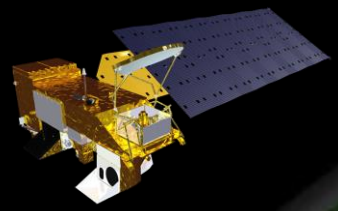

Aquatic Primary Productivity Workshop

Building community consensus on current methodological approaches

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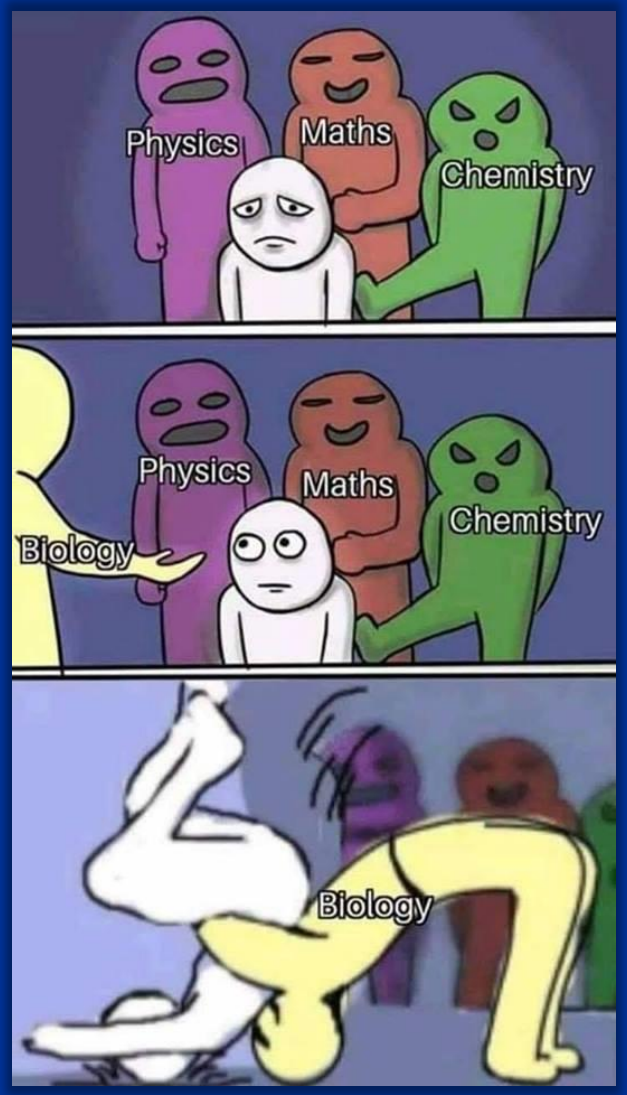
December 5-7, 2018 - Columbia, MD, U.S.A.

NPP modeling, in a nutshell



WHY ARE WE DOING THIS, YET AGAIN?

