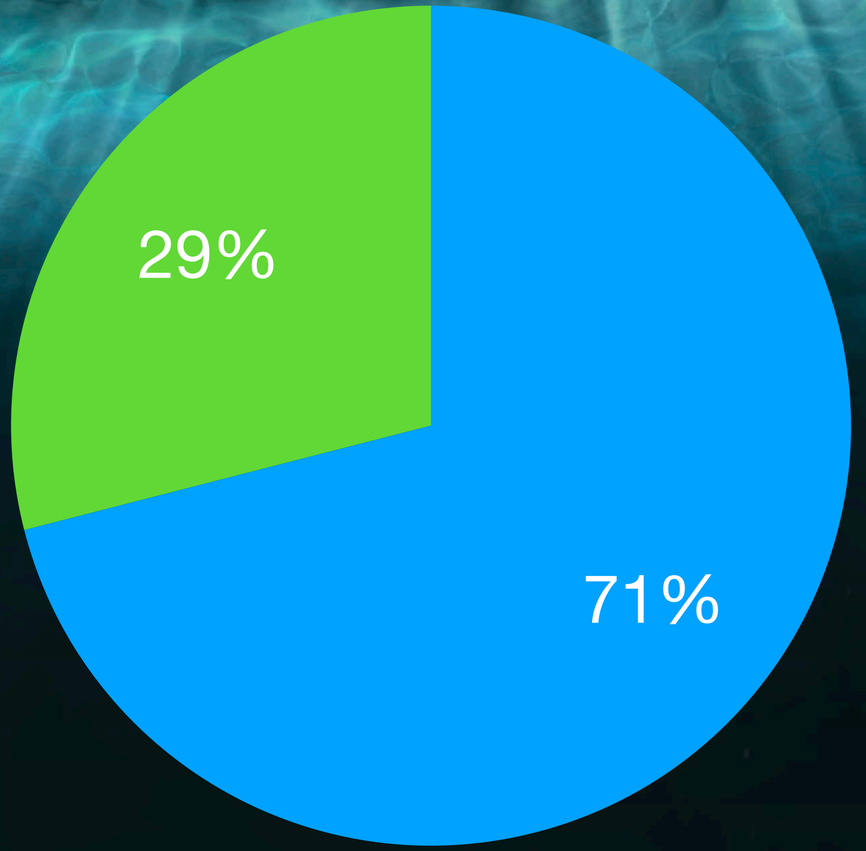
Let’s look at our ocean!

The ocean is a big place.

How much of the world is covered by the sea?

Almost three quarters!



Why do we need the ocean?

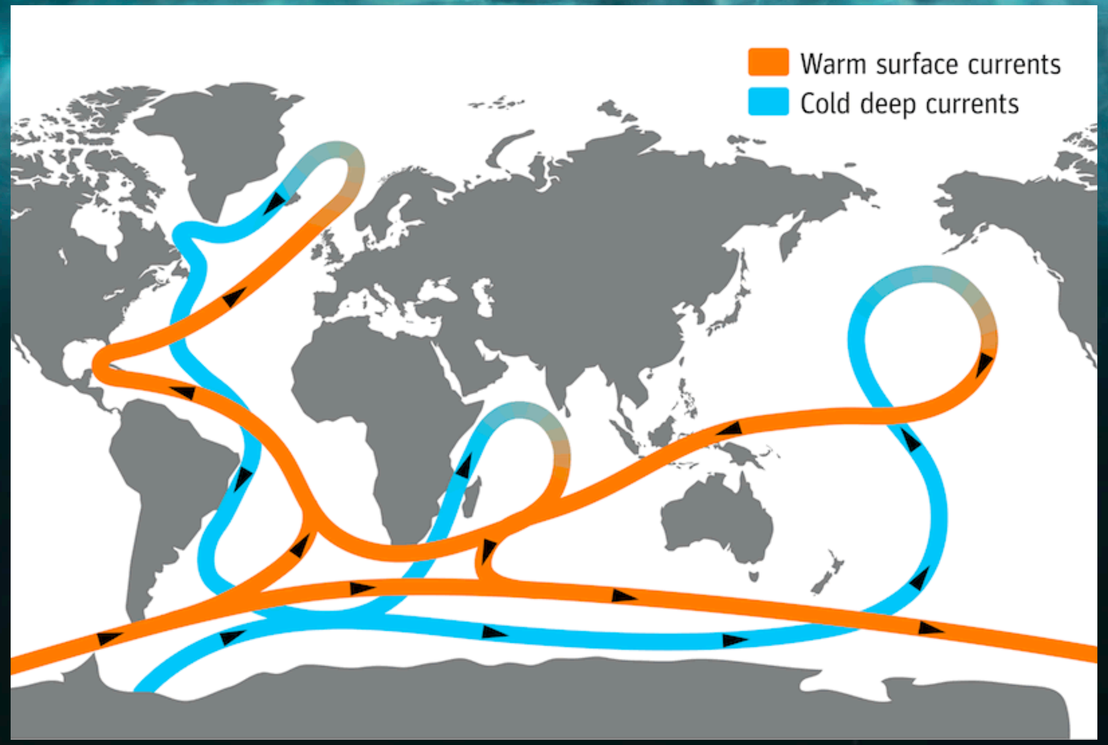
Why do we need the ocean?

It produces a lot of the air we breathe!
Small plants called phytoplankton produce half our oxygen!

Why do we need the ocean?

