

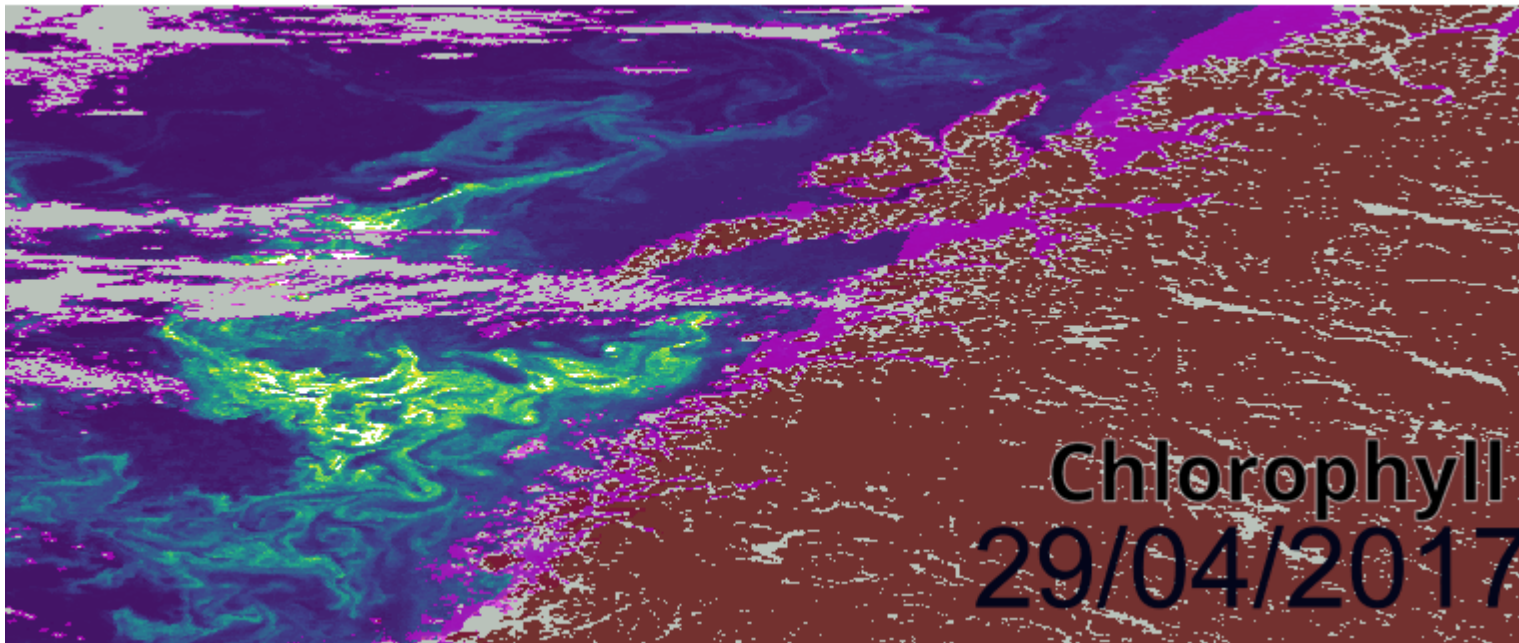
