

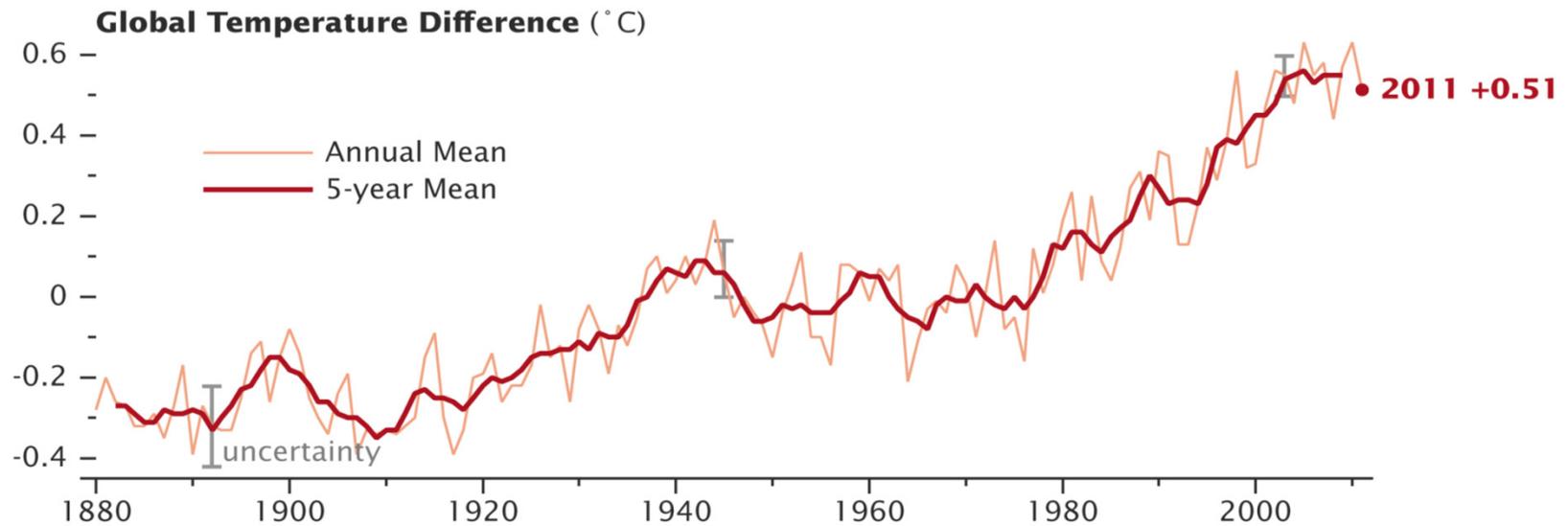
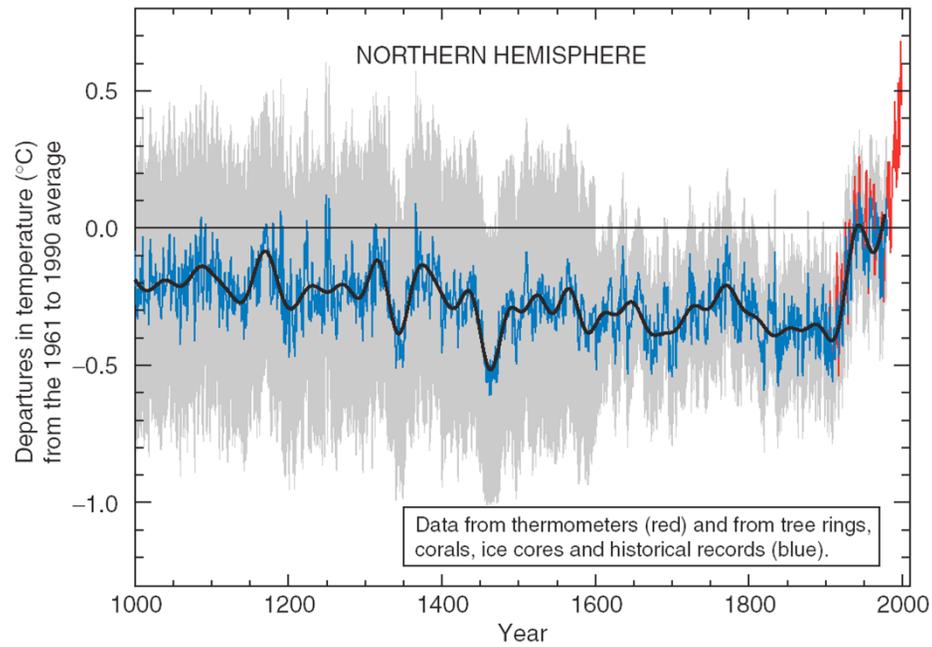


