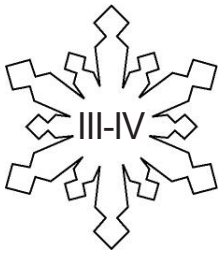
Satellite Sense

Levels



Grades 5-8

Overview:

Students explore satellite images to understand how scientists interpret data on synthetic aperture radar (SAR) imagery. (NOTE: Students should complete "Sea Ice on Satellite" before this lesson. This lesson may require more than one class period.)

Objectives:

The student will:

- analyze satellite images; and
- identify prominent features on satellite images.

Materials:

- Alaska Space Grant Program. (2006). *Treasure Hunt in Alaska.* Fairbanks, Alaska: Geophysical Institute. OR Computer with Internet access
- OVERHEAD: "Sample Image"
- OVERHEAD: "Images of Alaska"
- STUDENT WORKSHEET: "Sample Image"
- STUDENT WORKSHEET: "Identifying Objects on Satellite Images"
- STUDENT WORKSHEET: "Satellite Sense"

Activity Procedure:

1. As a class, explore *Treasure Hunt in Alaska,* which can be accessed on CD-ROM or at http://www.treasure-hunt/alaska.edu/title.html.
2. Remind students that scientists use satellites with microwave radiometers, such as SAR satellites, to gather data on sea ice, volcanoes, and other land features.
3. Distribute STUDENT WORKSHEET: "Sample Image."
4. Ask students what they notice about the image: what colors do they see; what shapes are present; are there any patterns?

CRITICAL THINKING QUESTION:
Think-Pair-Share Method: Divide students into pairs. Ask students to label the image, mark features they can identify, and put a question mark next to the ones they don't know. (See OVERHEAD: "Sample Image" as an example). When students are finished, ask them to share with another pair, then share as a class. Make sure students explain their reasoning for labeling a landform in a particular way.

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5. In order to analyze remote sensing data, scientists must know the images' location on Earth, the height of objects, and the scale of the image. Learning how to analyze satellite images is crucial to scientists who use remote sensing in their work. In addition to sea ice studies, scientists use satellite images to study weather patterns, volcanoes, permafrost, and other objects and phenomena on Earth and in space.
6. Divide students into small groups and distribute STUDENT WORKSHEET: "Identifying Objects on Satellite Images." Allow groups time to complete the worksheet. Discuss student answers as a class and provide students with the correct answers.

Teacher's Note: In addition to the ways of identifying objects in satellites images listed on the STUDENT WORKSHEET, scientists also identify objects by analyzing shadows. Shadow length is determined by the angle of the sun and the height of objects. Shadows are sometimes used to determine the height of objects. Association is the relationship between known objects and unknown objects. For example, if one knows that a dark area on an image is a lake, it is likely that other dark areas on the image are also lakes. Size can be determined similarly to association; if one knows the size of an object in an image, the size of other objects can be determined by creating a scale.

7. Display OVERHEAD: "SAR Images of Alaska." Walk students through each image. Ask students to identify the prominent feature in each image and explain how they came to their conclusion. After student analysis of each image, verify the feature using the TEACHER INFORMATION SHEET: "SAR Images."
8. Distribute STUDENT WORKSHEET: "Satellite Sense" and instruct students to complete the worksheet independently.

Answers:

STUDENT WORKSHEET: "Sample Image"

Answers will vary, but should resemble the example shown in the "Activity Procedure."

STUDENT WORKSHEET: "Identifying Objects on Satellite Images"

Image courtesy of the Alaska Satellite Facility

1. a. Answers may vary; the above shows possible solutions.
   b. Answers may vary; lake or water.
2. a. Answers may vary, but should include triangle and rectangle.
   b. City
3. a. Answers may vary but should indicate a grid-like pattern.
   b. Agricultural field
4. a. Mountains or hills
   b. Water or ice

STUDENT WORKSHEET: “Satellite Sense”

1. River
2. Lake
3. Glacier
4. Volcano

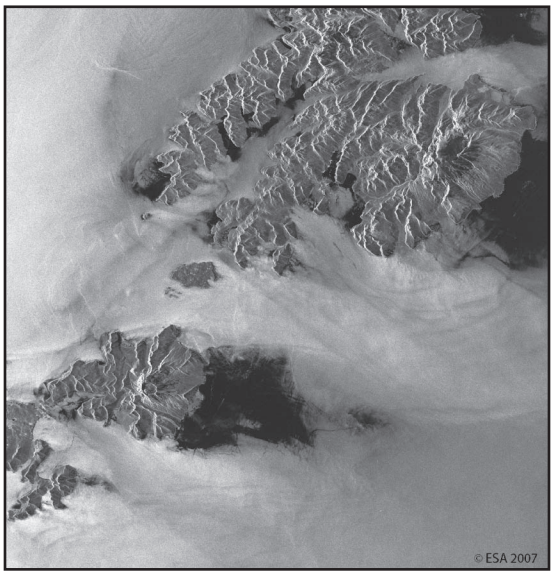
SAR Images

Teacher Information Sheet (page 1 of 3)

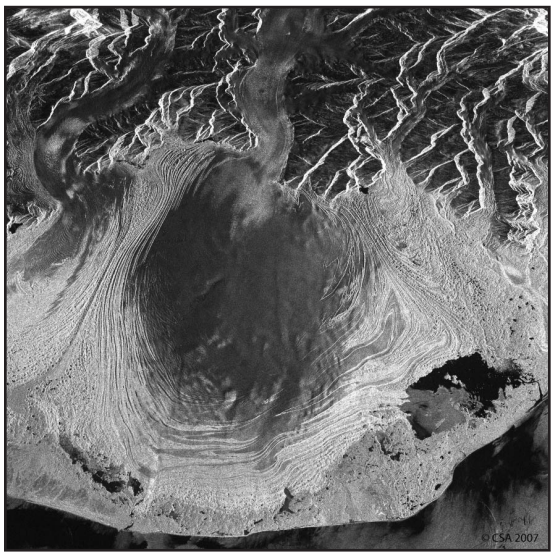
Levels

III-IV

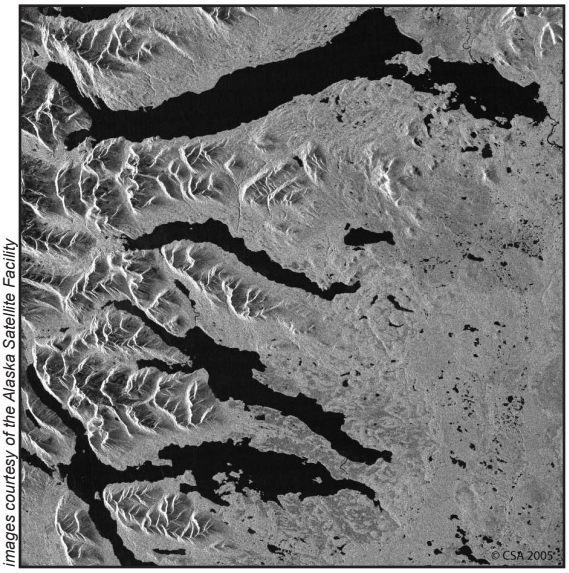
Grades 5-8



Archipelago: An archipelago is a group of islands. Islands are one of the easiest things to spot on a satellite image because they are smaller than continents and surrounded by water.



Glacier: A glacier is a slow moving river of ice. Glaciers carve valleys and are often present in mountain ranges.

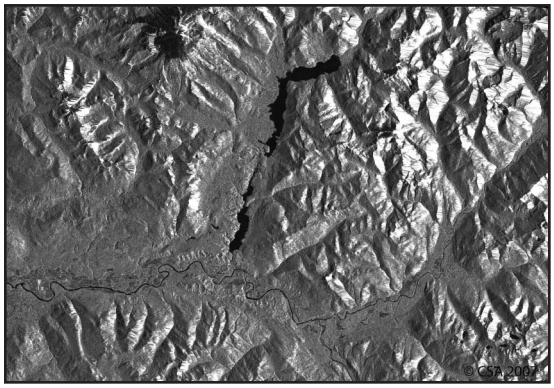


images courtesy of the Alaska Satellite Facility

Lake: Surface water collected from rain and snow-melt flows downstream, oftentimes ending in a lake. A lake can form at a depression in the Earth or behind a river.