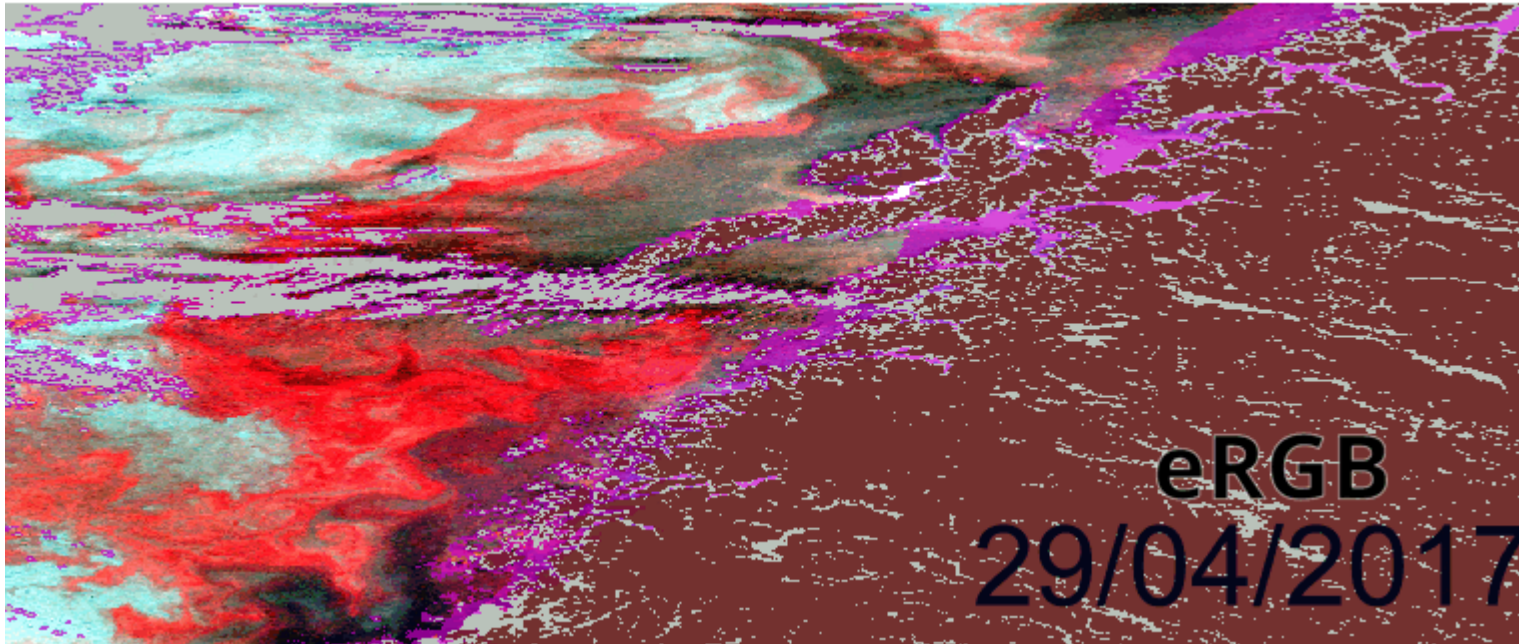
All the colors of the ocean