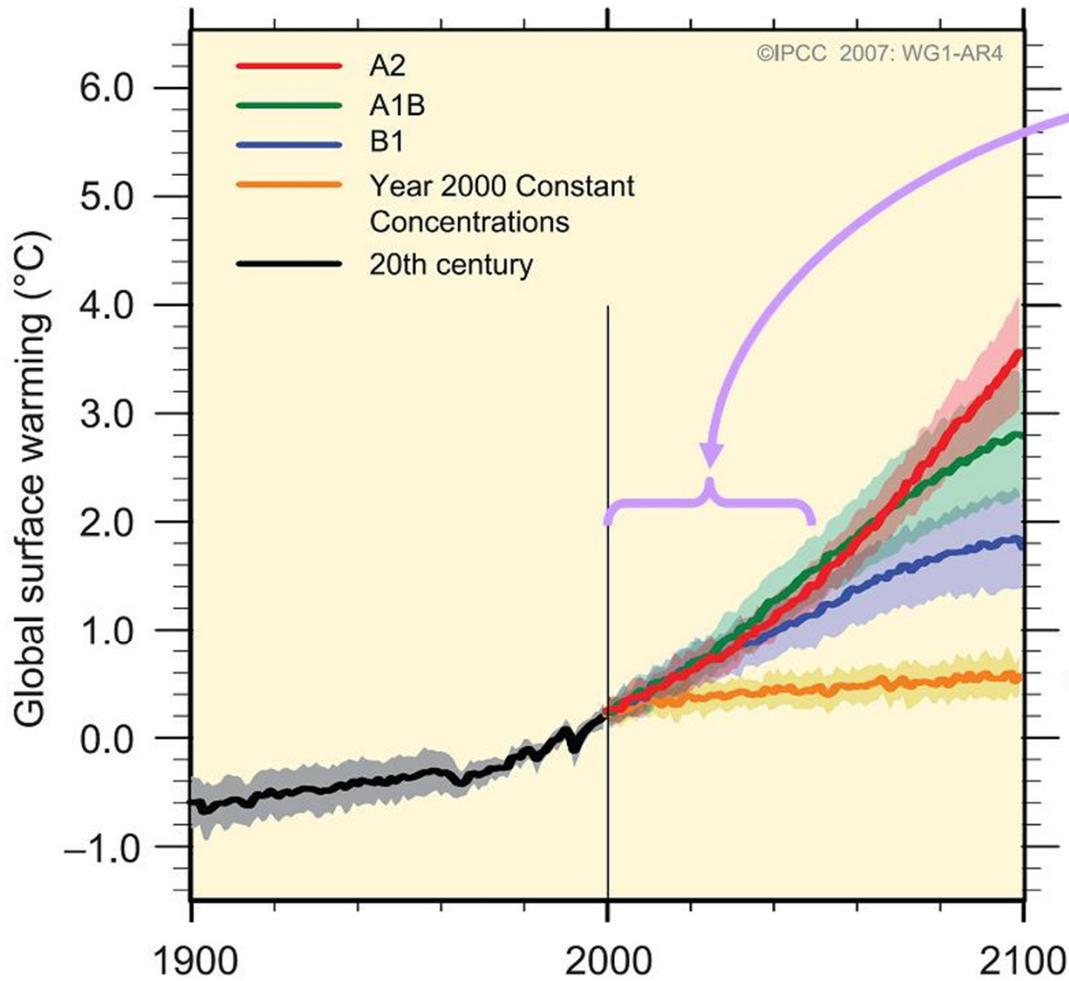
The Impact of a Changing Climate on the Ocean

**President's Council of Advisors on Science and Technology
July 11, 2014**

Robert B. Gagosian
President and CEO, Consortium for Ocean Leadership

Variations of the Earth's surface temperature for the past 1,000 years





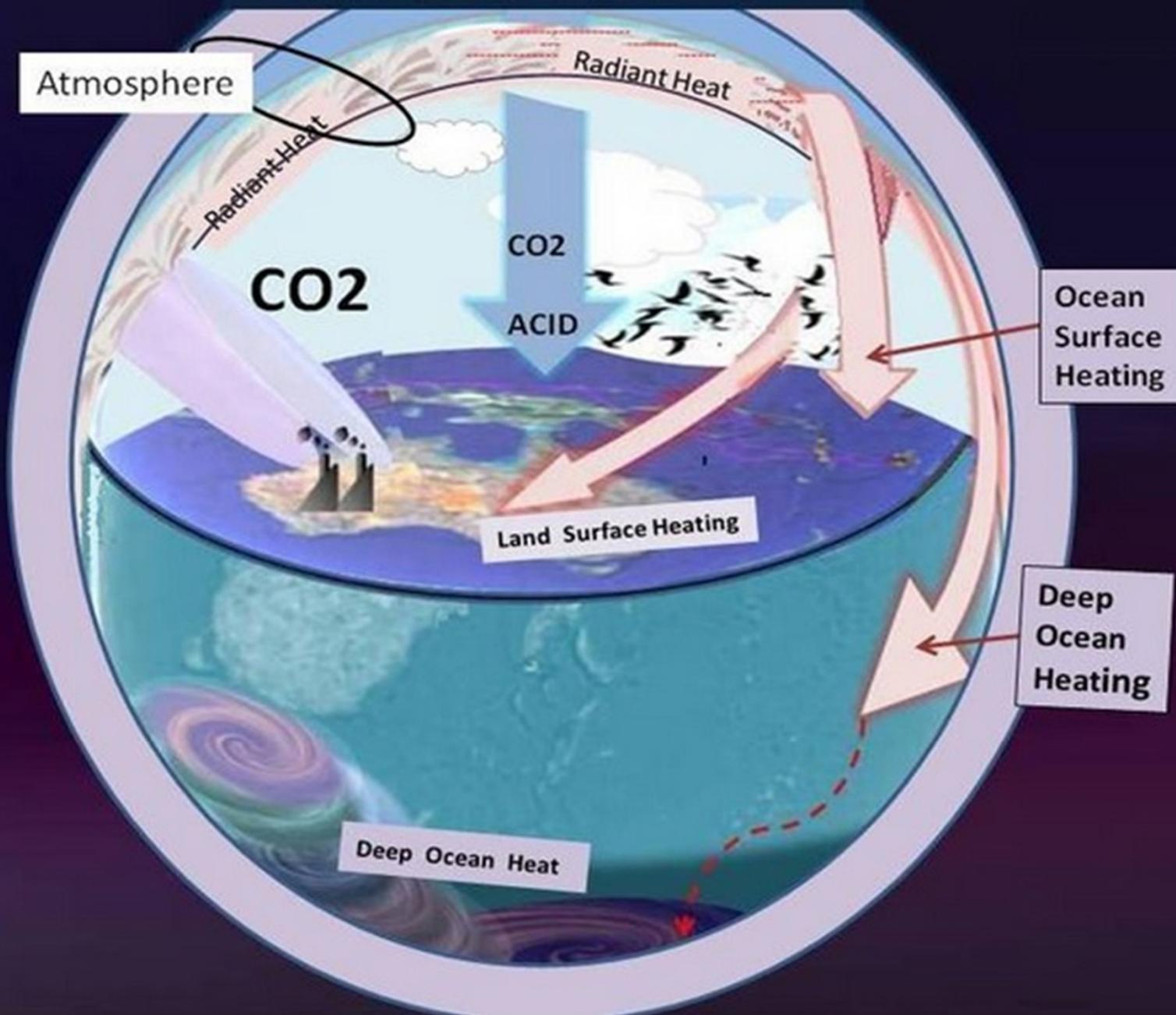
All scenarios show similar increases up to 2050