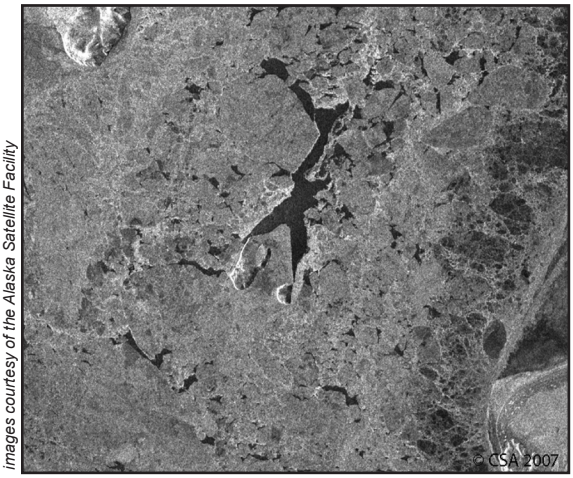
SAR Images

Teacher Information Sheet (page 2 of 3)



Mountain Range: A mountain is a piece of land considerably higher than the surrounding land. A mountain range consists of multiple mountains close together. Mountain ranges appear as rugged creases on a landscape.

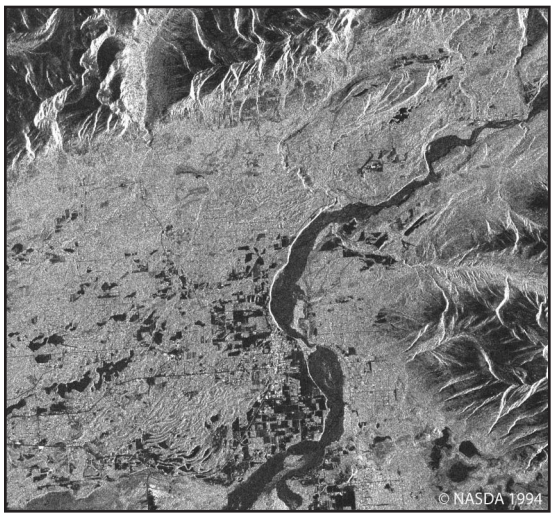
River: A river carries water from higher to lower elevations, ending in oceans or lakes. Rivers etch various patterns into the land, but often appear to wind their way through the landscape. Rivers can also be identified by their various branches.



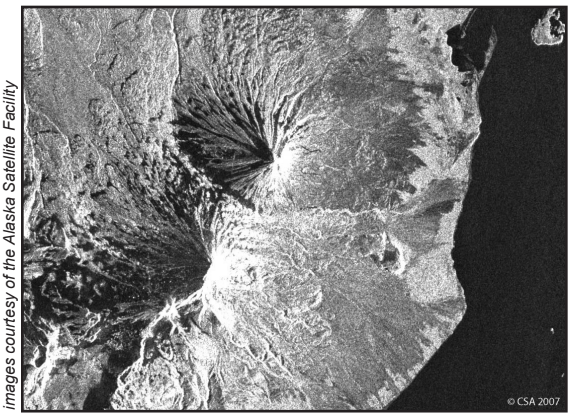
images courtesy of the Alaska Satellite Facility

Sea Ice: Sea ice is ice that forms on the ocean. Sea ice can be identified by its often slightly rugged appearance and its approximation to water and/or land.

Teacher Information Sheet (page 3 of 3)



Valley: A valley is a depression in the Earth that has an outlet. Most valleys can be found between mountain ranges. Valleys are often formed by erosion caused by flowing rivers and glaciers.



images courtesy of the Alaska Satellite Facility

Volcano: A volcano is a mountain or hill formed by the upwelling of magma from below Earth's crust. Cone-shaped volcanoes are most easily identified in satellite images.

Name:_____

Levels

III-IV

Sample Image

Student Worksheet

Directions: Examine the image below. Label the features you can identify. Put a question mark next to the ones you don't know or are unsure of.

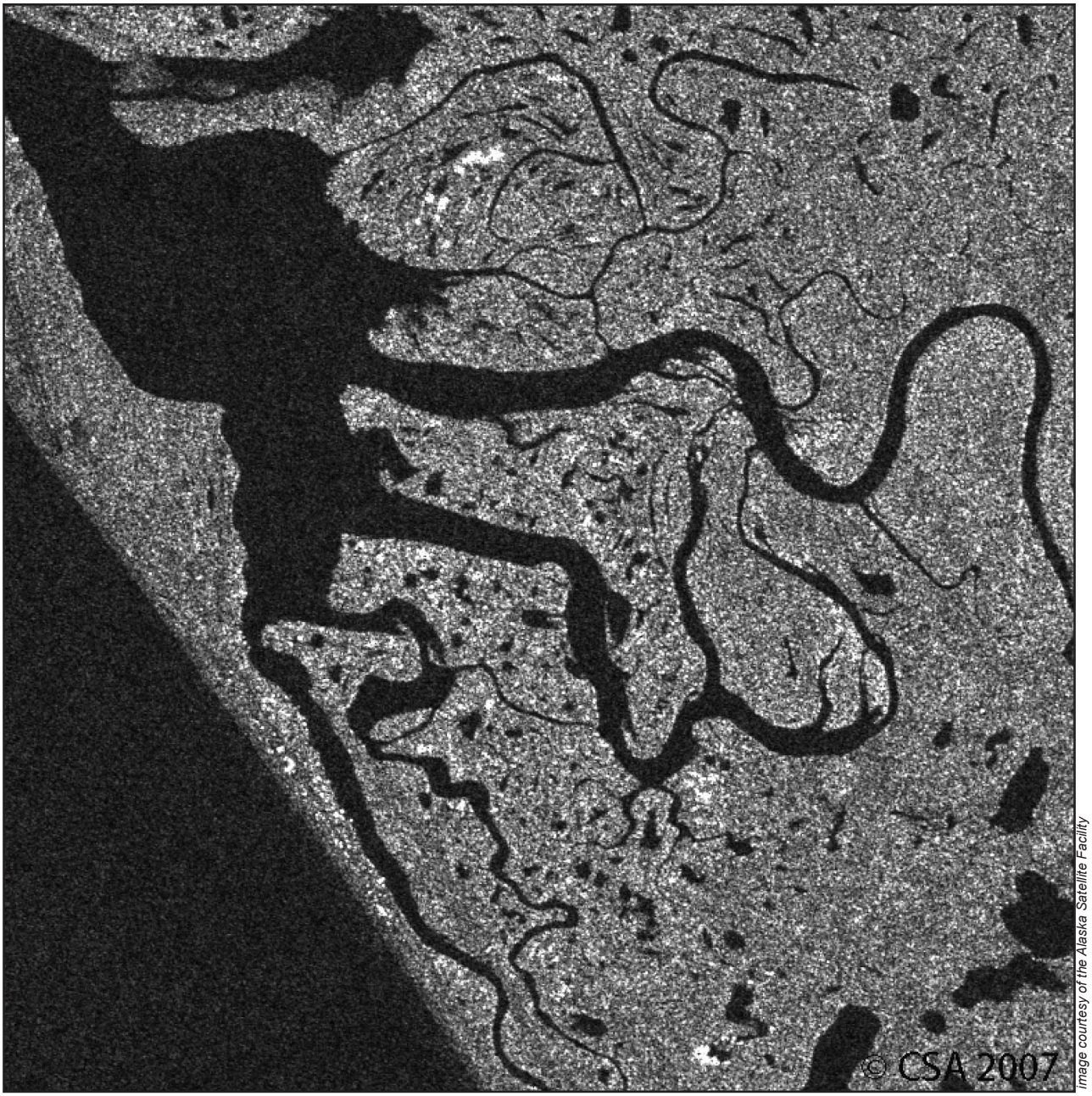


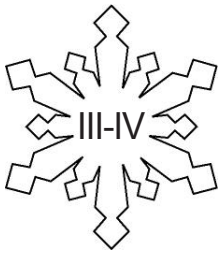
image courtesy of the Alaska Satellite Facility

Name:_____

Identifying Objects on Satellite Images

Student Worksheet (page 1 of 4)

Levels



Directions: Examine each image and answer the questions regarding the image.