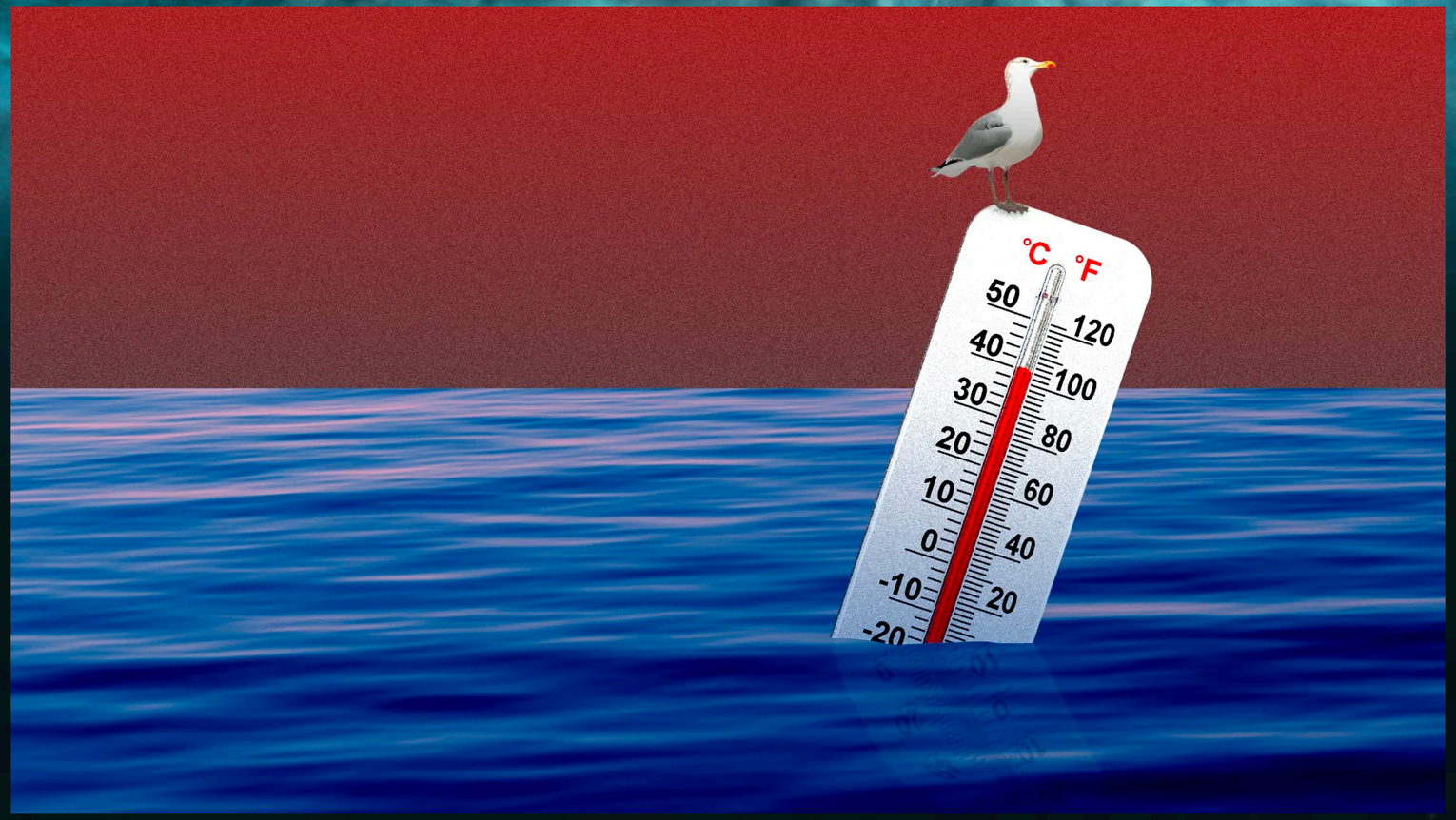
It connects us - in many ways

Why do we need the ocean?



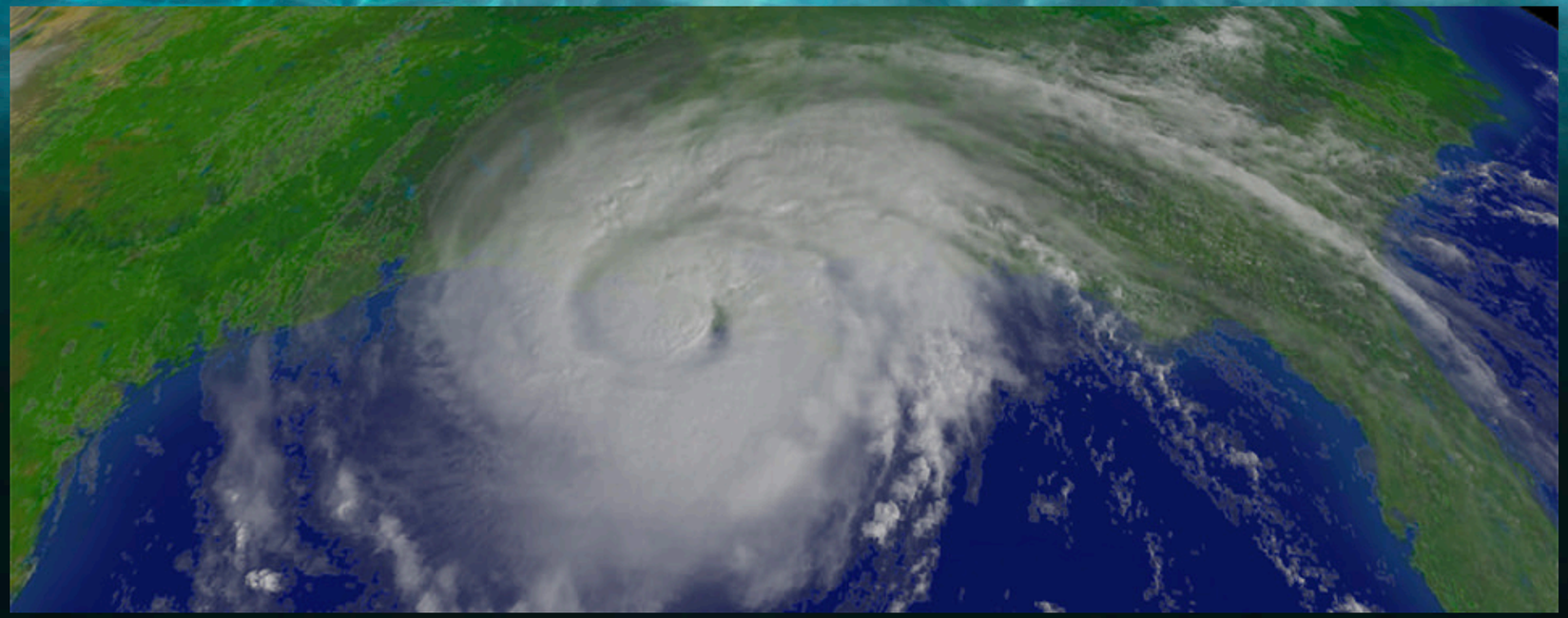
It connects us - in many ways

Why do we need the ocean?