Due to the effect of emissions released in the past

Model scenarios

If we kept emissions at 2000 levels

OCEAN WARMING & ACIDIFICATION FROM CO2 EMISSIONS

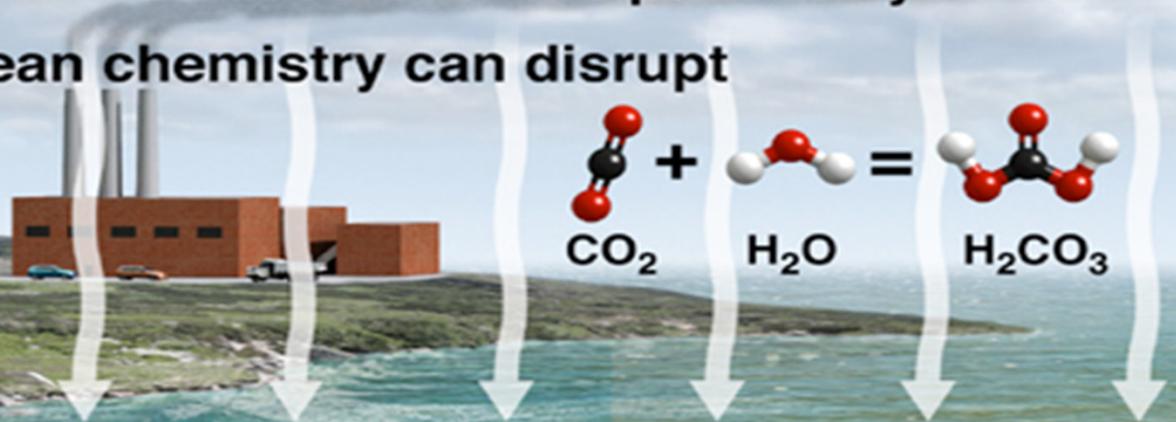


Most of the greenhouse gas heat (over 80%) is used up by warming up the oceans.

The oceans have taken up 30 to 40% of the CO2 emissions acidifying the ocean water.

Carbon dioxide dissolves in the ocean to make carbonic acid. The amount of acid has increased over the past 150 years.

These changes in ocean chemistry can disrupt the entire marine food web.



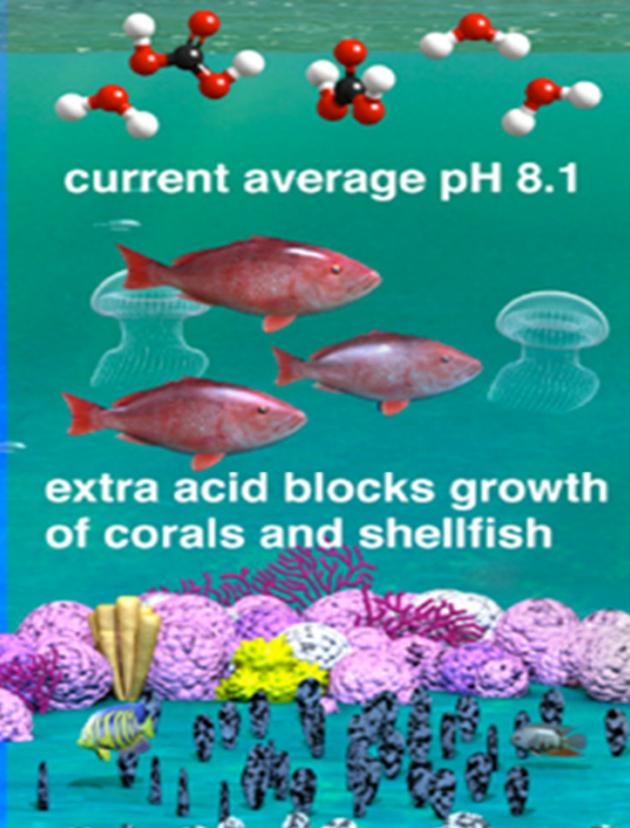
pre-1850 average pH 8.2



This panel shows a vibrant blue ocean. At the top, several water molecules (H_2O) and a few carbon dioxide molecules (CO_2) are shown. Below, a healthy coral reef is visible with various colorful corals and fish. Several red snappers and blue jellies are swimming in the water.