NOTE: One of the reasons scientists use microwave radiometers to collect sea ice images is the enhanced contrast they provide between ocean water and sea ice.

1. Look at the image below.

   a. Circle the area that is the brightest. What do you think this bright tone is showing?

   _____

   _____

   b. Circle the darkest area. What do you think this is showing?

   _____

   _____

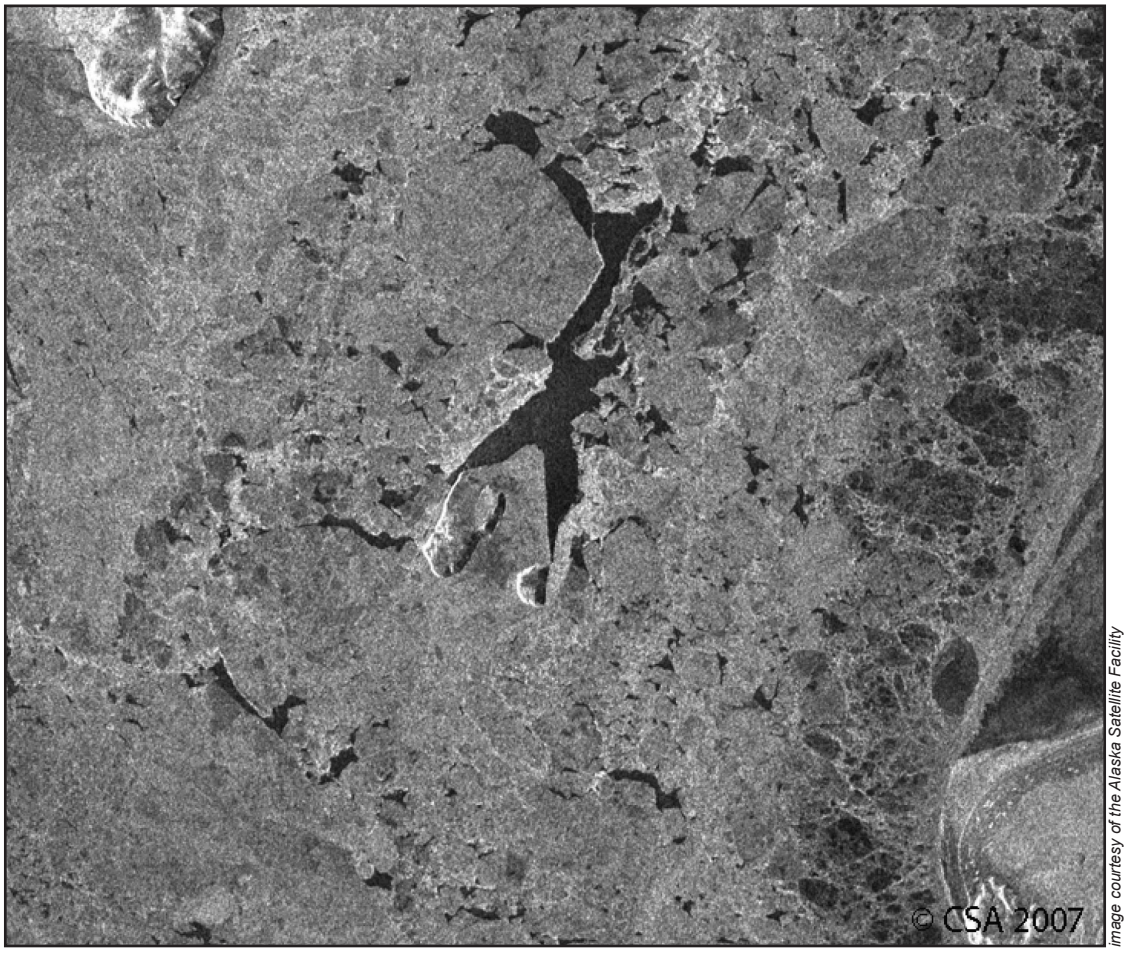


image courtesy of the Alaska Satellite Facility

Name:_____

Identifying Objects on Satellite Images

Student Worksheet (page 2 of 4)

2. Look at the image below. Use the image to answer the questions on the following page.

   a. List the geometric shapes in the image.

   _____ _____ _____

   b. What is shown in the image?

   _____

image courtesy of the Alaska Satellite Facility

Name:_____

Identifying Objects on Satellite Images

Student Worksheet (page 3 of 4)

3. a. Describe the pattern in the image below.

_____

_____

_____

b. What do you think the pattern shows?

_____

_____

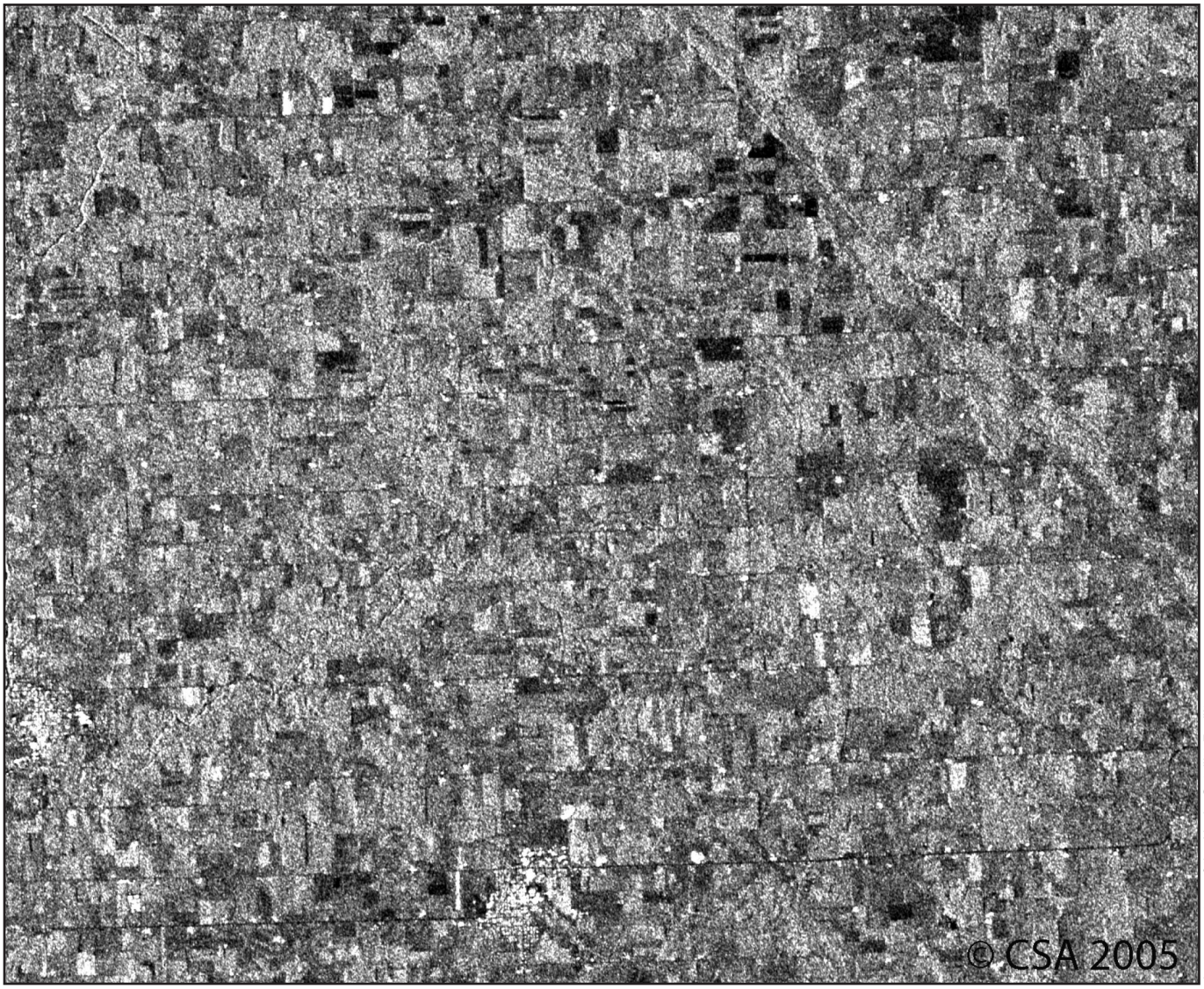


image courtesy of the Alaska Satellite Facility

Name:_____

Identifying Objects on Satellite Images

Student Worksheet (page 4 of 4)