Advancement in remote sensing technology.

Urszula Kędzierska



What is the color of Norwegian Sea?



**Changes in ocean
color**

Chain of events

March / April

**Phytoplankton
blooms**

Late April / May

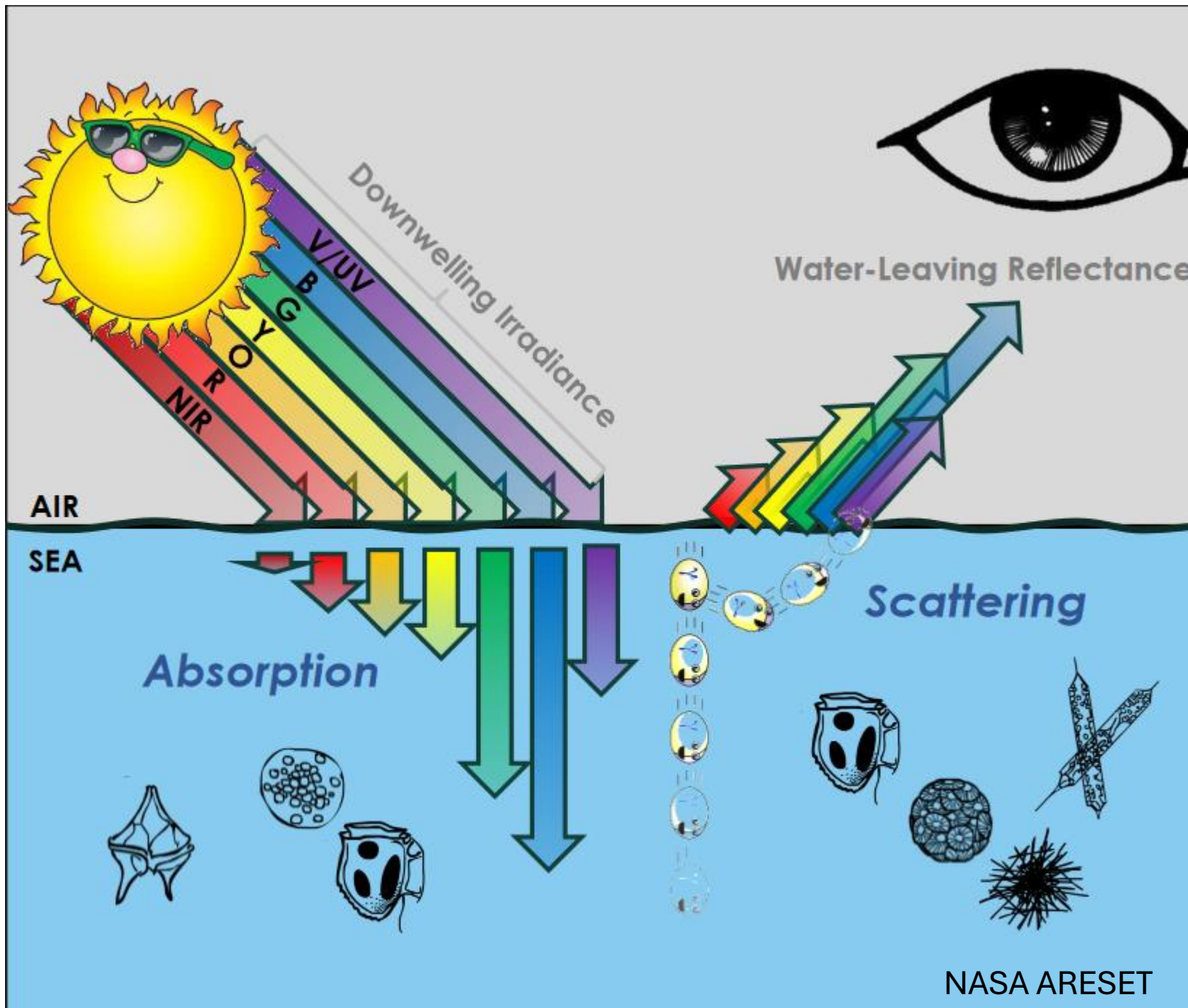
Zooplankton grazing

June

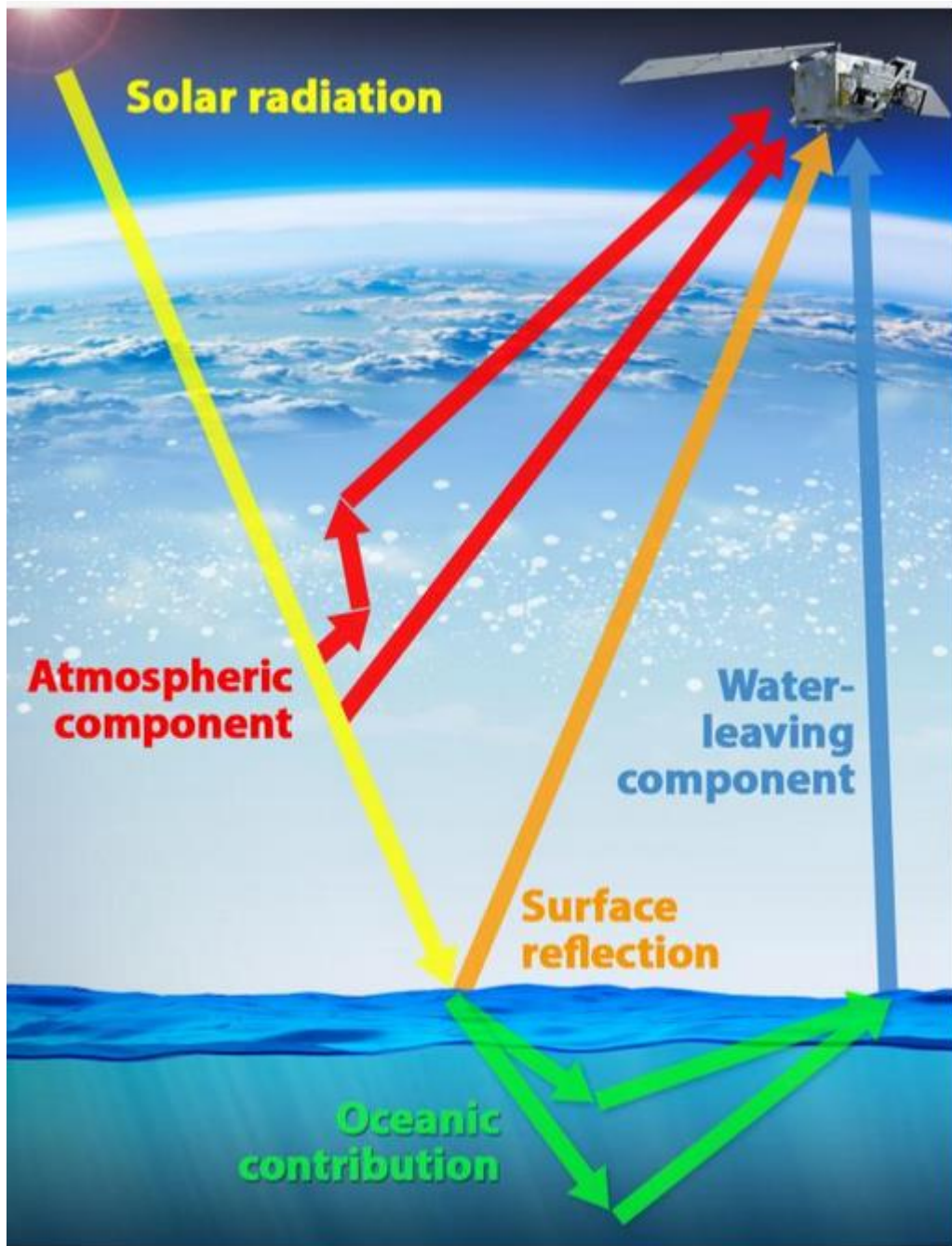
Transitional phase

June / July

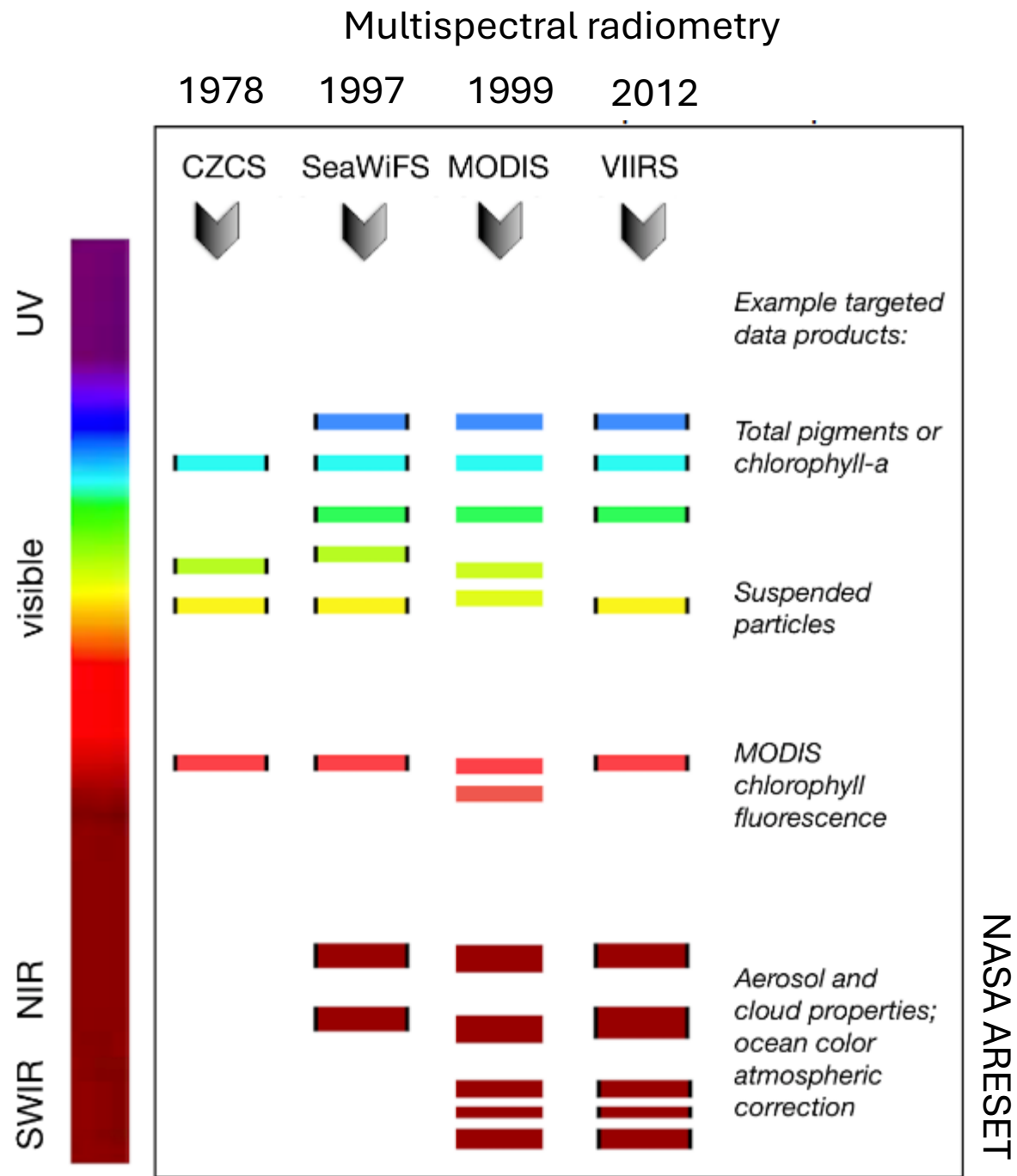
**Coccolithophore
blooms**



The color of the ocean is determined by the interactions of incident light with substances or particles present in the water



<https://pace.oceansciences.org/storymaps.htm?id=1887>



Hyperspectral radiometry

2022

2022

2024

EnMAP

EMIT

PACE

89 VNR (6.5 nm)

127 SWIR
(10 nm)

Bandwidths <10 nm

Broad spectral range

PACE:
OCI instrument
designed for
ocean colors studies

Multispectral radiometry

1978

1997

1999

2012

CZCS

SeaWiFS

MODIS

VIIRS

UV

visible

SWIR NIR

Example targeted
data products:

Total pigments or
chlorophyll-a

Suspended
particles

MODIS
chlorophyll
fluorescence

Aerosol and
cloud properties;
ocean color
atmospheric
correction

NASA ARESSET

PACE Ocean Color

Facts:

- Hyperspectral from 315 nm to 895 nm, in total 184 bands
- Spatial resolution of ~1.1 km

Goals:

- Establish remote sensing reflectances (RRS) profile for key ocean ecological events: phytoplankton blooms, zooplankton patch

Challenges:

- Lack of verified hyperspectral algorithms
- Need for field measurements to validate the products

What kind of data?