current average pH 8.1

extra acid blocks growth of corals and shellfish



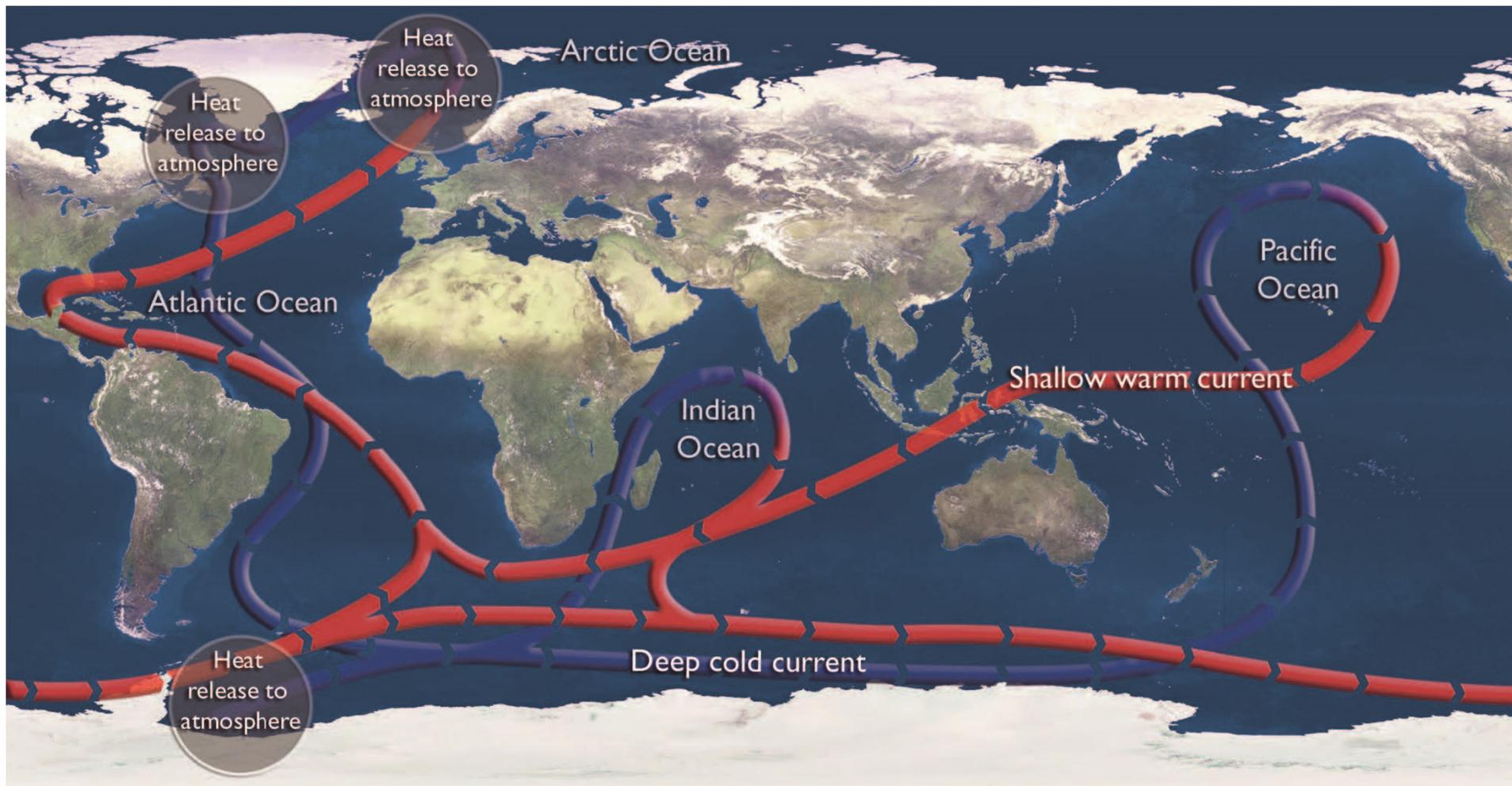
This panel shows a greenish ocean. At the top, there are more CO_2 and H_2O molecules, and a few H_2CO_3 molecules. The coral reef is partially bleached and less diverse. The fish and jellyfish are fewer in number and appear less healthy.