4. The image below has an area with a rough texture and an area with a smooth texture.

   a. What does the rough texture show?

   _____

   b. What does the smooth texture show?

   _____

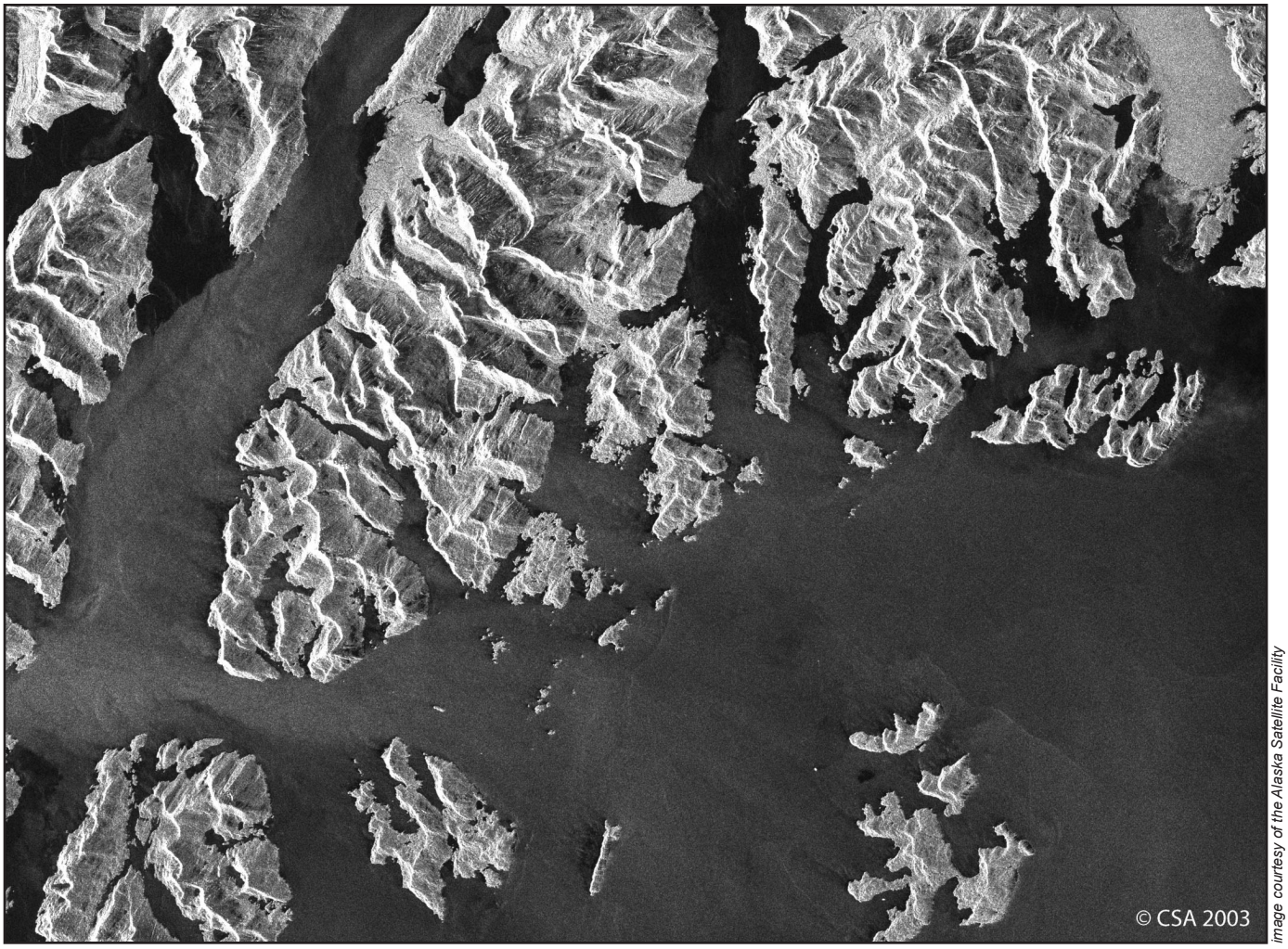


image courtesy of the Alaska Satellite Facility

Name:_____

Satellite Sense

Student Worksheet

Levels

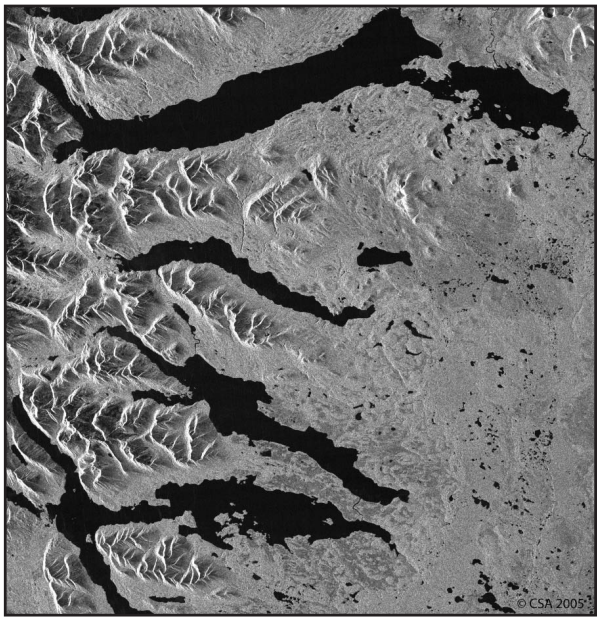
III-IV

Directions: Use the word bank to label the images below.

