

Phytoplankton spring blooms

by Anna Rummyantseva

Email: rummyantseva.anya@gmail.com



Many plants on land bloom in spring...

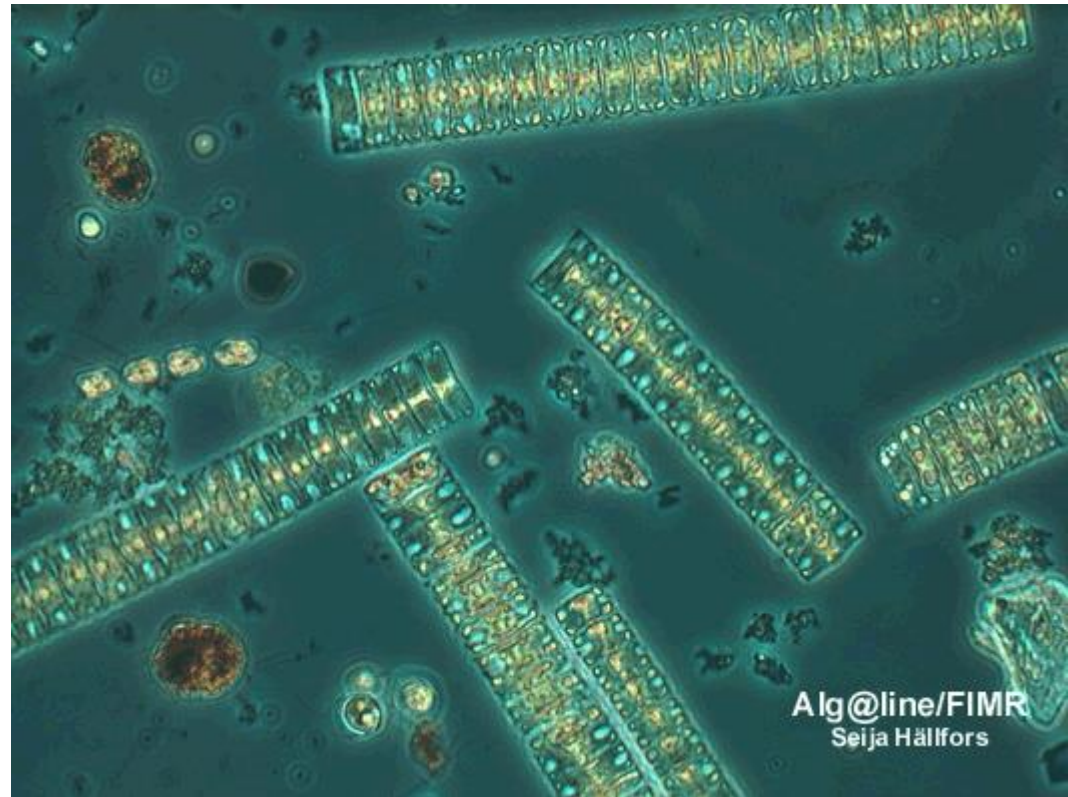
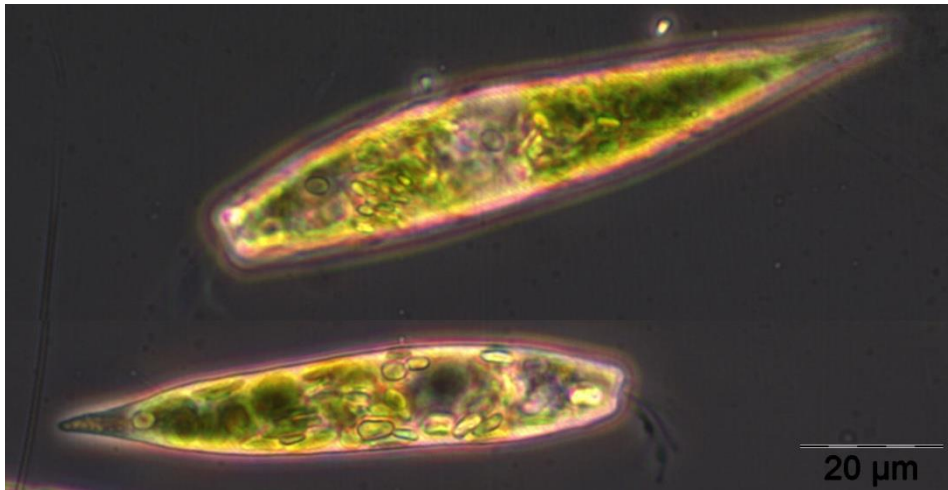
Photo from <http://www.forestwander.com/>