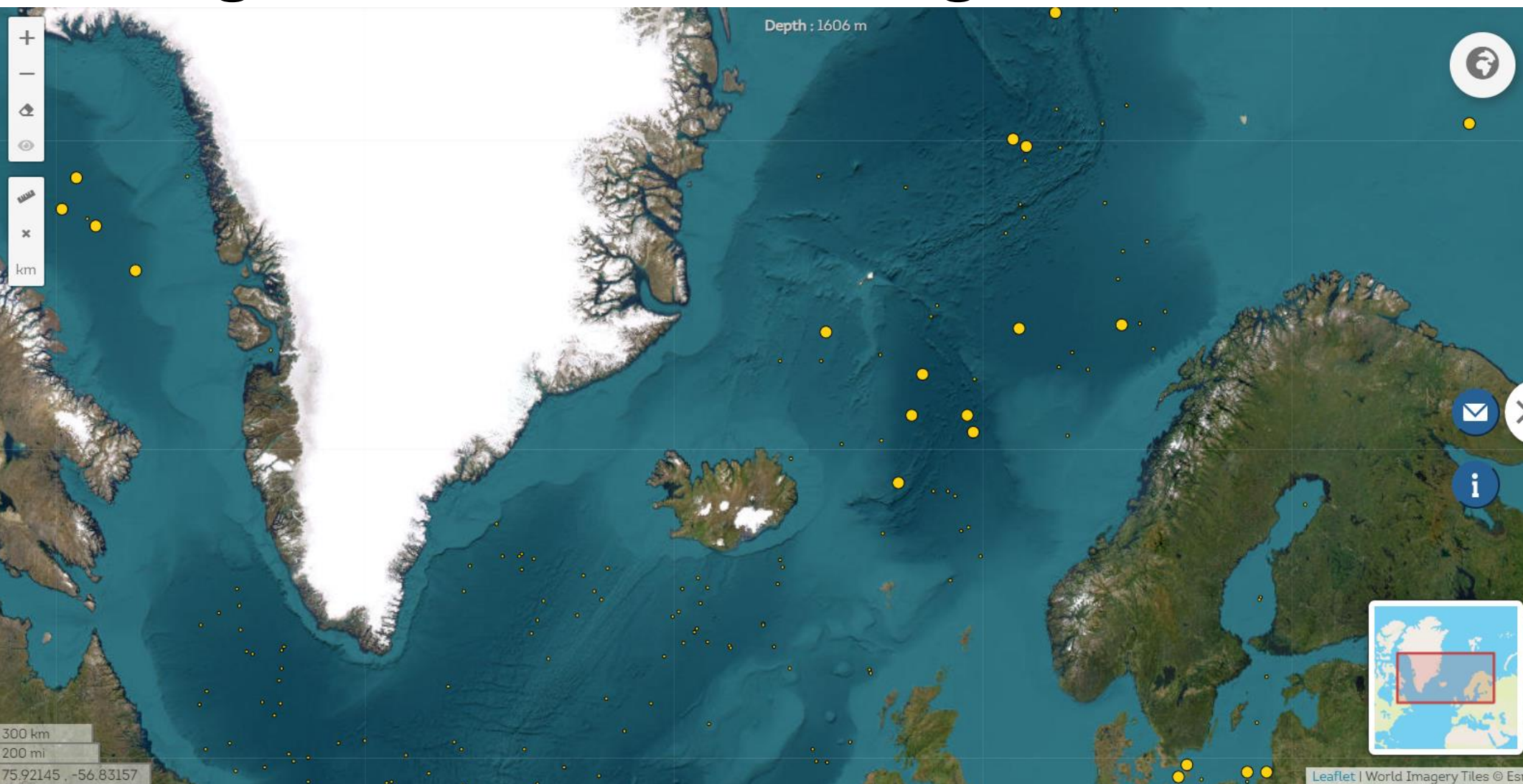
Raw data validation:

- Radiometry
- Polarimetry

Products validation:

- Chlorophyll a
- Turbidity
- CDOM
- Pigment compositions
- Abundance of plankton groups: phyto- and zooplankton

Argo floats are not enough



Active floats
with chlorophyll
measurements:

Baltic sea: 4

Arctic ocean: 12

Atlantic ocean: 127

Thank you for your attention

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1234ulus

<https://otlibrary.com/zooplankton/>