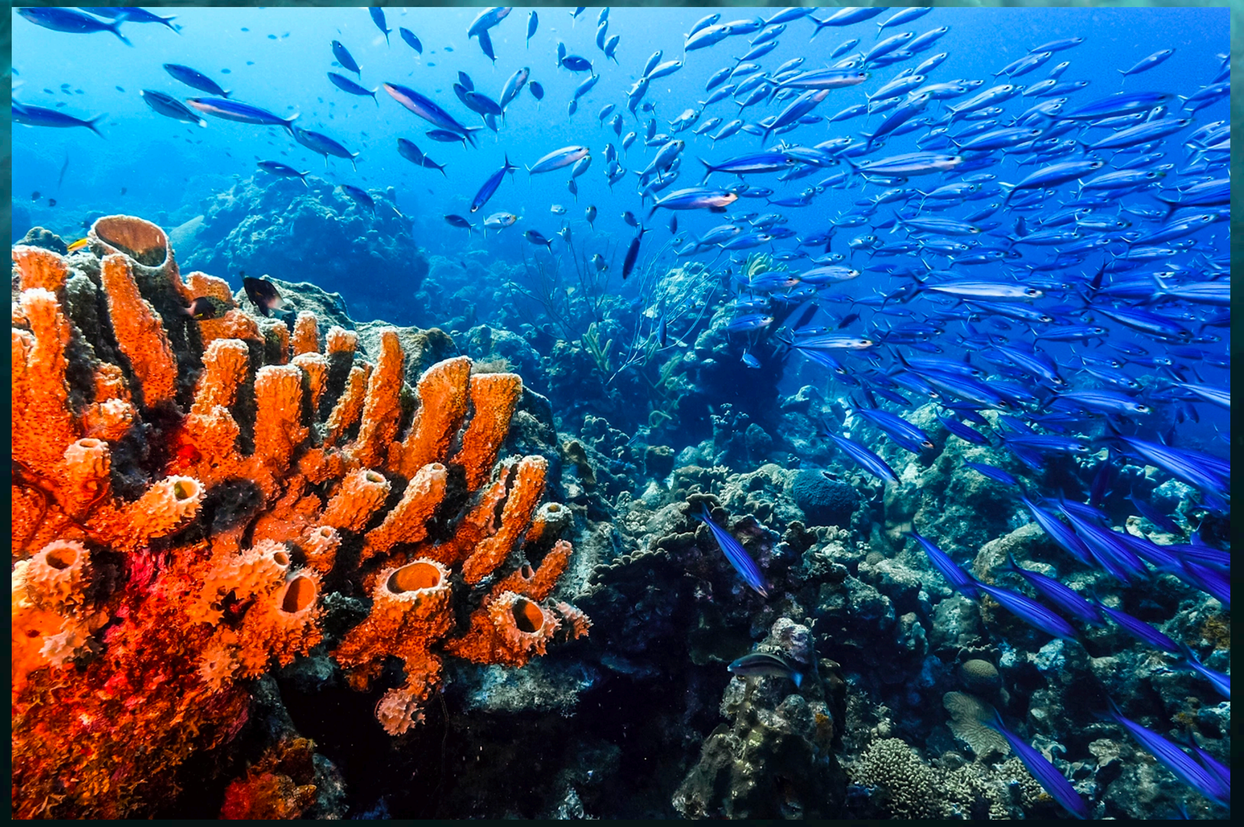
It keeps us not too warm, not too cold.

Why do we need the ocean?



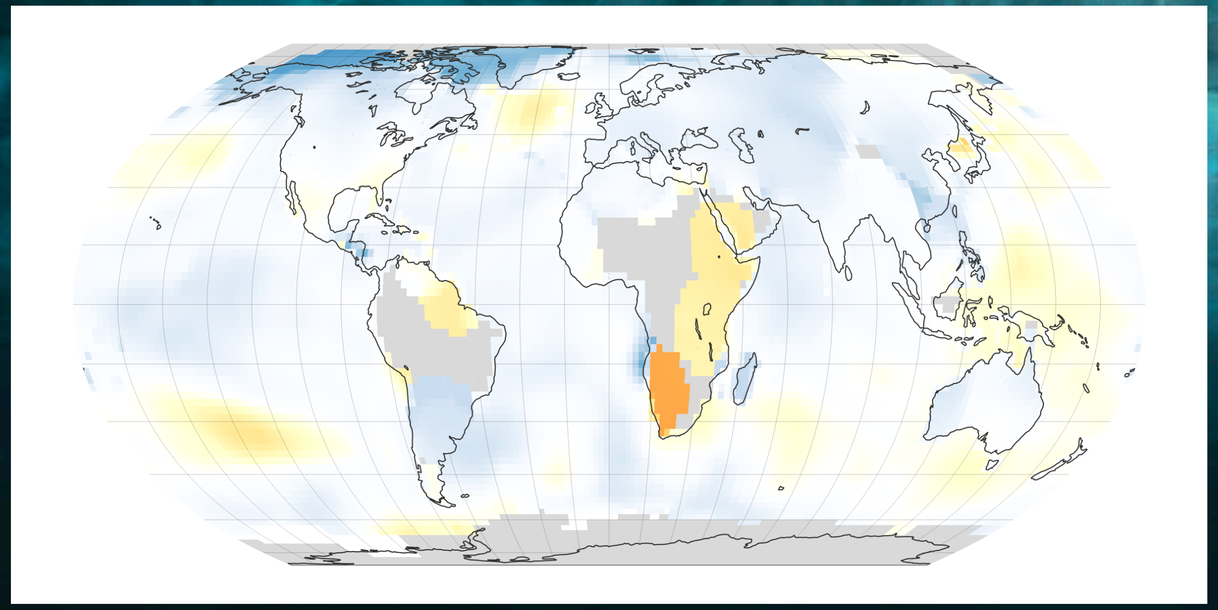
It makes our weather!

Why do we need the ocean?