...so does the ocean

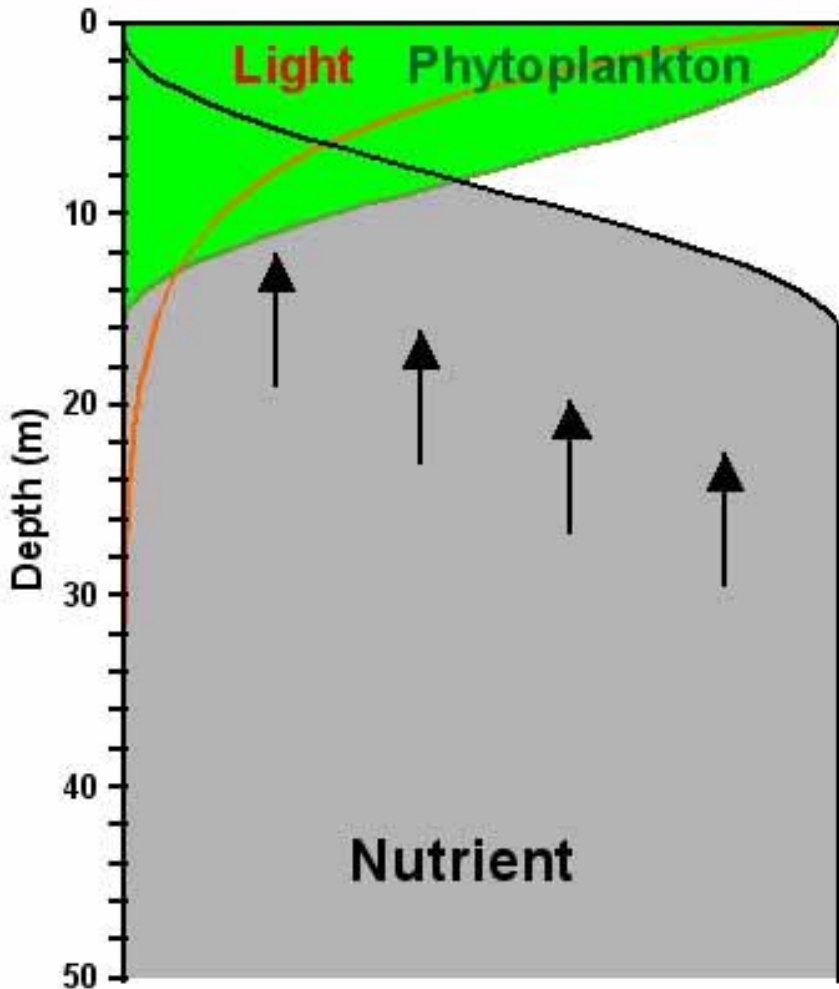


NASA image by Norman Kuring, GSFC Ocean Color Team
A phytoplankton bloom seen in the Barents Sea

In many parts of the ocean phytoplankton (microalgae) concentration increases dramatically in spring