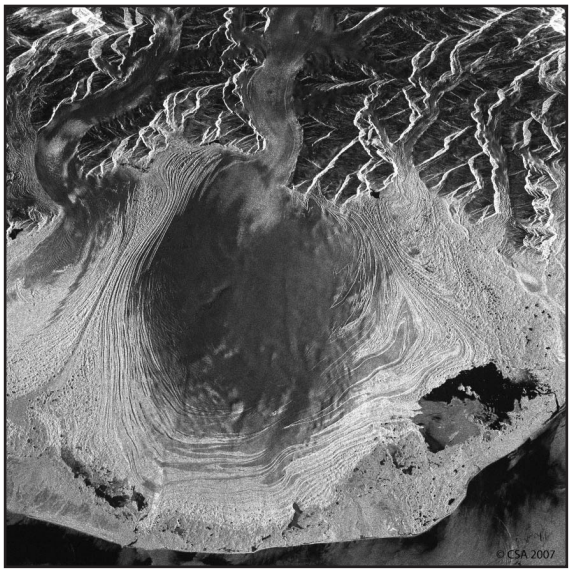
WORD BANK

glacier	river
lake	volcano

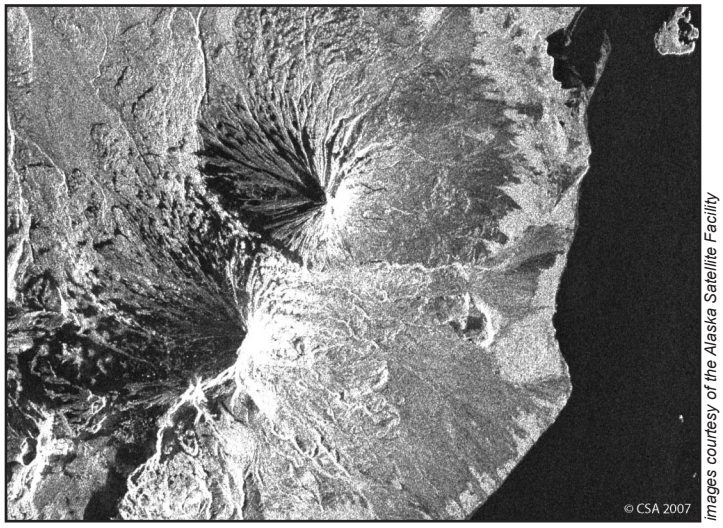
1._____



2._____



3._____

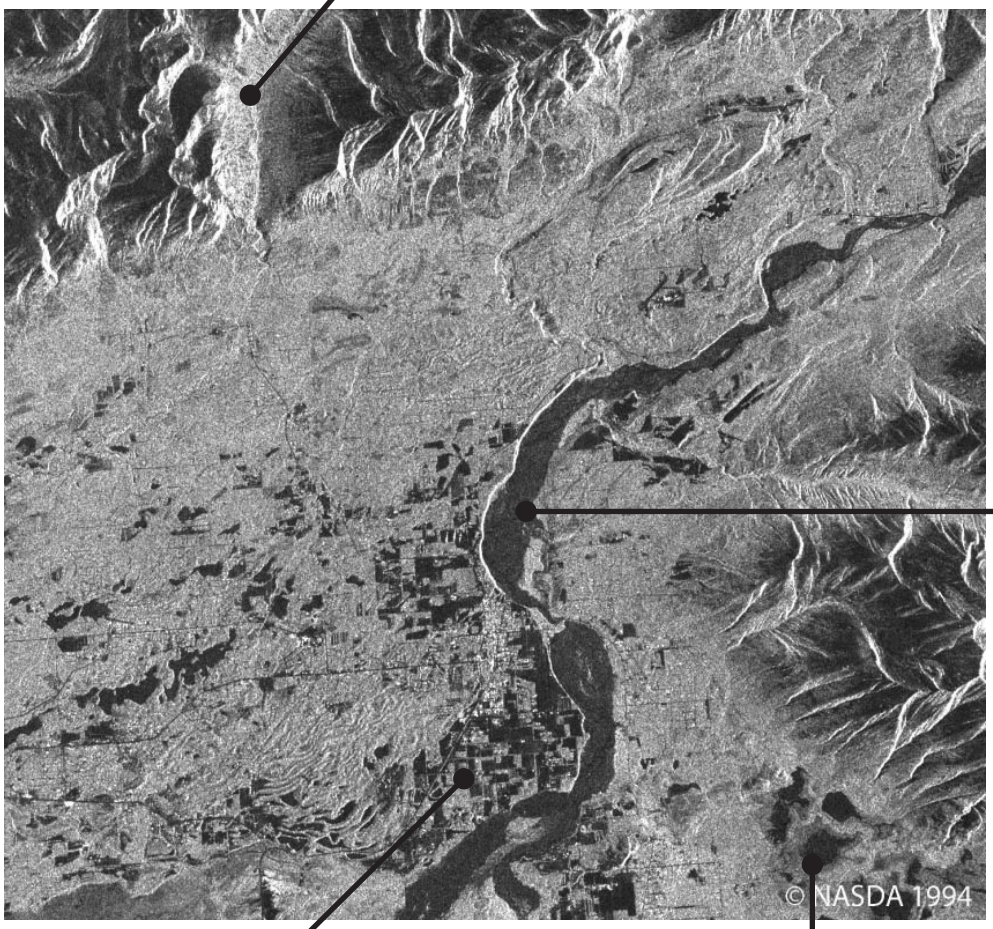


4._____

images courtesy of the Alaska Satellite Facility

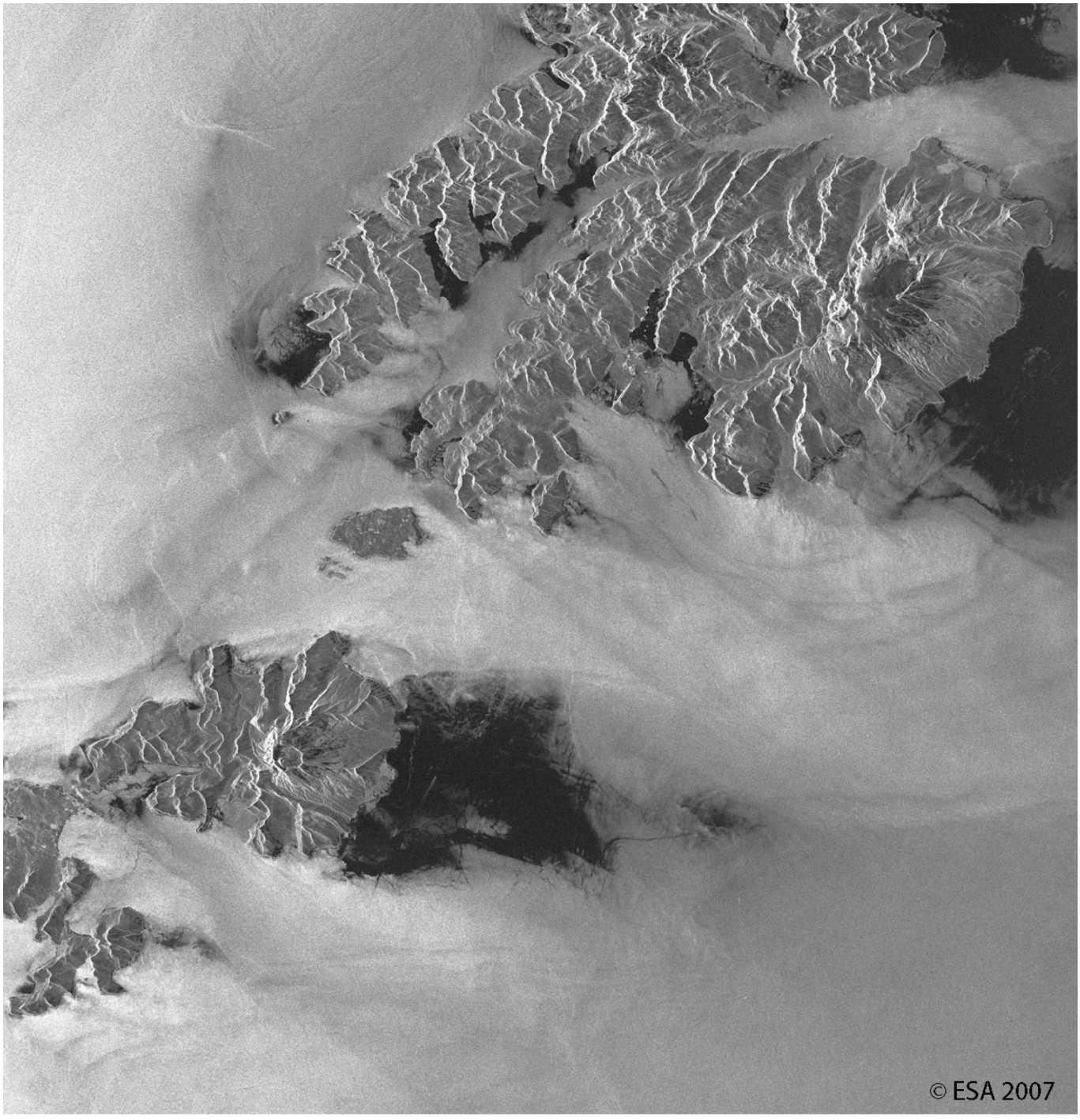
Sample Image

Overhead



SAR Images of Alaska

Overhead (1 of 8)