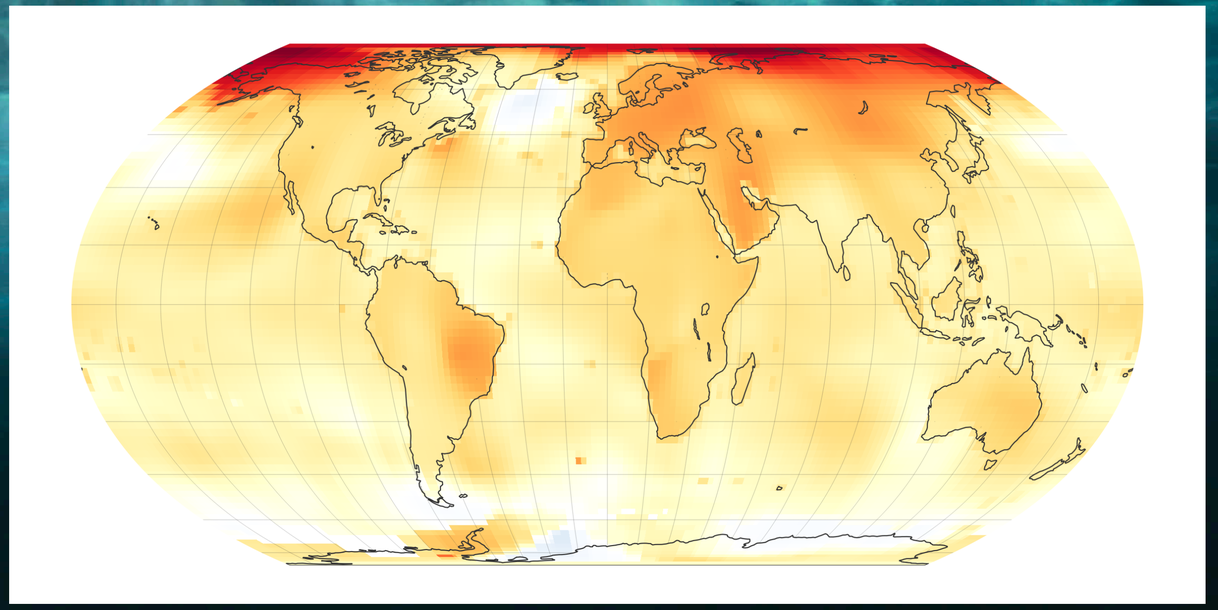


It’s home to very many of our fellow animals - some of whom we haven’t met yet!

It’s also changing, very fast, because of fossil fuel emissions.



1895-1900
(Anomaly from 1951-1980)



2015-2019
(Anomaly from 1951-1980)

But - it’s complicated,
and we still don’t know that much about it!

Oceanographers try to find out about the ocean!

We have two main ways of doing that.

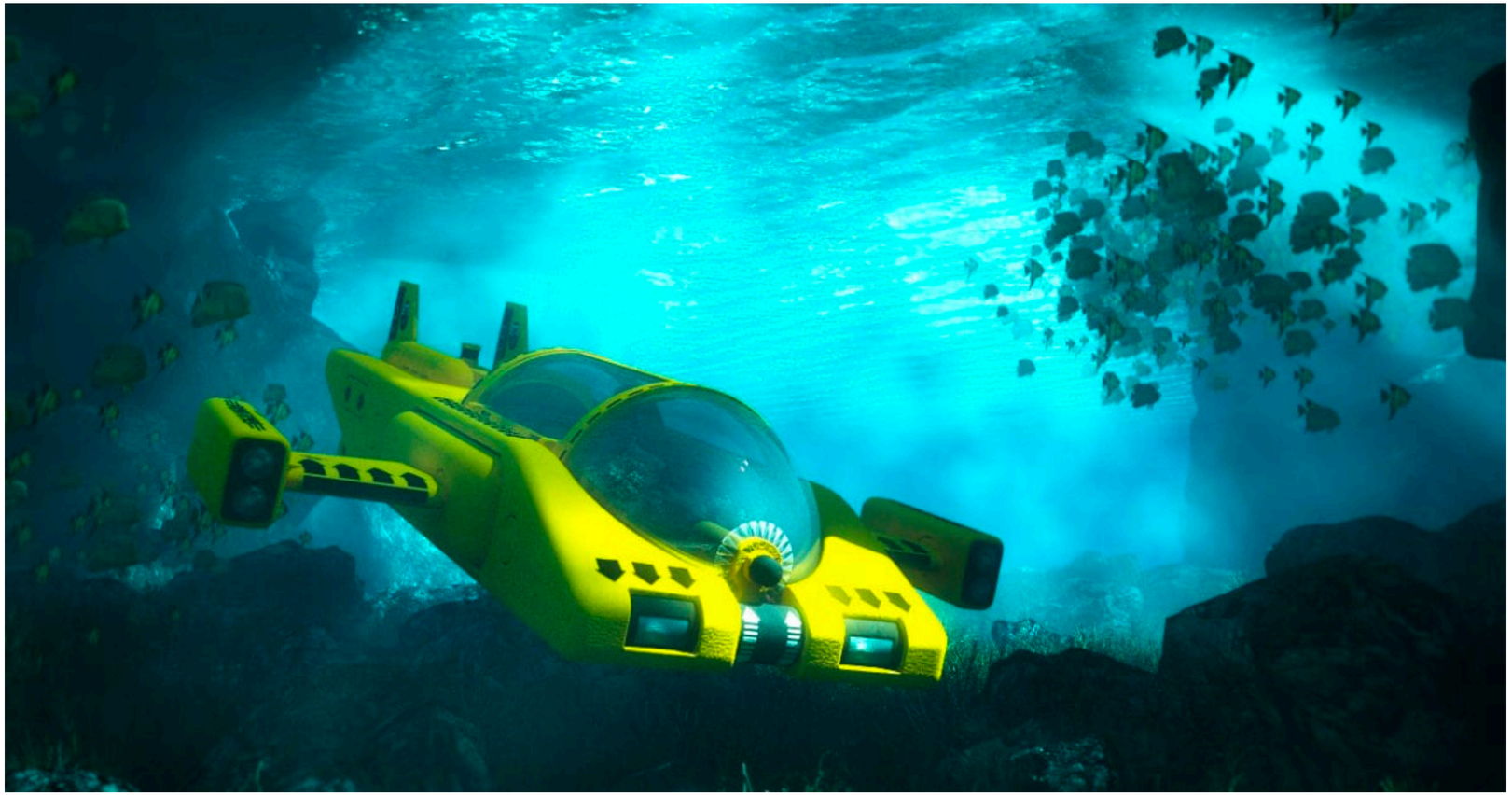
We can visit the ocean with boats or robots

A sail-robot!

