Ocean colour: marine plant life from space

The fast surface cycle: The surface ocean exchanges carbon dioxide (CO₂) with the atmosphere all the time (1). Marine plants (mainly phytoplankton) take up carbon dioxide and water during photosynthesis, turning these into organic carbon as they grow (2). Most of this carbon is returned to the water as CO₂ during respiration (3). In this way carbon is continuously cycled in the surface ocean over a few days to a few years.

Chlorophyll images can help us estimate marine plant production.

The deep ocean cycle: Some organic carbon sinks into the deep ocean as plants and animals die (4). Decomposition in the deep ocean releases CO₂, which may take hundreds of years to return to the surface (5).

The slow geological cycle: Some of the carbon is buried so deep in bottom mud that it does not decompose, but returns to the geological carbon cycle (6). Millions of years will pass before this carbon returns to the atmosphere in geological events such as volcanic eruptions (7). When we burn fossil fuels we take carbon out of the geological cycle and release it into the fast-spinning cycle between the surface ocean and the atmosphere. We do this much faster than nature can return the carbon to the geological cycle. For now the ocean is removing some of the carbon released from fossil fuel burning and storing it in the deep ocean, buying us time, but in the next few hundred years this deep ocean carbon will return to the surface.

Ocean colour instruments measure the intensity of sunlight reflected from the Earth's surface at different wavelengths (or bands). This image is created by combining red, green and blue bands, which correspond to the 3 colours seen by the human eye. The image resembles a photo from space, but it is put together from half-orbit images obtained over many days in all seasons. The jagged edges are a result of missing data near the North and South poles. Inset: ocean data from a single day in February 2009.

Global ocean chlorophyll concentrations from satellites - average calculated for 15 years 1997–2012.