future

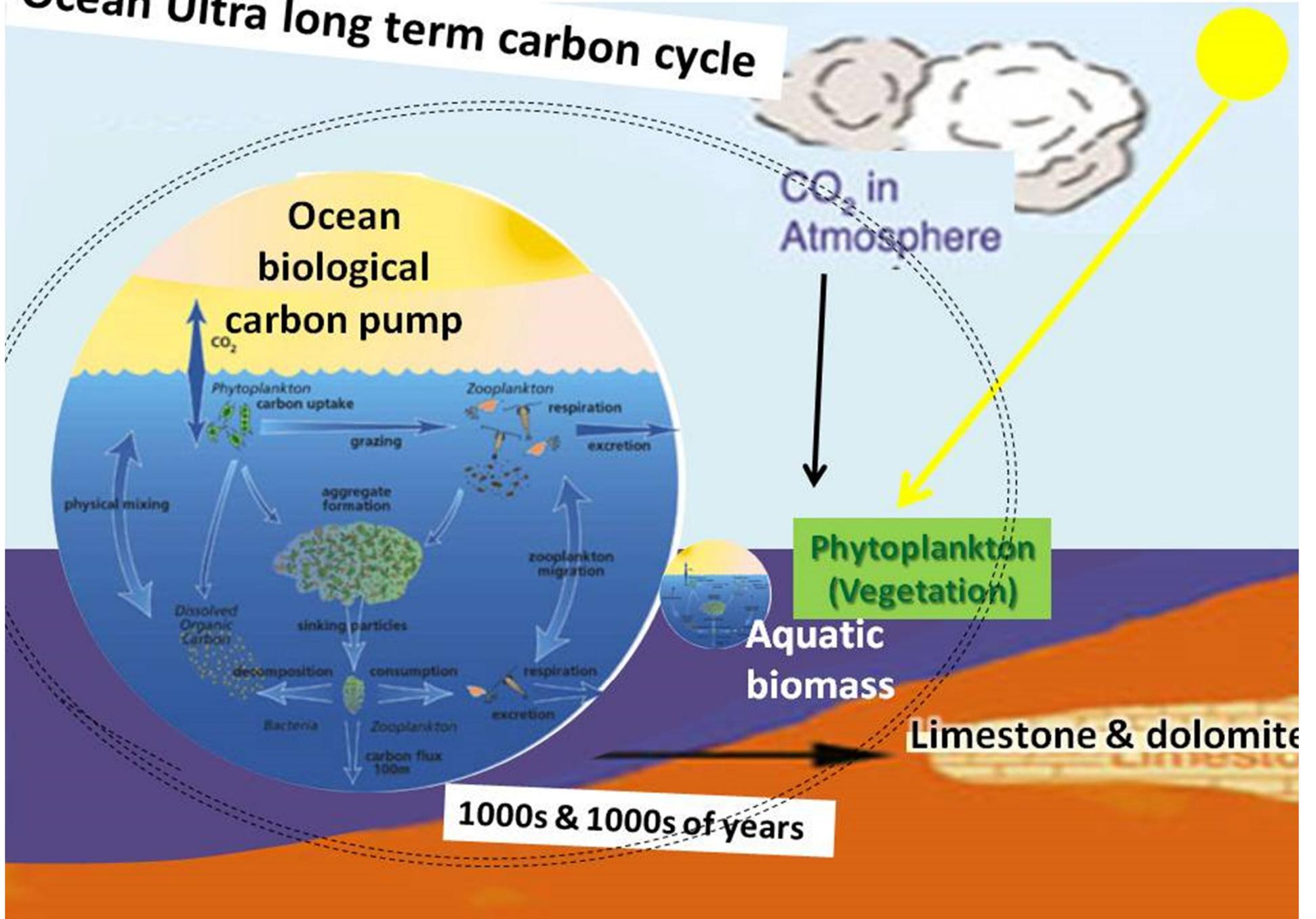
some species in the food web benefit while others decline



This panel shows a dark green ocean. At the top, there are many H_2CO_3 molecules. The coral reef is almost entirely white (bleached). Only a few fish and jellyfish remain, and they appear stressed.