Phytoplankton needs light and nutrients to grow



Light conditions are favorable in the shallow surface layer

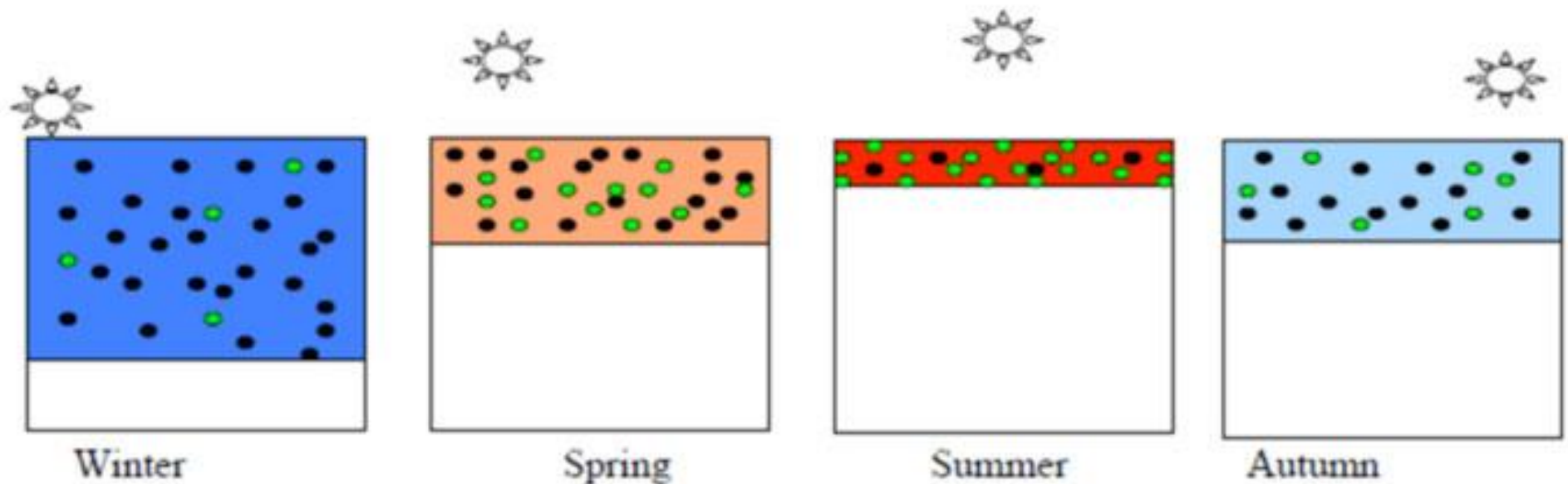
Nutrient concentrations (nitrate, silicate, phosphate etc) are high in deeper layers

Mixing in the ocean determines conditions for the phytoplankton growth

Why does the ocean bloom in spring?

Green dots: phytoplankton

Black dots: nutrients



Many nutrients
Low light

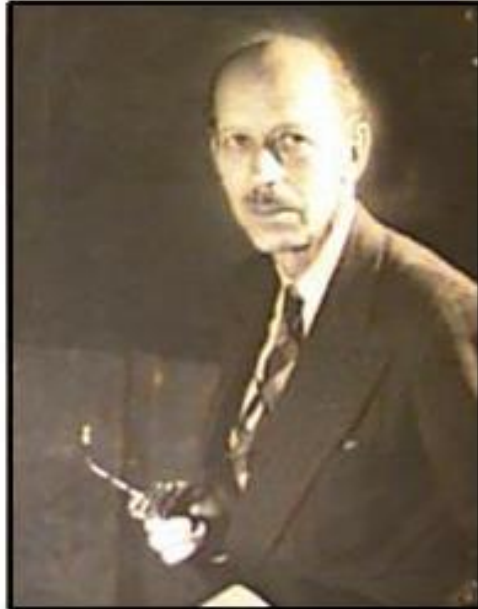
Many nutrients
Good light

No nutrients
Good light

Some nutrients
OK(ish) light

(the figure is taken from <http://noc.ac.uk/>)

When does the spring bloom start exactly?



On Conditions for the Vernal Blooming of Phytoplankton.

By

H. U. Sverdrup,
Norsk Polarinstitut, Oslo.

Sverdrup, H. U. 1953. *J. Cons. Perm. Int. Explor. Mer.* **18:** 287-295.

