

TRANSCRIPT FROM NOAA/GFDL EDUCATIONAL VIDEO:

Modeling Dynamic Surface Ocean Currents:

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ANNOUNCER [KF]: Here we present animations of sea surface temperatures produced by a high resolution climate model developed at NOAA's Geophysical Fluid Dynamics Laboratory in Princeton, New Jersey.

All the images that you will see were simulated spontaneously by the ocean model component of a global climate model.

No ocean observations of any kind – not satellites, nor measurements made at sea – were used by the model when generating the data visualized in these animations.

[zoom into South Africa]

First, let's look at the oceans around southern Africa.

In the Indian Ocean, warm and relatively salty waters flow southward along the east coast of Africa until they reach the southern tip of the continent.

There, much of this surface current turns and flows to the east.

But, as seen here, some of the warm water spins off into large eddies known as Agulhas Rings that instead move westward, into the Atlantic Ocean.

The Agulhas Rings form a connection between the Indian and Atlantic Oceans and are responsible for transporting sizable amounts of heat and salt into the Atlantic.

[Pan to Brazil]

Here in the western tropical Atlantic, just south of the Equator, the South Equatorial Current flows from east to west until it encounters South America.

Some of that water then flows to the north and west along the coast of Brazil.

It flows past the mouth of the Amazon River, crosses the Equator and moves toward the islands of the Lesser Antilles, occasionally forming rings along the way.

[Pan to Gulf of Mexico]

In the Caribbean Sea, warm surface waters flow northward into the Gulf of Mexico through the Yucatan Strait that separates Mexico from Cuba.

This computer model successfully simulates the formation of the Loop Current in the Gulf of Mexico.

Upon entering the Gulf from the south, the current first turns to the right and then the left before exiting to the east ... past the southern tip of Florida.

The mighty Gulf Stream flows northward, following the coast from Florida to North Carolina before separating from the coast and heading across the Atlantic Ocean.

Numerous eddies and rings form along the edges of the Gulf Stream.

[Pan to Greenland]

Farther north, we can see the northern extension of the Gulf Stream as it flows northeastward toward Europe.

Some of these relatively warm waters eventually enter the Norwegian Sea between Norway and Iceland.

You can also see ribbons of cold water exiting the Arctic.

The East Greenland Current streams southward along the coast of Greenland, passing through the strait between Greenland and Iceland, before curling around the southern tip of Greenland.

There the surface waters circulate counterclockwise around the perimeter of the Labrador Sea.

[Pan to east Pacific]

Let's turn our focus to the eastern tropical Pacific Ocean.

This is the region where, every few years, unusually warm water appears at the sea surface as part of a phenomenon known as El Niño.

The effects of El Niño extend well beyond the eastern tropical Pacific.

For example, it's associated with drought in Indonesia and Northern Australia and with wetter than normal winters in the southern US.

[Pan to Japan]

Finally, in the western Pacific, we see the Kuroshio Current as it flows past Japan.

As is the case for its Atlantic counterpart, the Gulf Stream, the Kuroshio Current sheds many large eddies and rings.

They begin forming as meanders that develop along the edges of the current and then break off to form closed circulations.

[Map of Major Western Boundary Surface Currents]

You may have noticed that most of the major ocean currents lie along the western edges of ocean basins. Their location is largely determined by the daily rotation of the Earth.

These currents are responsible for moving large amounts of heat from tropical latitudes toward the poles, and thus play an important role in the global climate system.

[GFDL CM2.4 globe image and model grid]

Computer models, like the one from which these animations were derived, are powerful tools used to investigate the 3-dimensional ocean circulation and the role of the oceans in influencing our planet's climate.

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