Ocean Ultra long term carbon cycle

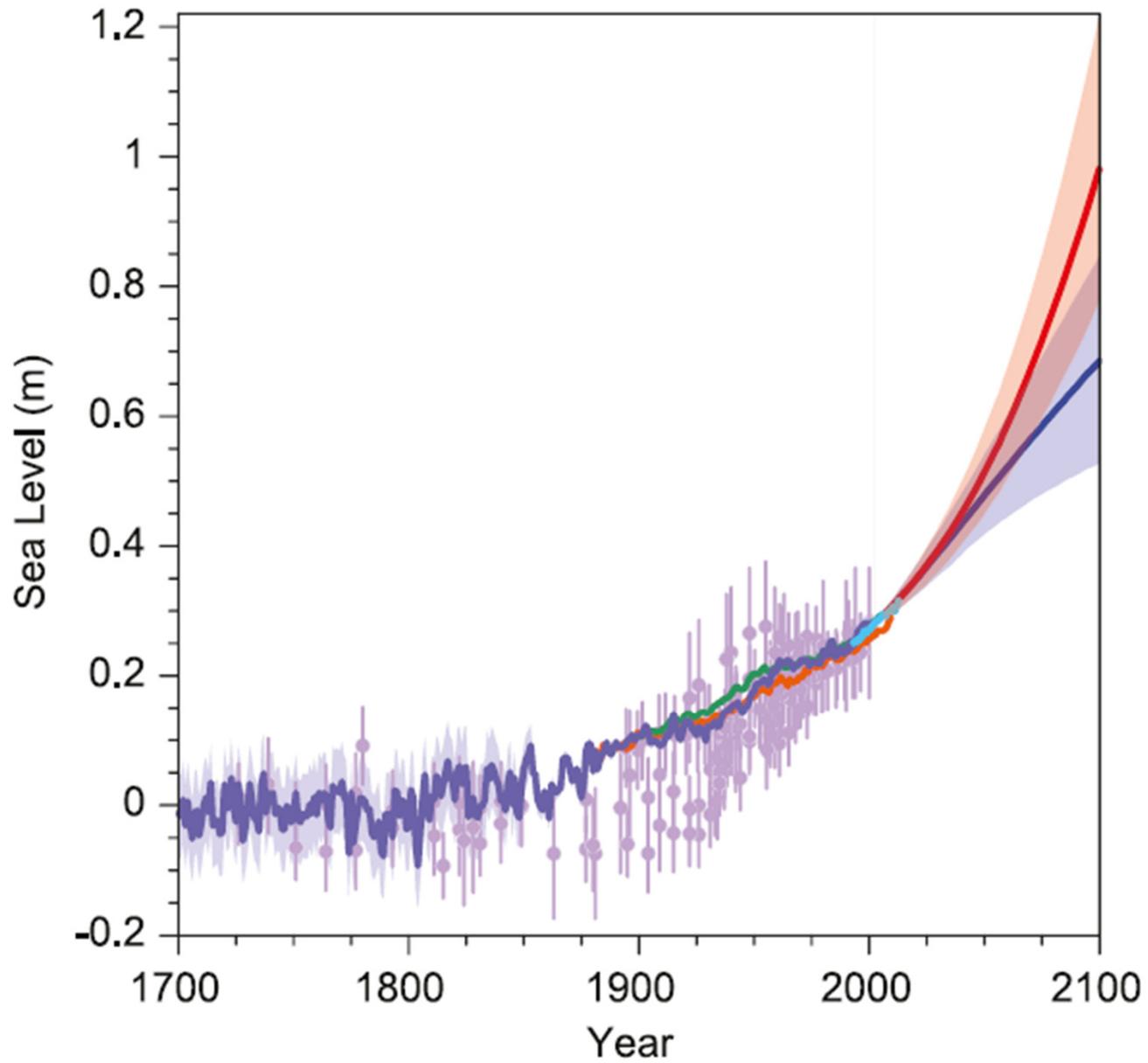




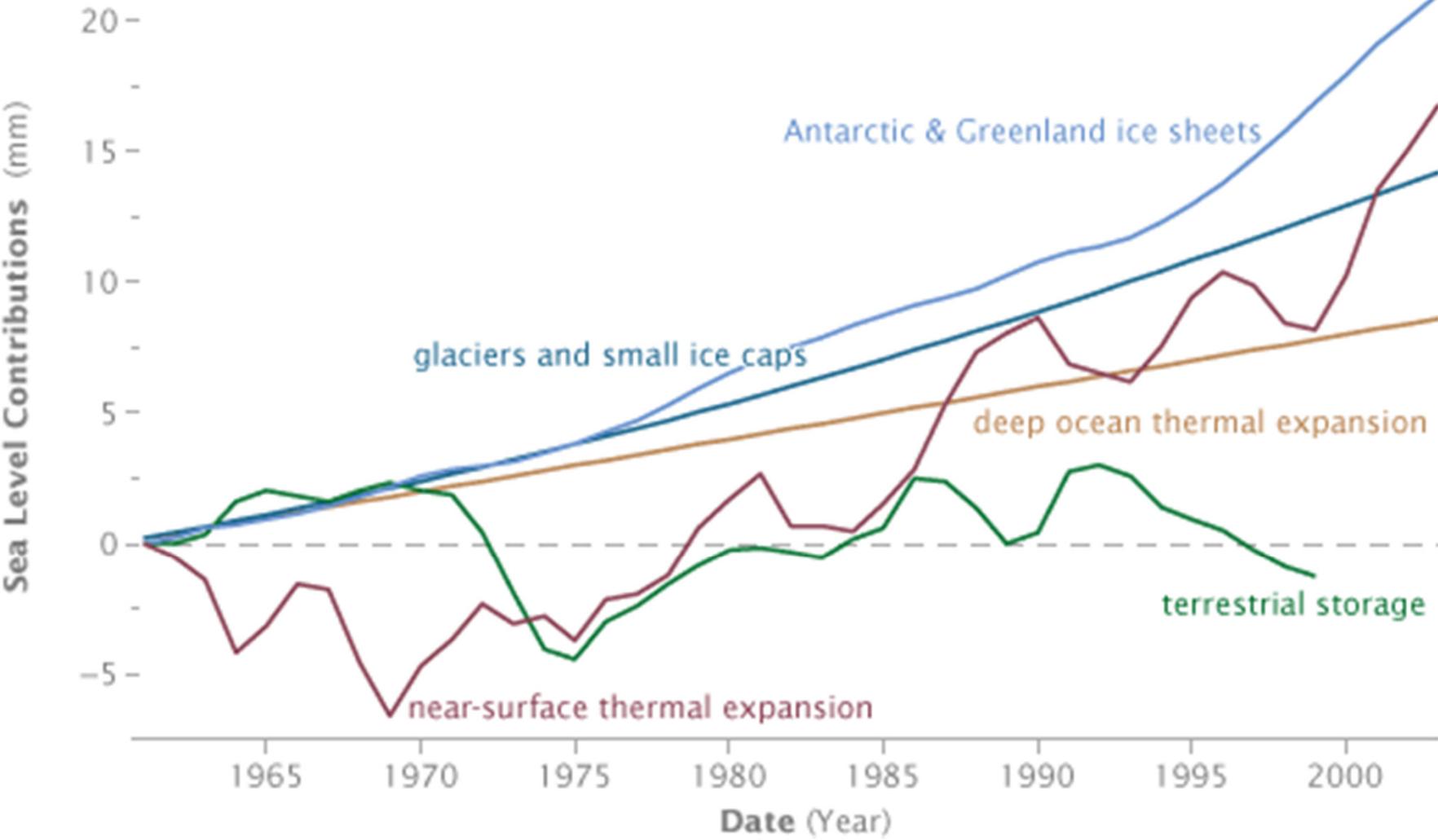
Communities and Sea Level Rise



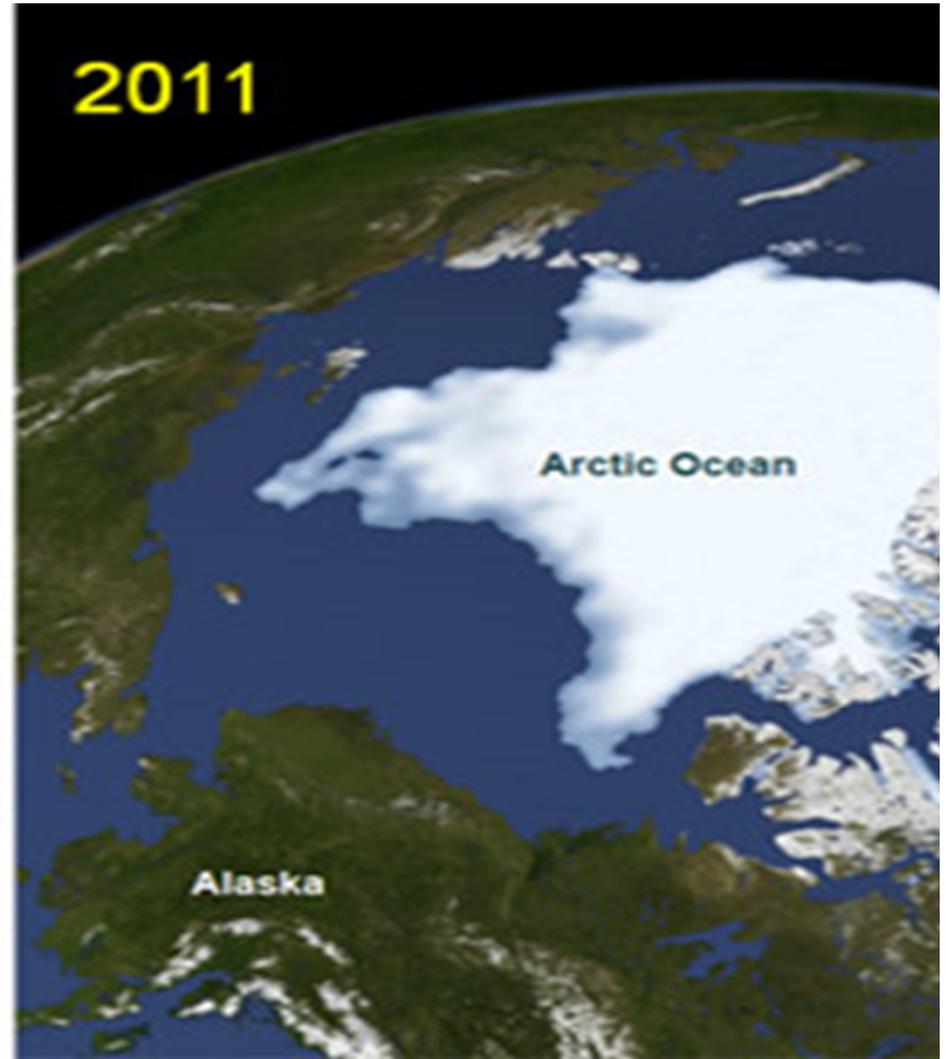
Sea Level Rise