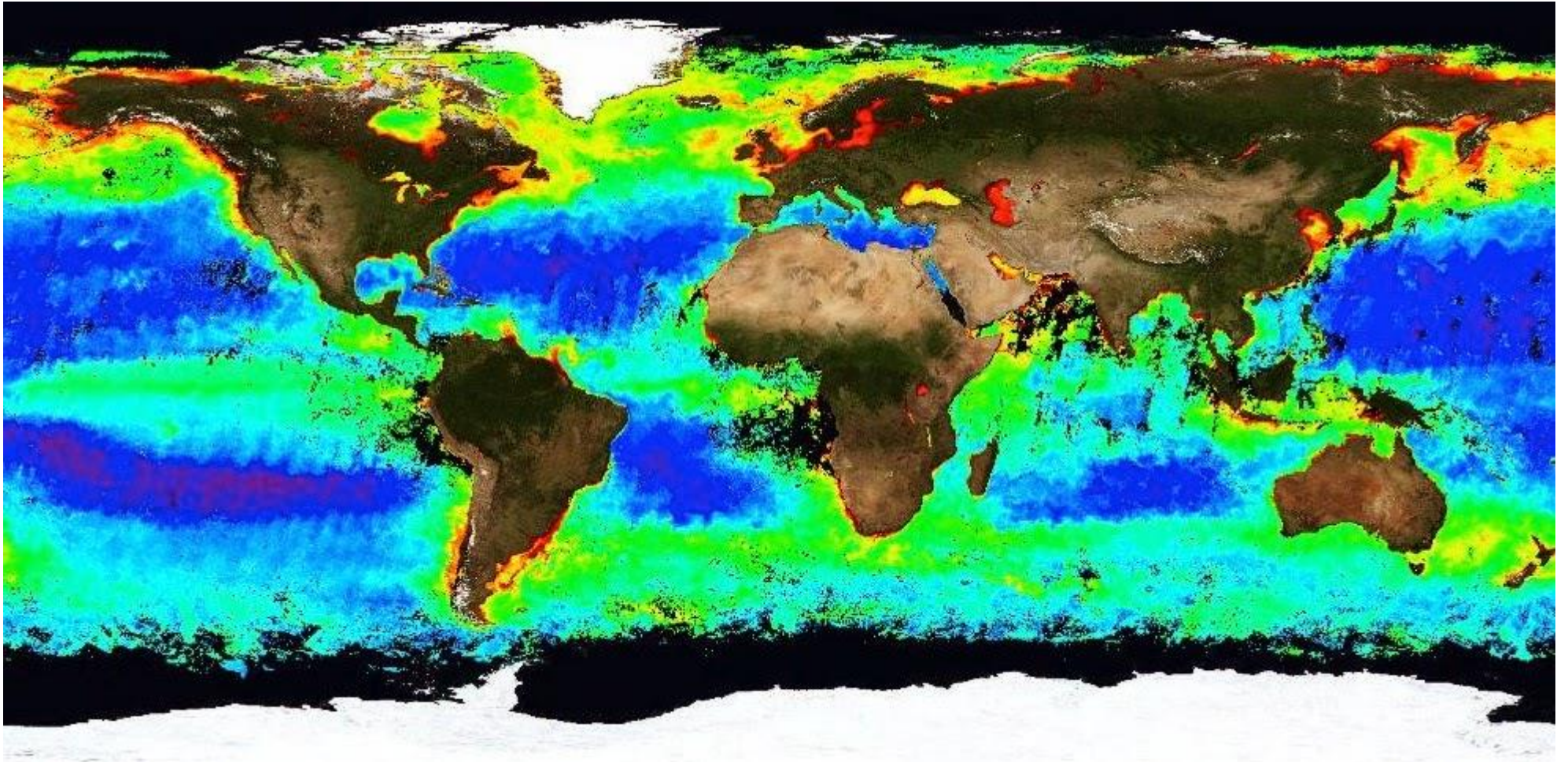
In 1953 Harald Sverdrup proposed the first mathematical model describing optimal light – mixing conditions for the phytoplankton spring bloom initiation.