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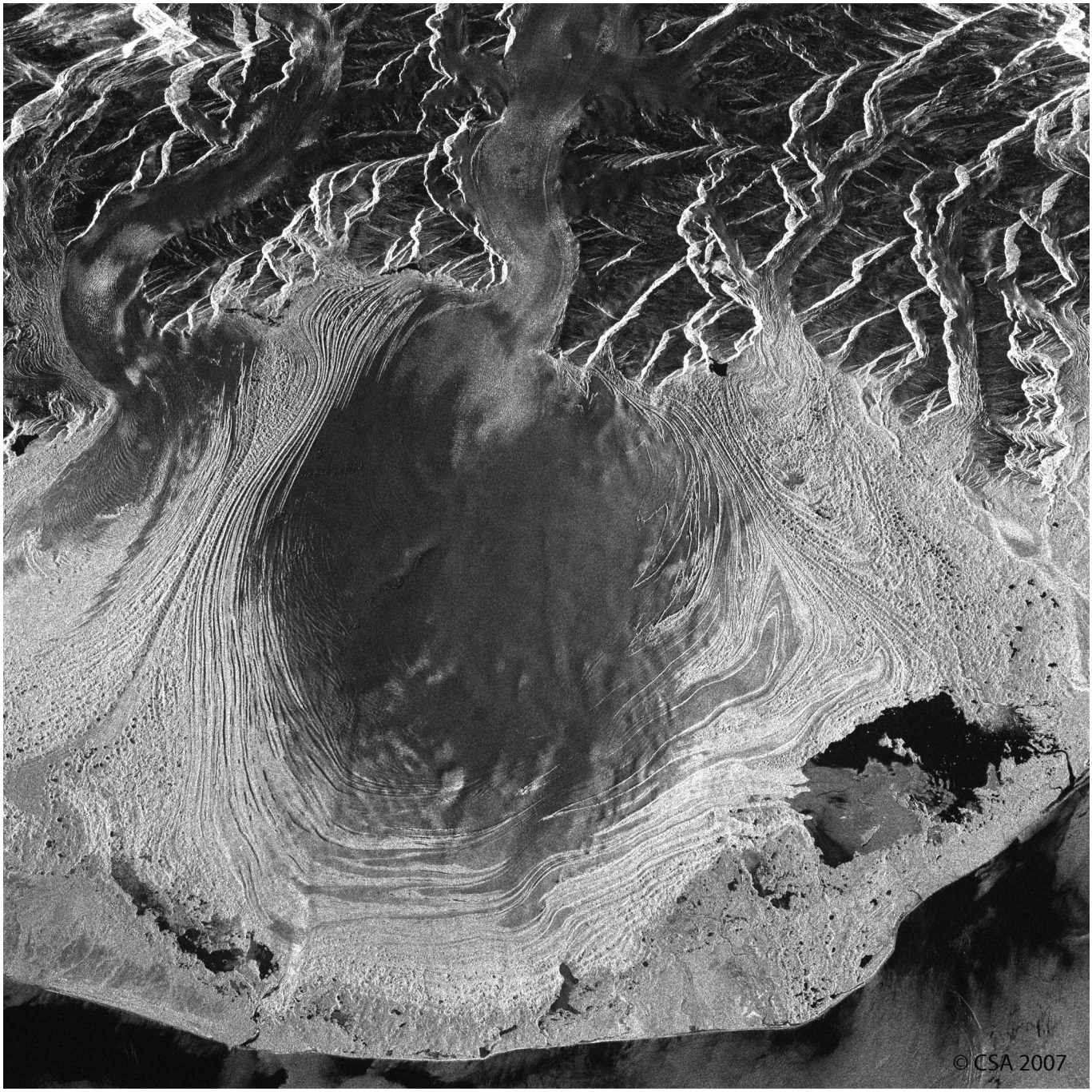
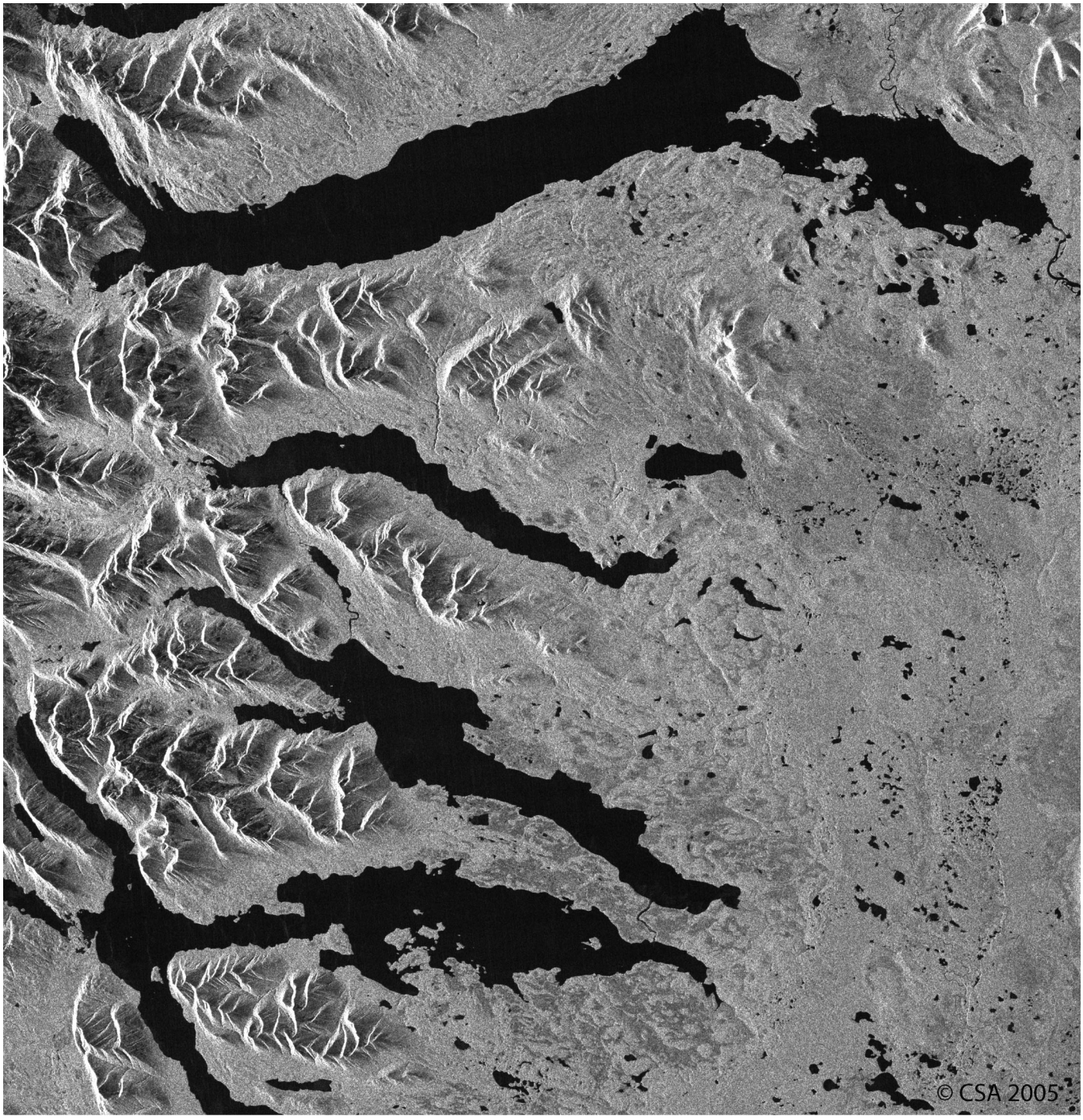
SAR Images of Alaska