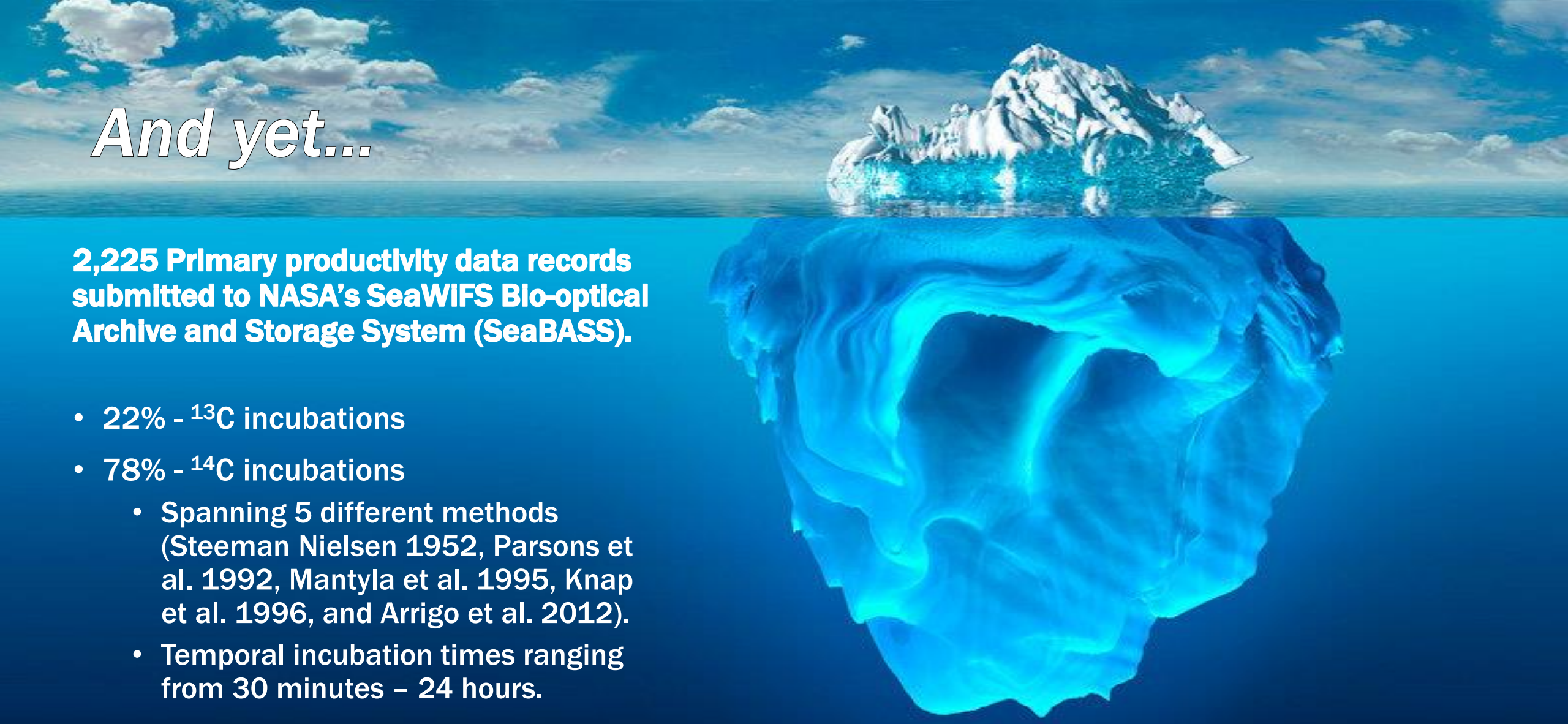
- Perhaps no single measurement in the suite of significant oceanographic observations exhibits as much methodological diversity as well as interpretive ambiguity.

- Uncertainties arise from:
  - Varying time and space scales
  - Measurement of linked (but de-coupled) processes
  - Environmental or experimental variability
  - Non-uniformity in assumptions
  - Lack of a “truth” standard for biological rates

These uncertainties are not quantified in a manner that is standard for biogeochemical measurements.

- There are multiple ways to define and measure primary productivity, and the inter-relatability among these measurements is relatively ambiguous.

And yet…



2,225 Primary productivity data records submitted to NASA's SeaWIFS Bio-optical Archive and Storage System (SeaBASS).

- 22% - ^{13}C incubations
- 78% - ^{14}C incubations
  - Spanning 5 different methods (Steeman Nielsen 1952, Parsons et al. 1992, Mantyla et al. 1995, Knap et al. 1996, and Arrigo et al. 2012).
  - Temporal incubation times ranging from 30 minutes – 24 hours.

The lack of a standard protocol for primary productivity presents a challenge in attempting to integrate and reconcile measurements to establish a robust validation dataset in a similar manner to other ocean color algorithms.

What are we doing different this time?

1) Normalize some emerging technologies, which can give us a better handle on spatio-temporal dynamics and/or physiology.
2) Determine consensus on *multiple* field-based methodological approaches used for Cal/Val, model development activities.
3) Strictly define the applicability and scalability of various rate measurements as they pertain to satellite remote sensing.
4) Establish priorities that set the ground work for future experiments, papers, and novel science funded through space agencies.

Deliverable: NASA/IOCCG Protocol Series

We are on the hook for a comprehensive, evolving document that defines field protocols for measuring aquatic primary productivity, including:

- *What does each method specifically measure and define, and at what space and time scales is the measurement applicable?*
- *Through what metabolic pathway does the method measure primary productivity?*
- *What is the relative or absolute uncertainty of each measurement type?*
- *What specific protocols need to be followed?*
- *What environmental and/or experimental control parameters are non-negotiable?*
- *Under what conditions are collected data applicable for satellite algorithm development?*

Consider the next paradigm:

- Hyperspectral radiometry
- LIDAR from space/UAVs
- Geostationary observations
- CubeSAT constellations
- Mass Spectrometry, Flow Cytometry
- Bio-ARGOs, Gliders, PP floats, etc.
- Neural Networks/Machine Learning