Scientists use chlorophyll-*a* concentration as a proxy of biomass to investigate phytoplankton seasonality



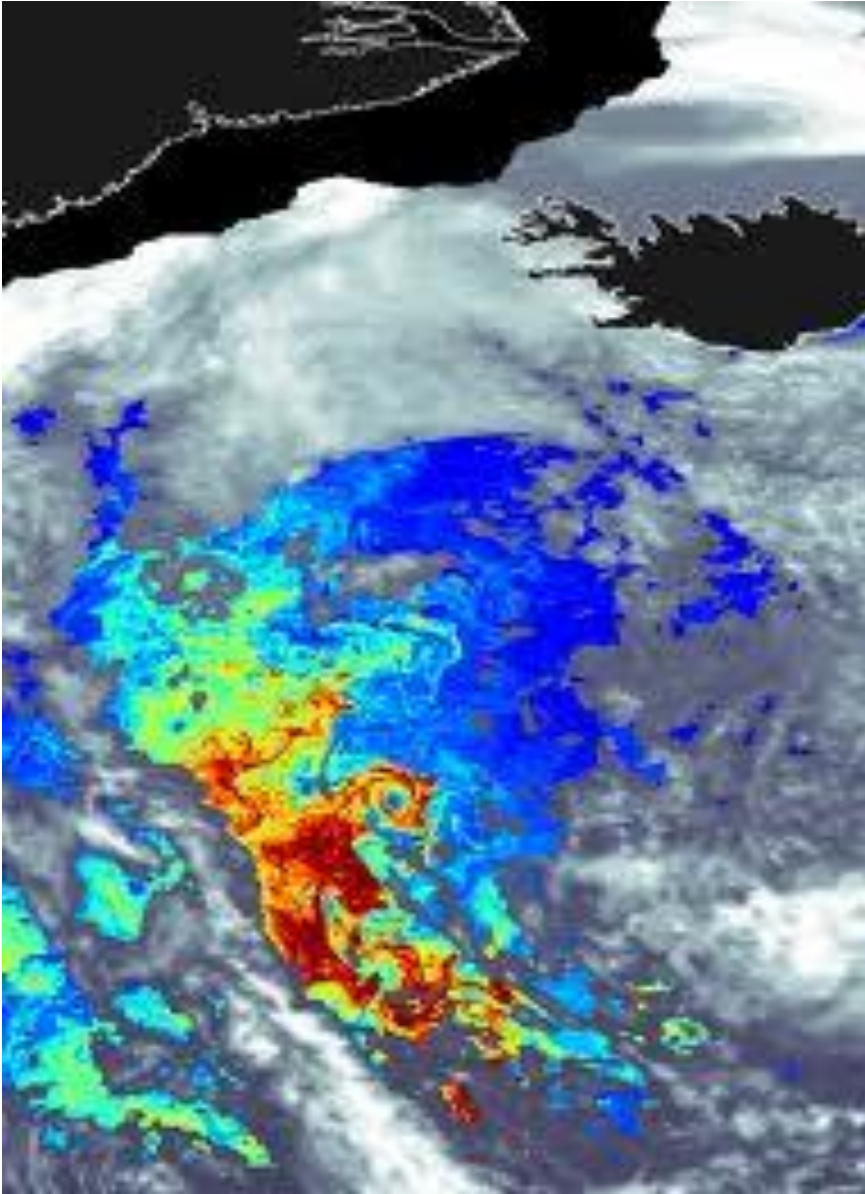
(from <https://www.eeb.ucla.edu/>)

Satellites measure how "green" is the ocean and provide global estimates of chlorophyll-a concentration in the surface layer



(Source: NASA Ocean Color Web)