Overhead (2 of 8)



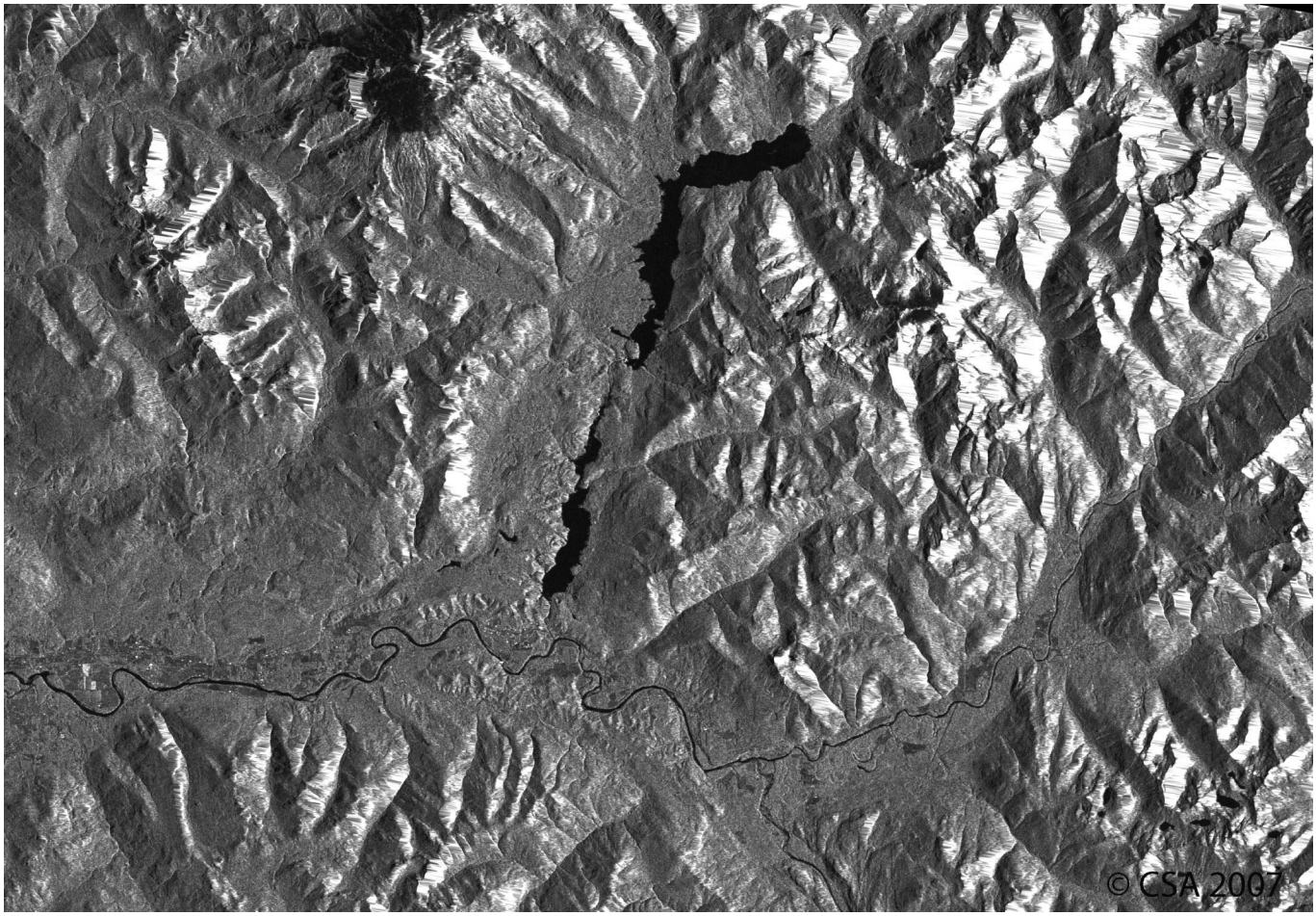
SAR Images of Alaska

Overhead (3 of 8)



SAR Images of Alaska

Overhead (4 of 8)

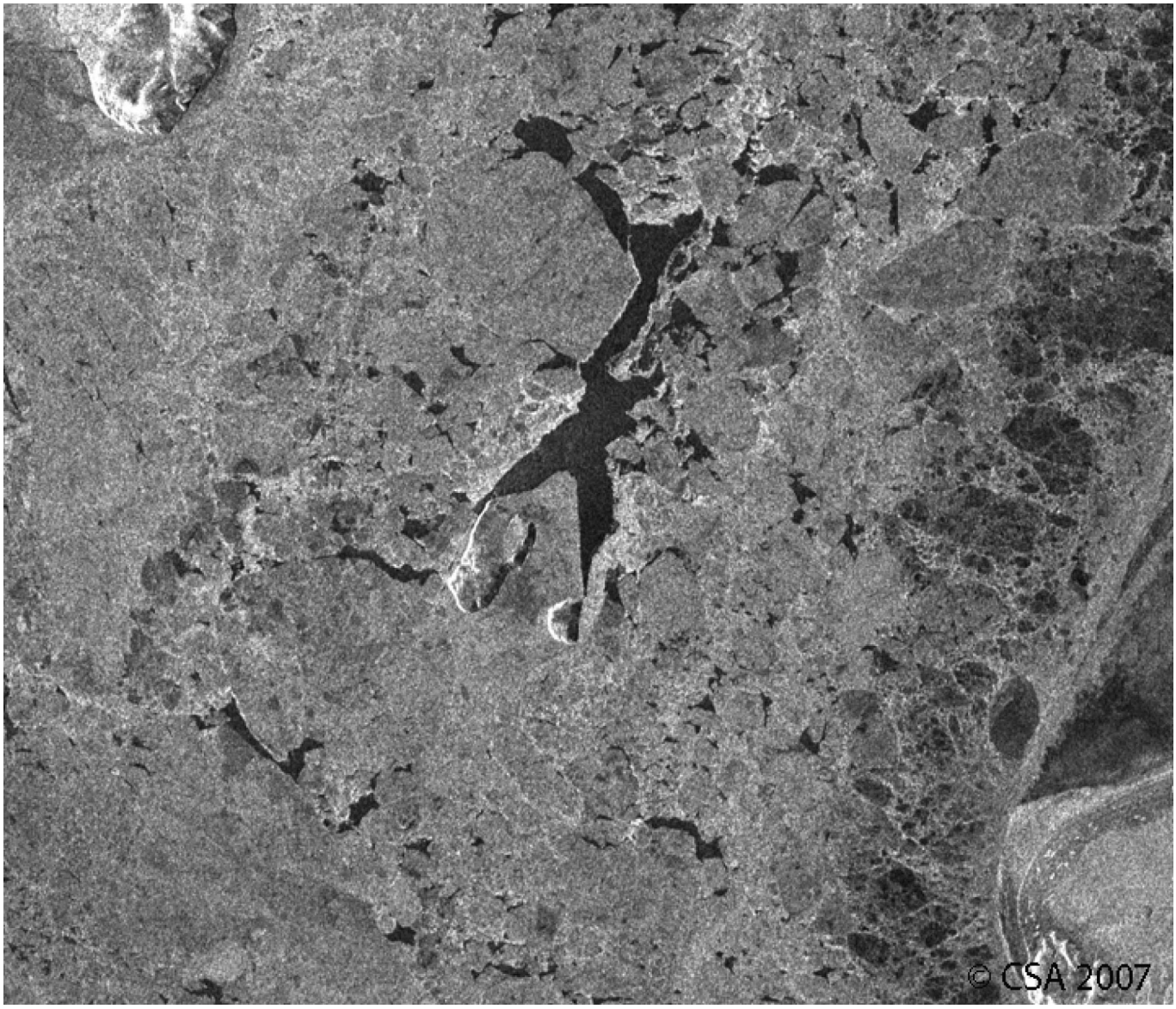


SAR Images of Alaska

Overhead (5 of 8)

