorials of all the software we used for future DEVELOP students!”

SCENE 25 – FINAL INTERVIEW, BLDG 242 AMES RESEARCH CENTER

*YAMINA PRESSLER*

“We’re most excited about the applicability of our methodology to the world-wide glacial monitoring effort. We’re committed to increasing our understanding of the global cryosphere as we step forward into the future.”

SCENE 26 – CREDITS

“This video and research was made with support from:”

SCENE 27 – CREDITS, TEAM MEETING WITH JAIME FAVORS, BLDG 242 AMES  
RESEARCH CENTER

Partners:

Alaska Satellite Facility  
Global Land and Ice Measurements from  
Space  
University of Alaska, Fairbanks

Acknowledgements:

US Naval Research Laboratory, Monterey  
CA – Tom Lee and Kim Richardson  
USGS National Hydrography Dataset –  
Sheryl Boyack

Technical Support:

ENVI SARscape – Dave Hulslander  
NASA GSFC Scientific Visualization Studio  
– Greg Shirah

With music by:

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([dfrc.nasa.gov/gallery/movie](http://dfrc.nasa.gov/gallery/movie))  
JAXA ALOS-PALSAR Animation  
([nicovideo.jp/watch/sm16329442](http://nicovideo.jp/watch/sm16329442))  
Unimak Area Website ([unimak.us/](http://unimak.us/))

SCENE 28 – CREDITS, OWEN PARKER WORKING AT COMPUTER, BLDG 242 AMES  
RESEARCH CENTER

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