...and provide us amazing snapshots of the blooming ocean

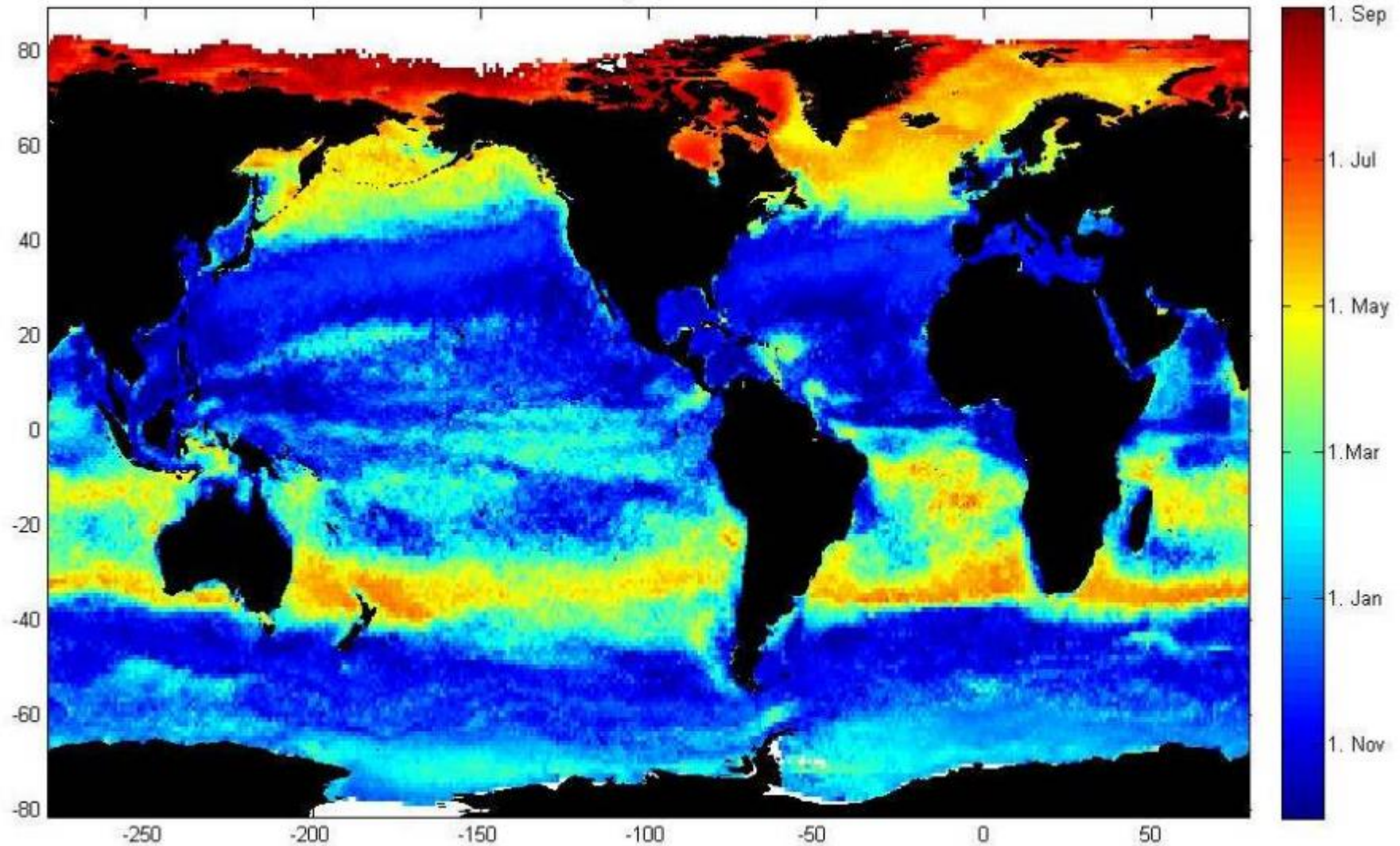


Spring bloom in the North Atlantic Ocean stirred by ocean eddies and fronts.

Phytoplankton cannot "swim". Its distribution reflects turbulence field in the ocean surface layer.