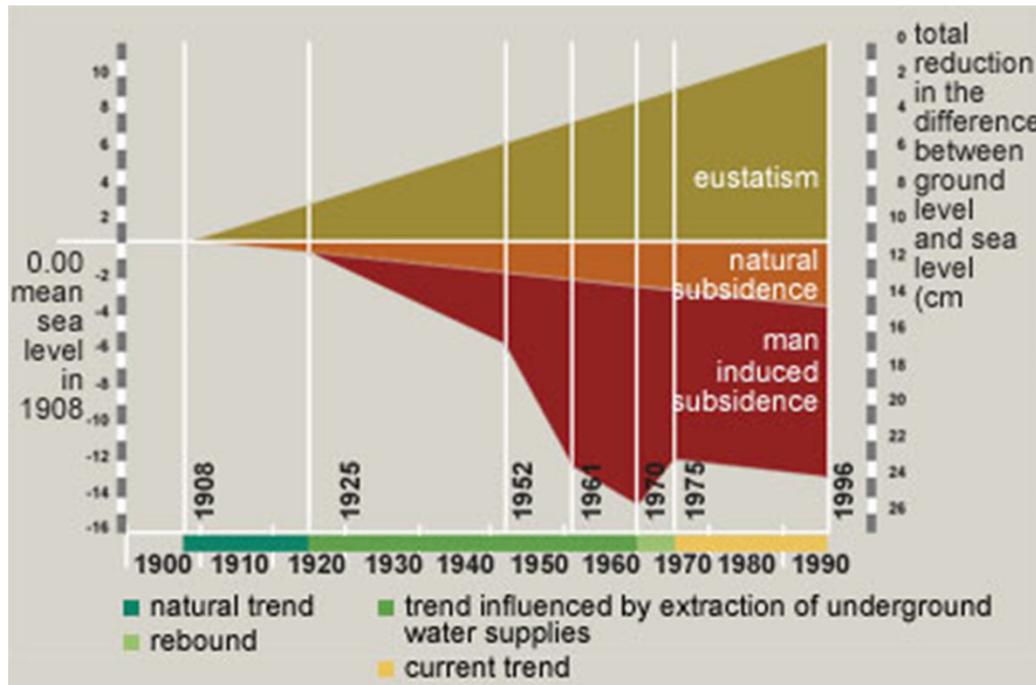
Components of Sea Level Rise



Components of Sea Level Rise



Case in Point: Venice, Italy



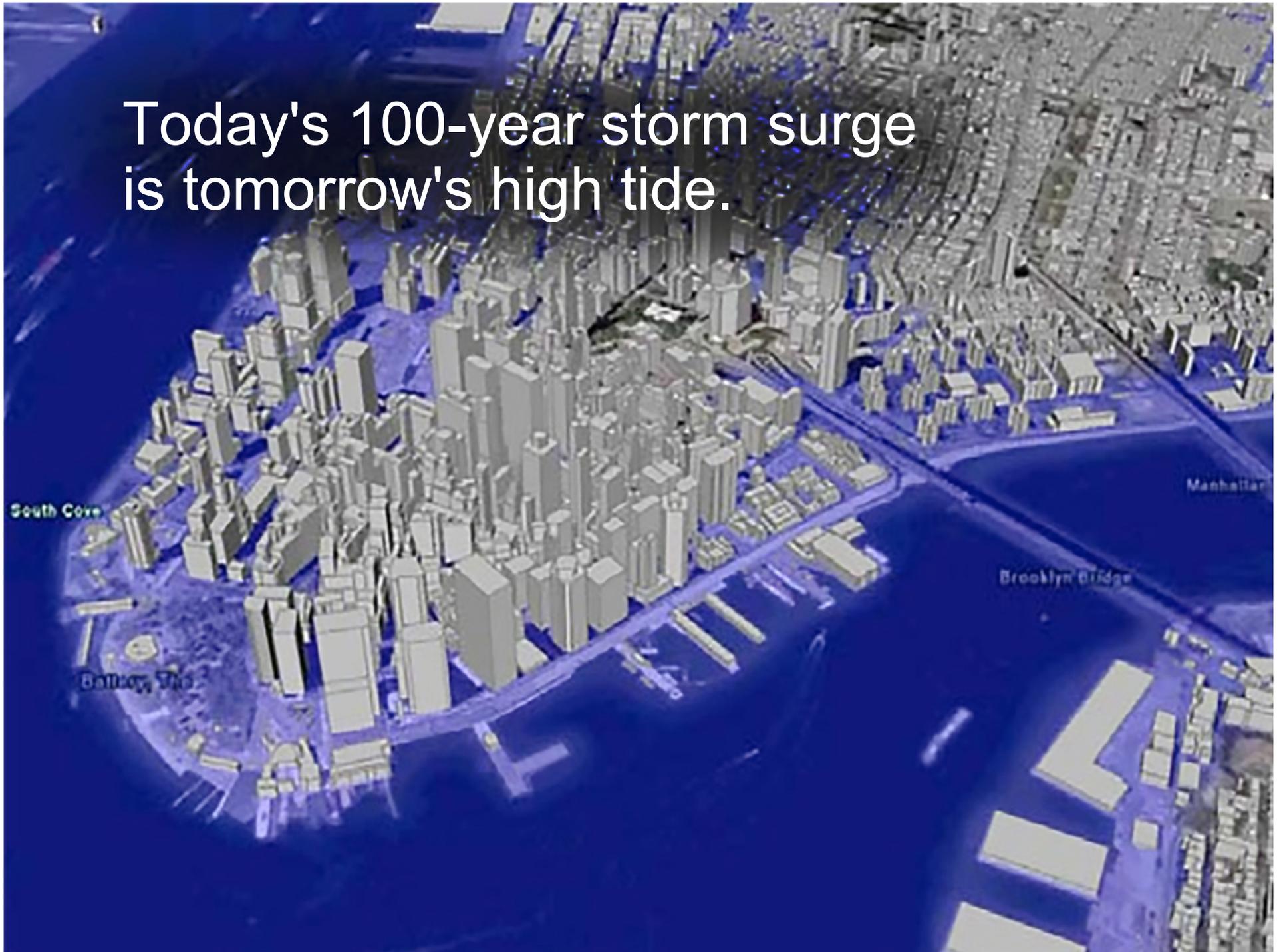
Today's 100-year storm surge
