

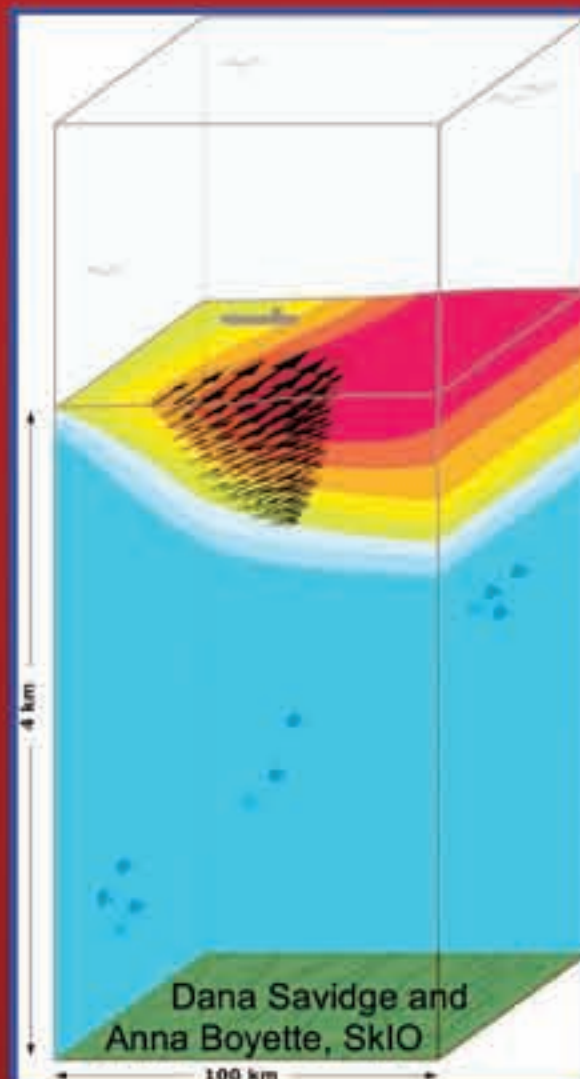
# Flowing Ocean: Understanding the Gulf Stream

## What are ocean currents?

Ocean currents transport water over long distances and to great depths. Currents flow in complex patterns driven by: 1) Wind created by atmospheric pressure differences originating from the sun's energy; 2) Density differences controlled by the water's temperature and salinity; and 3) The pressure gradient caused by differences in sea surface height. Currents are also affected by bottom topography and the earth's rotation.

Surface currents are driven by wind and only extend to depths where wind-derived energy can penetrate, usually the upper 200 m. Deep currents are formed when dense water sinks. Most deep currents are driven by the cooling and sinking of ocean water in polar regions. Deep currents are an important component in long term climate change.

The Gulf Stream in the western Atlantic Ocean is a strong current resulting from the distribution of winds blowing across the surface of the entire North Atlantic Ocean. It extends down nearly a kilometer into the ocean. The diagram illustrates the varying temperatures and current velocities within the Gulf Stream (red indicates warmer temperatures and larger arrows indicate stronger velocities). The boat, fish and birds are not drawn to scale.