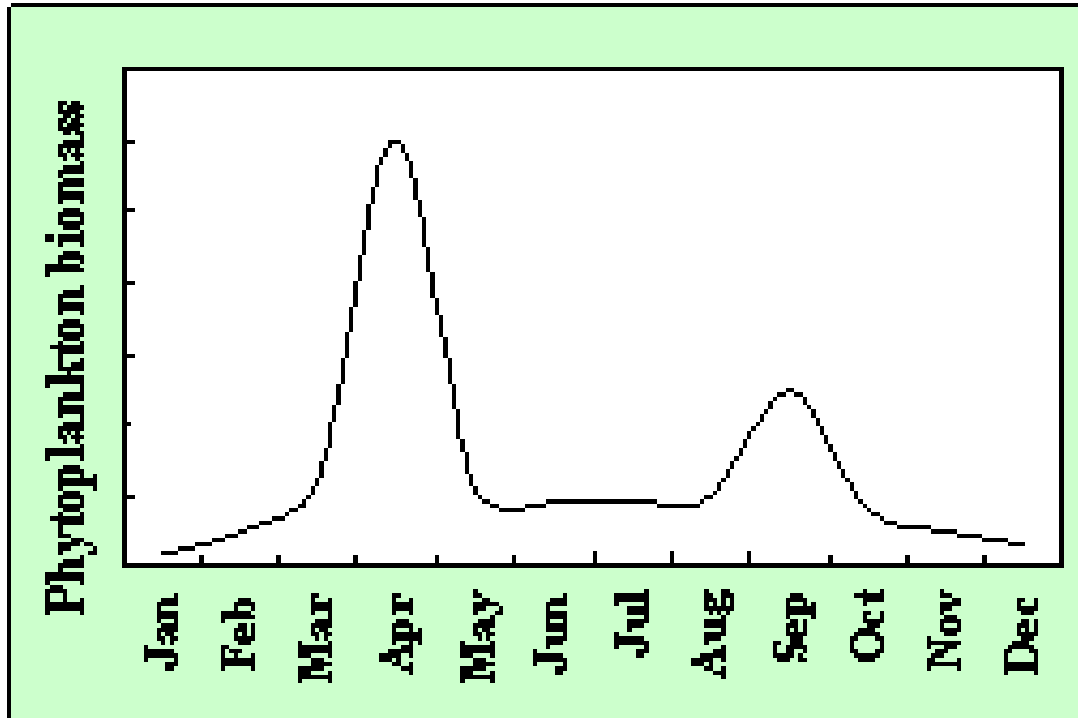
Using satellite data we can evaluate spring bloom characteristics on the global scale.

Example: date of phytoplankton spring bloom initiation



(courtesy of Dr. Stephanie Henson)

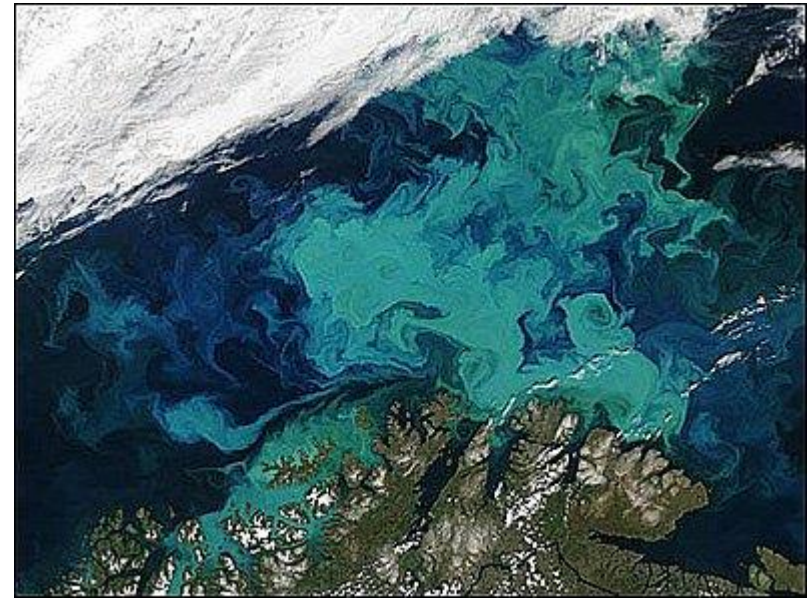
What bloom characteristics can tell us?



Duration and magnitude of the bloom affect amount of the atmospheric CO₂ that ocean uptakes through photosynthetic reactions driven by phytoplankton.

The date of the bloom start can affect fish larval survival





The end