is tomorrow's high tide.

South Cove

Battery Park

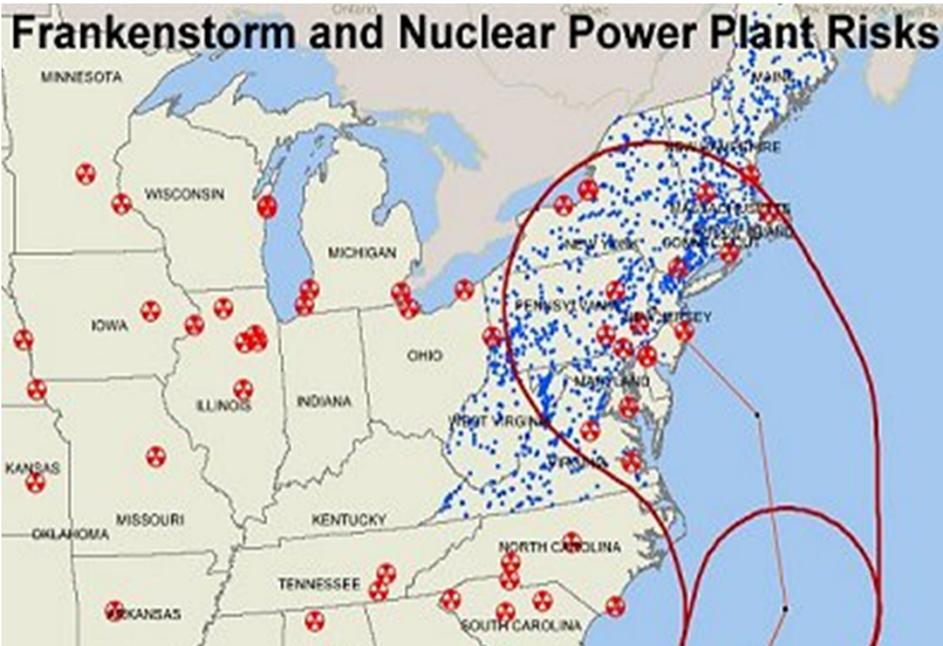
Manhattan

Brooklyn Bridge





Infrastructure and Sea Level Rise









For further discussion:
RGagosian@oceanleadership.org