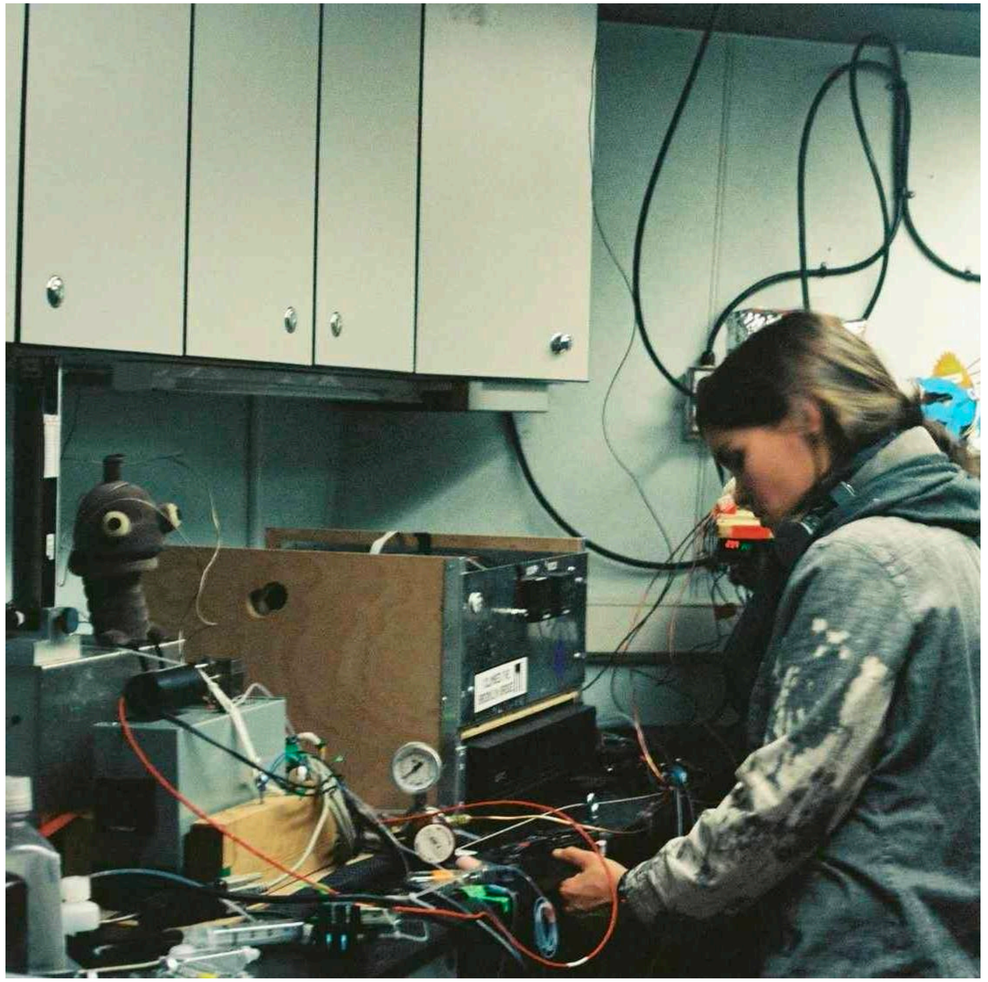

SAILDRONE
UNMANNED SCIENCE VEHICLE
KEEP CLEAR
1046
1046
1046

An underwater robot

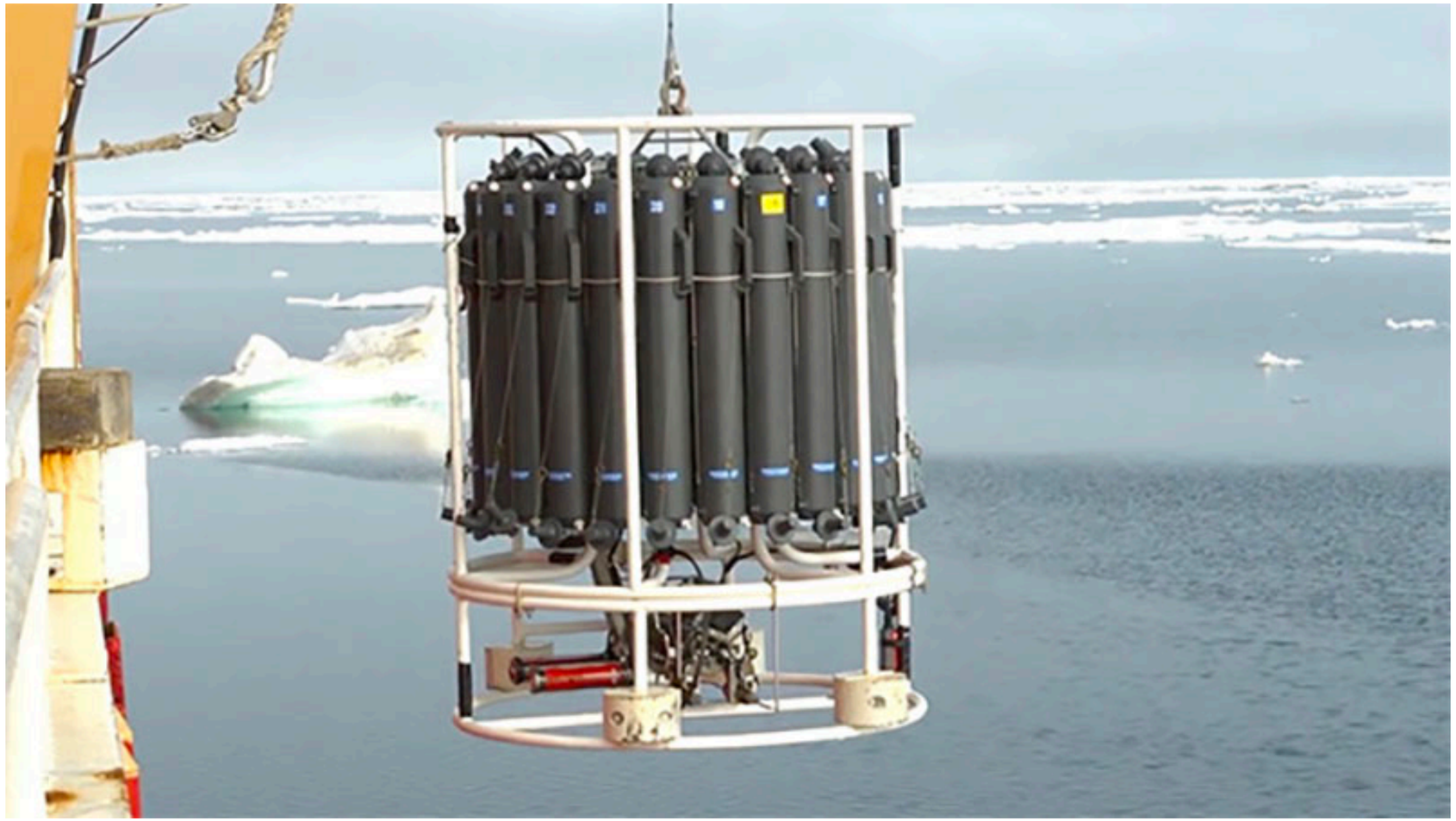