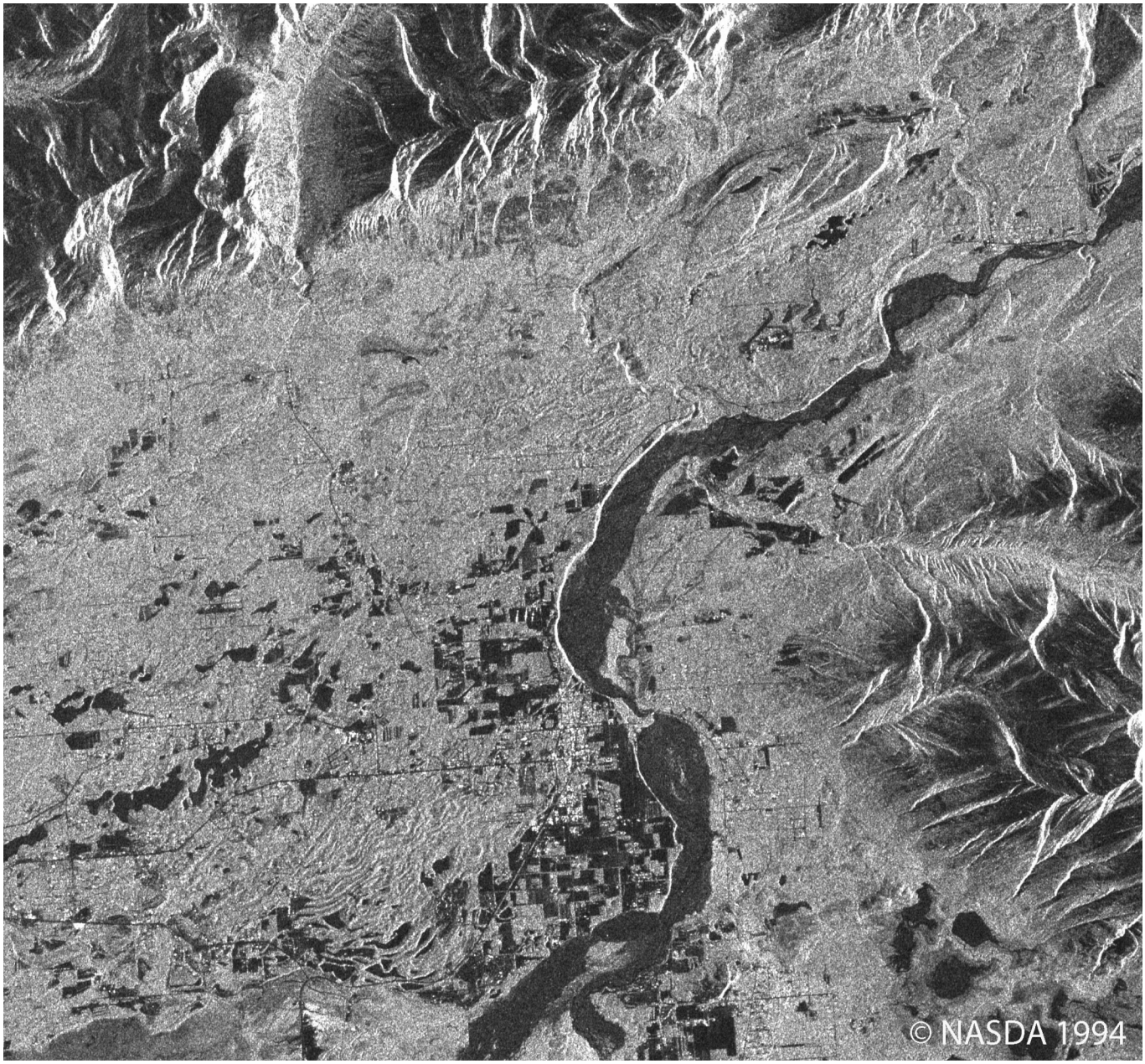
SAR Images of Alaska

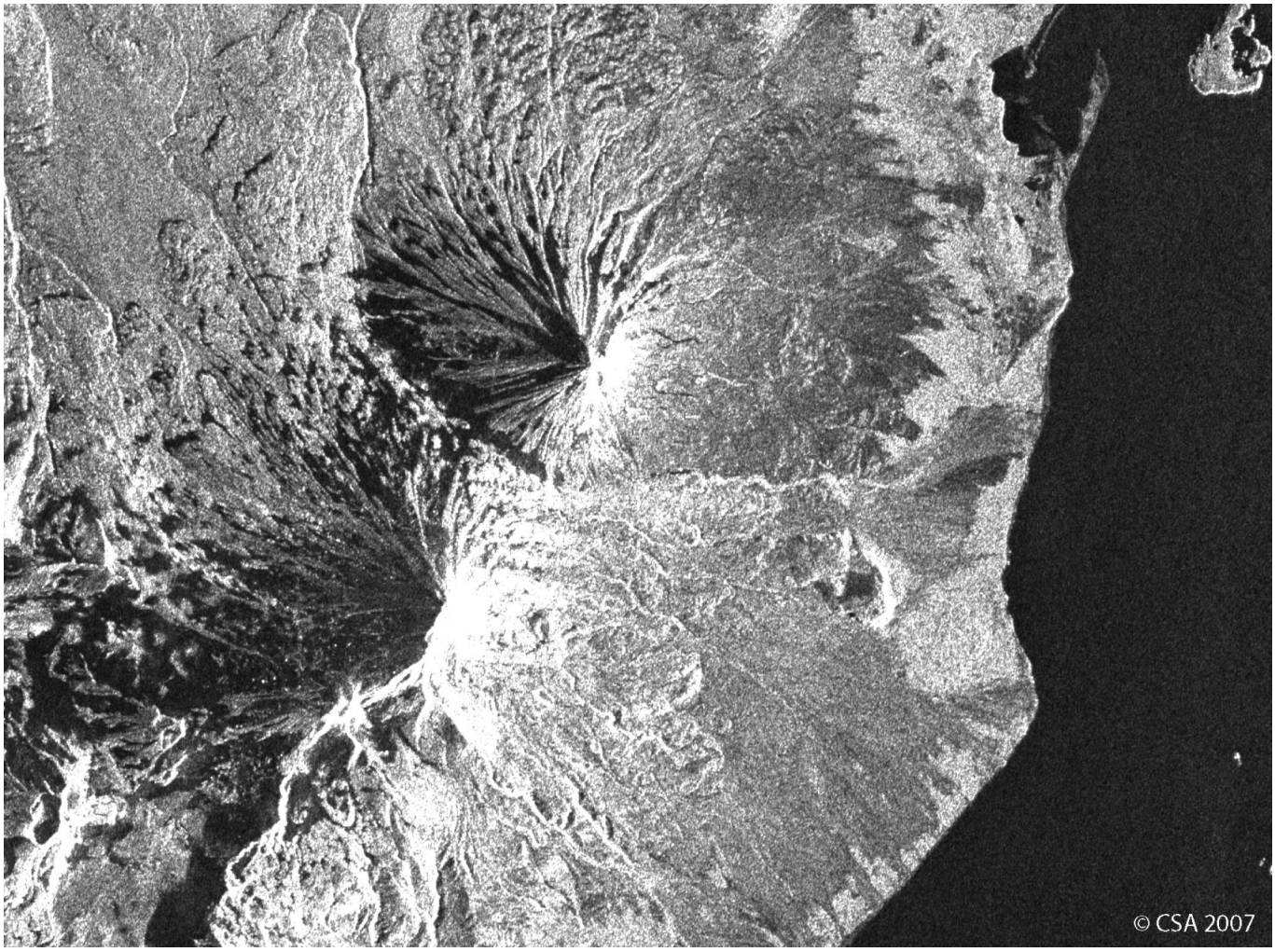
Overhead (6 of 8)



SAR Images of Alaska

Overhead (7 of 8)



SAR Images of Alaska

Overhead (8 of 8)