

# Sea Surface Salinity

Lesson source: NASA Goddard Space Flight Center Aquarius Program at <http://aquarius.gsfc.nasa.gov/education.html>

## Focus on Inquiry

The students will analyze sea surface *salinity* data patterns over time to understand variations in earth's water cycle.

## Lesson Overview

To learn more about the factors that influence salinity patterns in the ocean. Some water cycle processes increase salinity while other processes decrease salinity.

<b>Duration</b> Three 45-min. periods	<b>Setting</b> Computer lab or classroom	<b>Grouping</b> Small groups	<b>PTI Inquiry Subskills</b> 3.2, 3.7, 4.2, 4.3, 5.2, 5.3, 5.8, 7.3
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<b>Engage</b>	15-45 min	3.2, 3.7, 4.3, 5.3, 5.8	Computer with internet access	2 or 3	Students view and discuss animated map of ocean salinity's influence on the environment at earth's three major latitude zones. <b>AND/OR</b> Students create and observe a salt water density column.
<b>Explore</b>	45 min	4.2, 4.3, 5.2	Computer with internet access	3	Students will learn more about the factors that influence salinity patterns by examining data and using five pairs of data maps centered over the North Atlantic Ocean.
<b>Explain</b>	30 min	7.3	Computer; PowerPoint or other presentation software	3	Using Data Analysis Sheet teacher's answers, discuss students' conclusions concerning the data set that most closely corresponds to sea surface salinity patterns. In groups student create PPT presentation using maps from website to explain their conclusions.
<b>Evaluate</b>	Varies	7.3	none	3	The PPT presentation the students complete and the data analysis sheets may be used as evaluation.

### Level of Student Engagement

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

## National Science Education Standards – Inquiry

Develop descriptions, explanations, predictions, and models using evidence.



## National Science Education Standards – Earth Science

Water, which covers a majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle."

## Louisiana Grade Level Expectations – Inquiry

Gr. 8, Inquiry GLE#6 – Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3)

Gr. 8, Inquiry GLE#7 – Record observations using methods that complement investigations (SI-M-A3)

Gr. 8, Inquiry GLE#11 – Construct, use, and interpret appropriate graphical representations to collect, record, and report data (e.g., tables, charts, circle graphs, bar and line graphs, diagrams, scatter plots, symbols) (SI-M-A4)

Gr. 8, Inquiry GLE#12 – Use data and information gathered to develop an explanation of experimental results (SI-M-A4)

Gr. 8, Inquiry GLE#13 – Identify patterns in data to explain natural events.(SI-M-A4)

Gr. 8, Inquiry GLE#14 – Develop models to illustrate or explain conclusions reached through investigation (SI-M-A5)

Gr. 8, Inquiry GLE#16 – Use evidence to make inferences and predict trends (SI-M-A5)



Gr. 8, Inquiry GLE#19 – Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts, spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)

**Louisiana Grade Level Expectations Earth Science**

Gr. 8, GLE#24 – Investigate and explain how given factors affect the rate of water movement in the water cycle. (e.g., climate, type of rock, ground cover)(ESS-M-A10)

**Materials List (per group)**

**Engage**

- Computer Internet availability
- Clear plastic bottles, at least .5 liter
- Water
- Food color
- Salt
- Spoon

**Explore**

- Data analysis sheet
- Access to computer internet

**Explain**

- Computer with Internet access and PowerPoint presentation software

**Advance Preparation**

1. Copy **Data Analysis Sheet** for each student. This is found on <http://aquarius.gsfc.nasa.gov/education.html>
2. Gather materials listed in **ENGAGE** section above.
3. To obtain answers for the "Data Analysis Sheet", contact Annette deCharon <annette.decharon@maine.edu>, Senior Science Educator and Aquarius EPO Manager.

**Other Information**

**Learning Objectives**

The learner will...

- Compare the densities of water samples.
- Compare the factors that influence salinity patterns using animated global maps.

**Prior Knowledge Needed by the Students**

- Students read background information on water cycle at <http://aquarius.gsfc.nasa.gov/science-watercycle.html>

**Procedure**

**Engage**

1. Students read information at website and view animated map of ocean salinity's influence on the environment at earth's three major latitude zones at <http://aquarius.gsfc.nasa.gov/education.html>

**AND/OR**

Students create salt water density column using directions at <http://www.lpb.org/education/classroom/itv/envirotacklebox/teacherguide/module5/5hypIn2.htm>. Students in small groups can discuss answers to discussion questions in activity. Students in each group collaborate to produce an essay that states the results and conclusions of activity.

**Explore**

1. Give each student a Data Analysis sheet.
2. In small groups students access the website <http://aquarius.gsfc.nasa.gov/education.html> to view maps and complete analysis sheets. Each map shows monthly conditions based on long-term averages. The challenge is to find the data set that most closely corresponds to sea surface salinity patterns. (To view individual map data sets, use the pdf. links near the center of this page.)

**Explain**

1. Use the teacher answer sheet to help guide students to the best conclusions concerning the data set that most closely corresponds to sea surface salinity patterns. This sheet was created by Annette deCharon, Senior Marine Education Scientist, University of Maine School of Marine Sciences.



2. Student groups create PPT presentations using maps from <http://aquarius.gsfc.nasa.gov/education.html> to explain conclusions.

### **Evaluate**

1. The PPT presentation the students complete and the data analysis sheets may be used as either formal or informal evaluation.

### **Blackline Master**

1. **Data Analysis Sheet** for each student. This is found on <http://aquarius.gsfc.nasa.gov/education.html>.

### **Supplementary Resources**

<http://sealevel.jpl.nasa.gov/education/activities.html>

List of activities were provided by various educational organizations and educators for inclusion on the *Visit to an Ocean Planet CD-ROM*.

#### **NASA Goddard Space Flight Center: Hands-on Activities**

<http://aquarius.gsfc.nasa.gov/education-classroom.html>

Nine hands-on, very thoroughly written classroom activities that investigate the importance of salt driven circulation in the oceans.

#### **NASA Goddard Space Flight Center Activities: SALINITY & THE WATER CYCLE – OVERVIEW**

[http://aquarius.gsfc.nasa.gov/salinity\\_patterns\\_overview.html](http://aquarius.gsfc.nasa.gov/salinity_patterns_overview.html)

SALINITY & THE WATER CYCLE – OVERVIEW Classroom activities for K-12.

#### **NASA Goddard Space Flight Center Activities: SALINITY & THE WATER CYCLE – OVERVIEW**

<http://www.lpb.org/education/classroom/itv/envirotacklebox/>

Over 38 activity-driven lessons for Elementary/middle school students. Topics have ecological and environmental themes, including several concerning water and earth science.