A very deep underwater robot



My robot - for measuring trace gasses



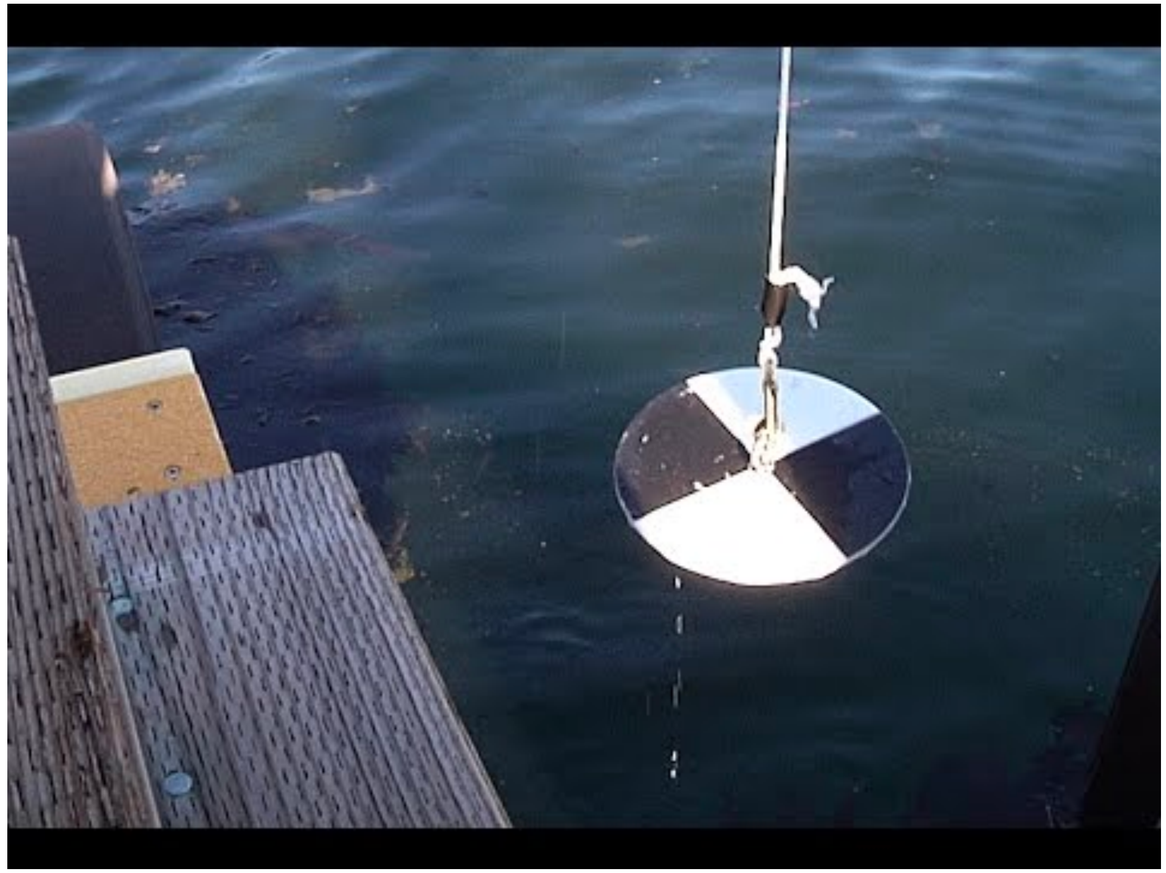
A fancy bucket (we use buckets a lot)