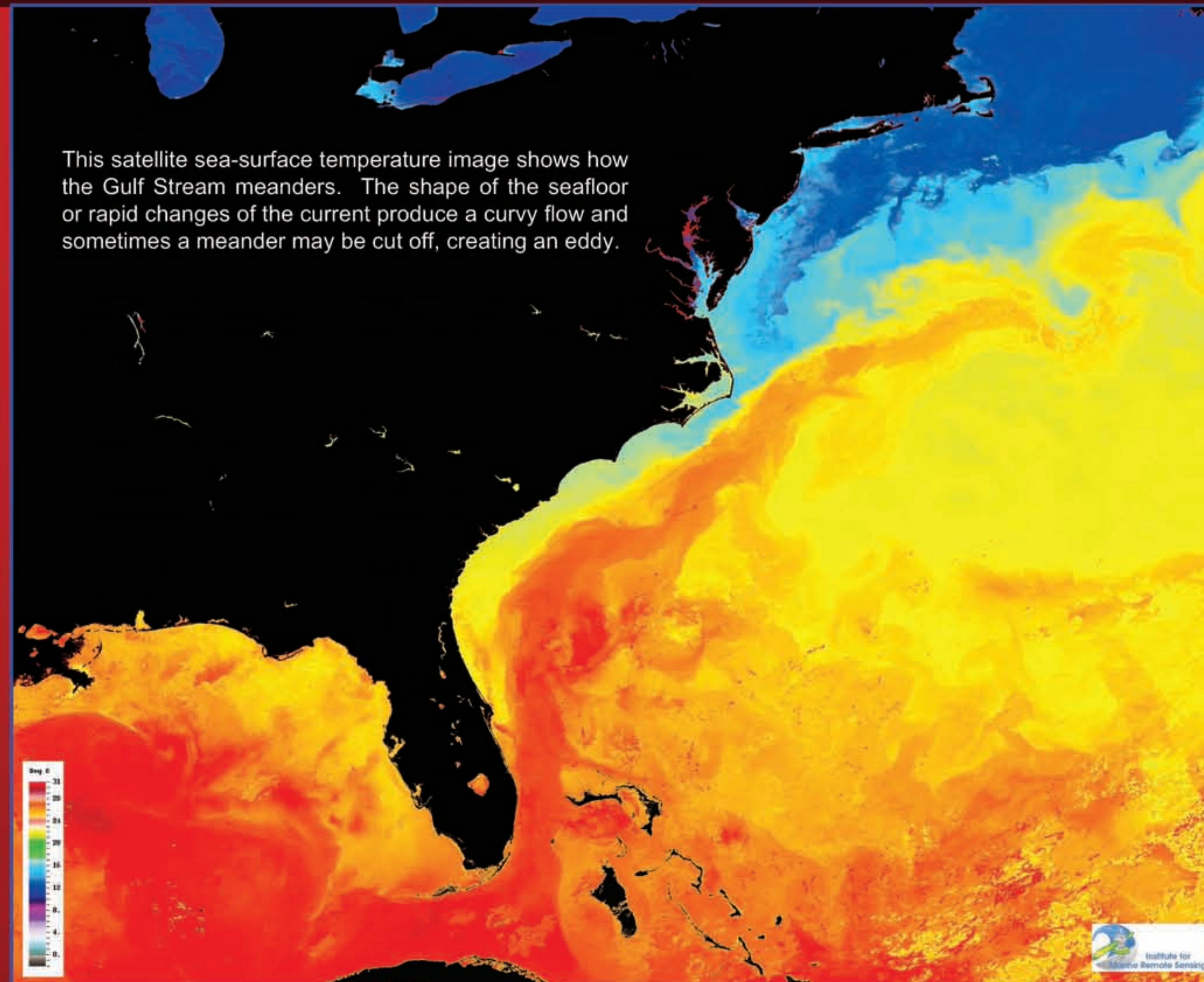


## How do scientists study currents?

Scientists collect information about current speed and direction using the following tools:

- Drifting buoys that can be tracked over time with satellites
- Current meters that are mounted on moored buoys, fixed platforms and ships
- Satellite altimeters that measure sea surface height (SSH). SSH is then used to calculate the slope of the surface of the ocean
- Shore-based radars that transmit electromagnetic waves. The signal reflected back to the station from the ocean surface is related to the current speed and direction
- Numerical models that provide computer-generated predictions

Poster Credits: Poster Design: David Palandro, USF  
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This satellite sea-surface temperature image shows how the Gulf Stream meanders. The shape of the seafloor or rapid changes of the current produce a curvy flow and sometimes a meander may be cut off, creating an eddy.

## Gulf Stream System Facts

- The Gulf Stream is the western boundary current of the North Atlantic Gyre (image far right).
- Ben Franklin first charted the Gulf Stream in the 1770's while working as the Postmaster General for the American colonies (image right).
- The volume of flow is 100 times more than all the rivers on Earth.
- Warm Gulf Stream System waters have an influence on northern climates, even as far away as Western Europe.
- Mariners use the Gulf Stream to navigate more efficiently.



## What is the Gulf Stream System?

The Gulf Stream System (GSS) begins in the Caribbean Sea and ends in the North Atlantic Ocean. Many segments make up the GSS (image below): (1) the Caribbean Current and (2) Yucatan Current feed (3) the Loop Current. The Loop Current and (4) Antilles Current feed the (5) Florida Current, which stretches from the Florida Straits to Cape Hatteras, NC. The (6) Gulf Stream begins near NC, where the Florida Current moves offshore. It persists to the Grand Banks, southeast of Newfoundland, Canada, where it flows eastward away from the coast and splits into multiple branches, one of which feeds (7) the North Atlantic Current.



## Why do we study currents?

Ocean currents are part of the large-scale system of the Earth, influencing climate, weather and living conditions for plants and animals. Current information from coastal and global ocean observing systems has many benefits. These benefits include improving search and rescue operations, tracking oil spills, aiding mariners at sea, and helping biologists learn where drifting plants and animals like larval fish go. Perhaps most important is that the information enhances our ability to provide more accurate weather forecasts, benefiting both human safety and our economy.



For Classroom lessons and ocean current information: [www.seacoos.org](http://www.seacoos.org) South East Atlantic Coastal Ocean Observing System