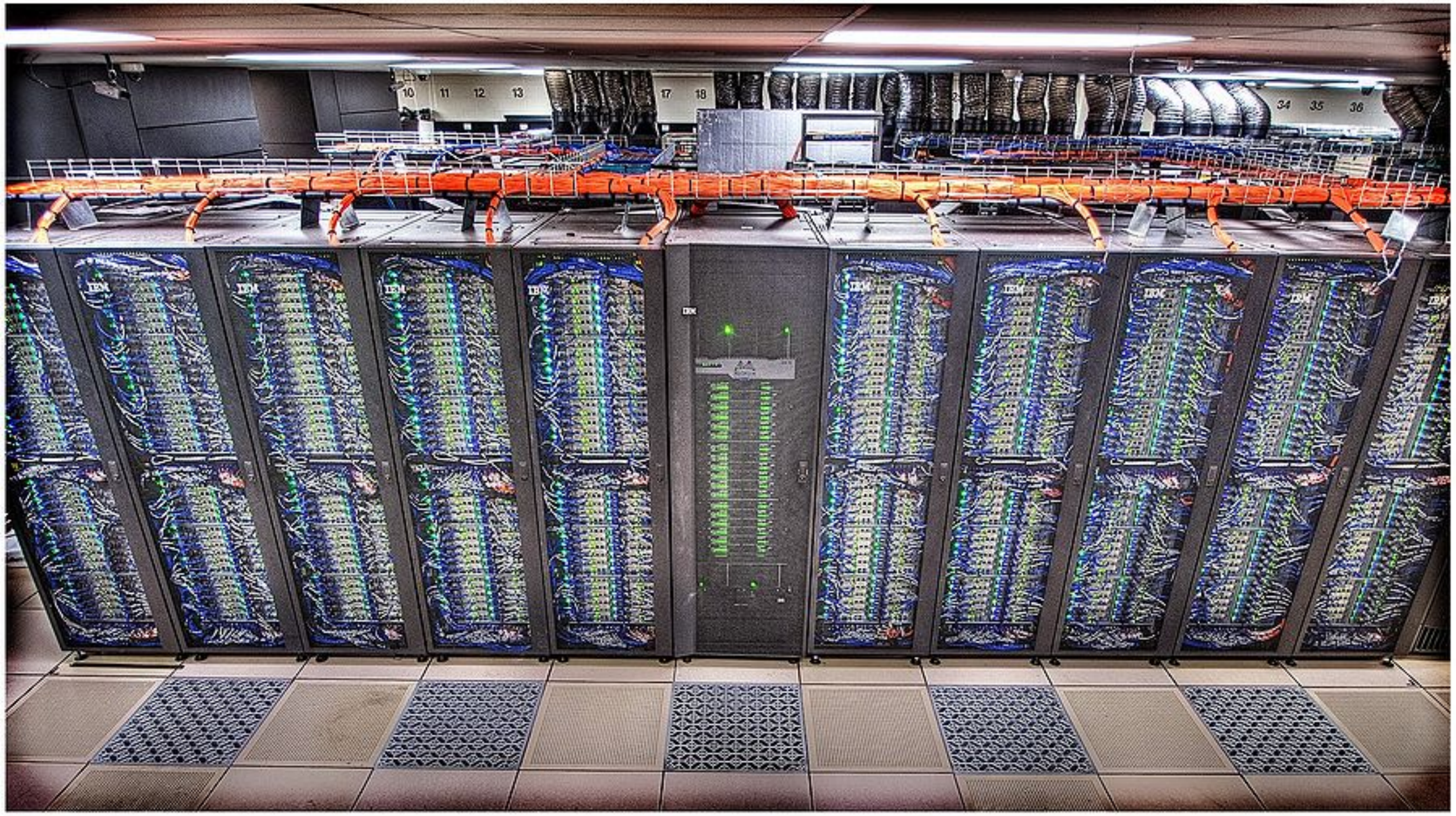
A space robot

A water-speed measuring robot

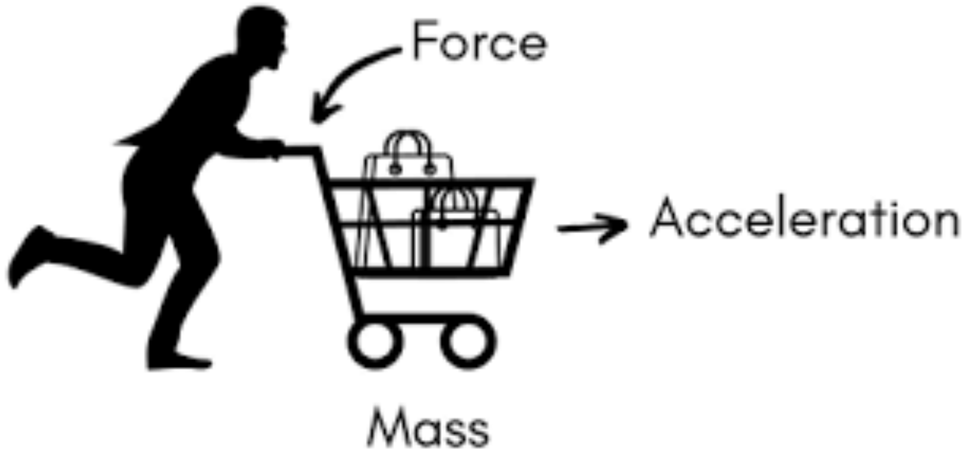
A piece of metal on a string



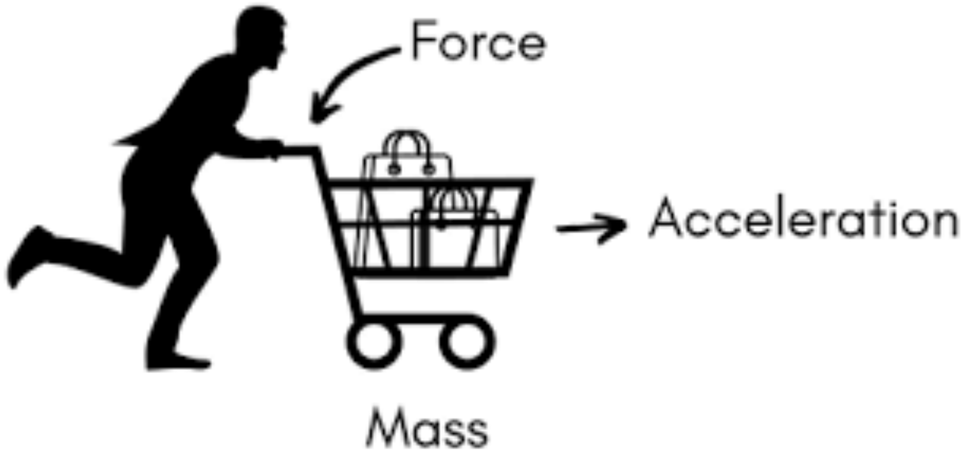
Or we can use computers



Computers take basic physical principles



Computers take basic physical principles



Navier-Stokes Equations

Continuity Equation

$$\nabla \cdot \vec{V} = 0$$

Momentum Equations

$$\rho \frac{D\vec{V}}{Dt} = -\nabla p + \rho \vec{g} + \mu \nabla^2 \vec{V}$$

Total derivative = $\rho[\frac{\partial V}{\partial t} + (V.\nabla)V]$

Change of velocity with time

Convective term

Pressure gradient

Fluid flows in the direction of largest change in pressure.

Body force term

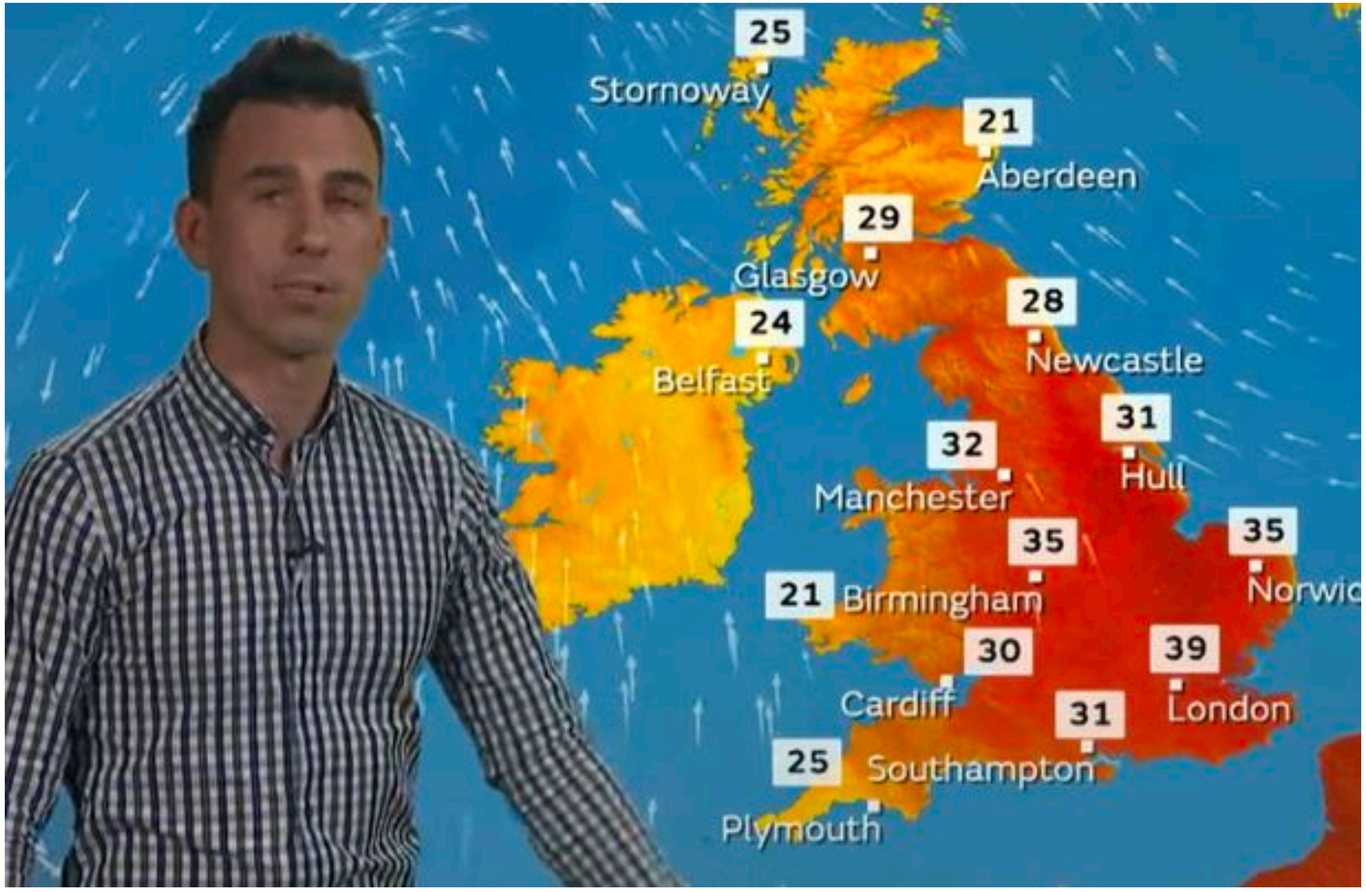
External forces, that act on the fluid (gravitational force or electromegnetic).

Diffusion term

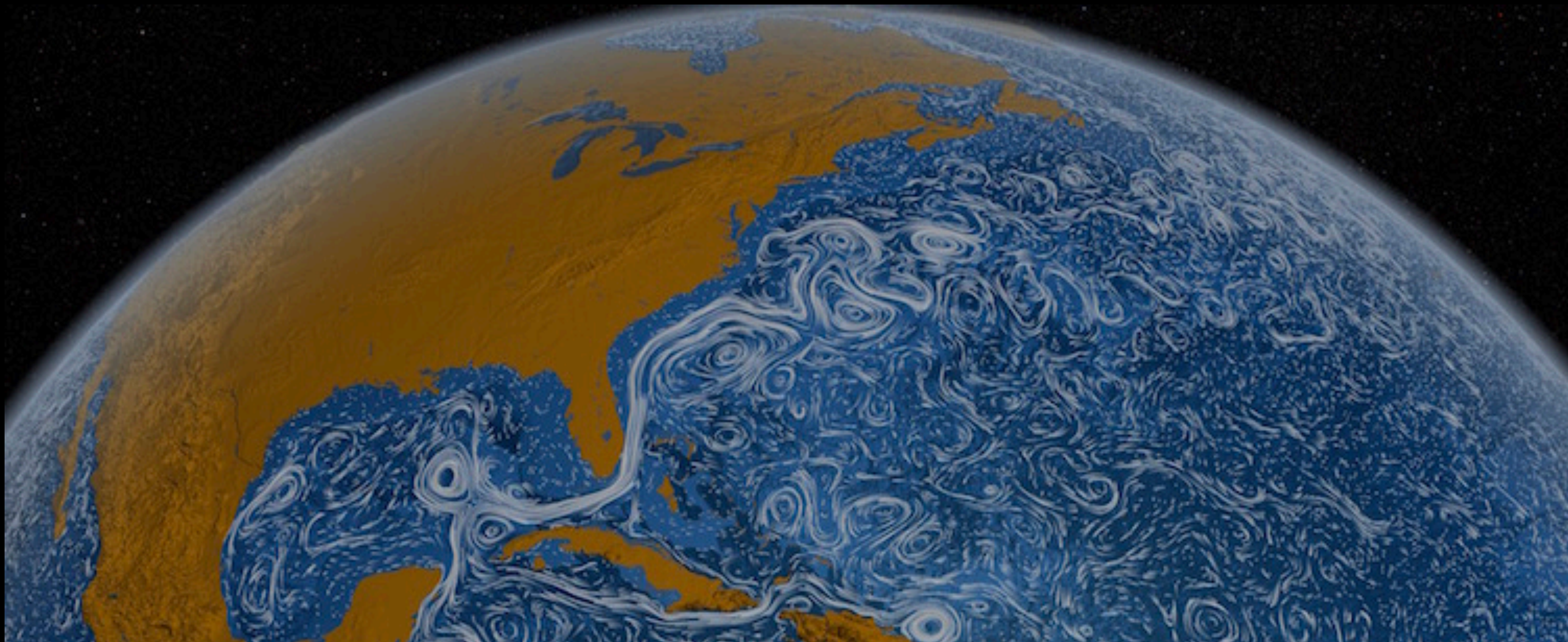
For a Newtonian fluid, viscosity operates as a diffusion of momentum.

and write them so we use them to guess how fast the ocean is moving

We use this idea to make weather forecasts



And also estimates of the big picture



The more we learn about the ocean, the more important we realize it is. And the more interesting. Never stop exploring!