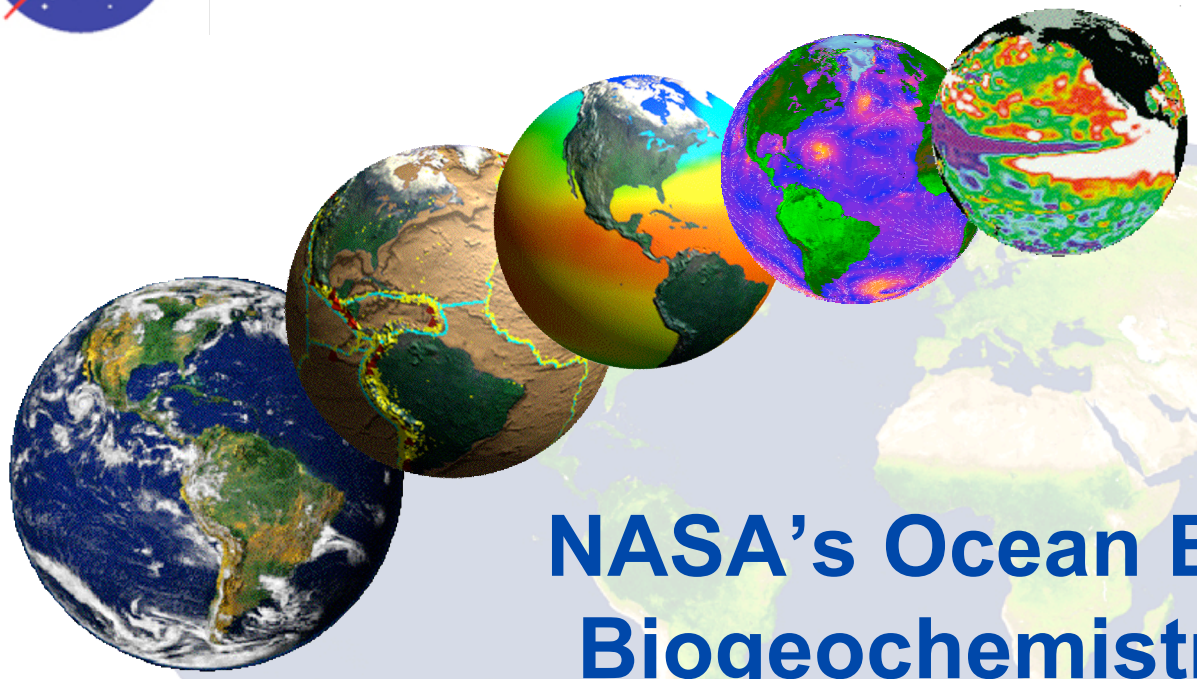
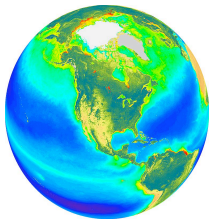
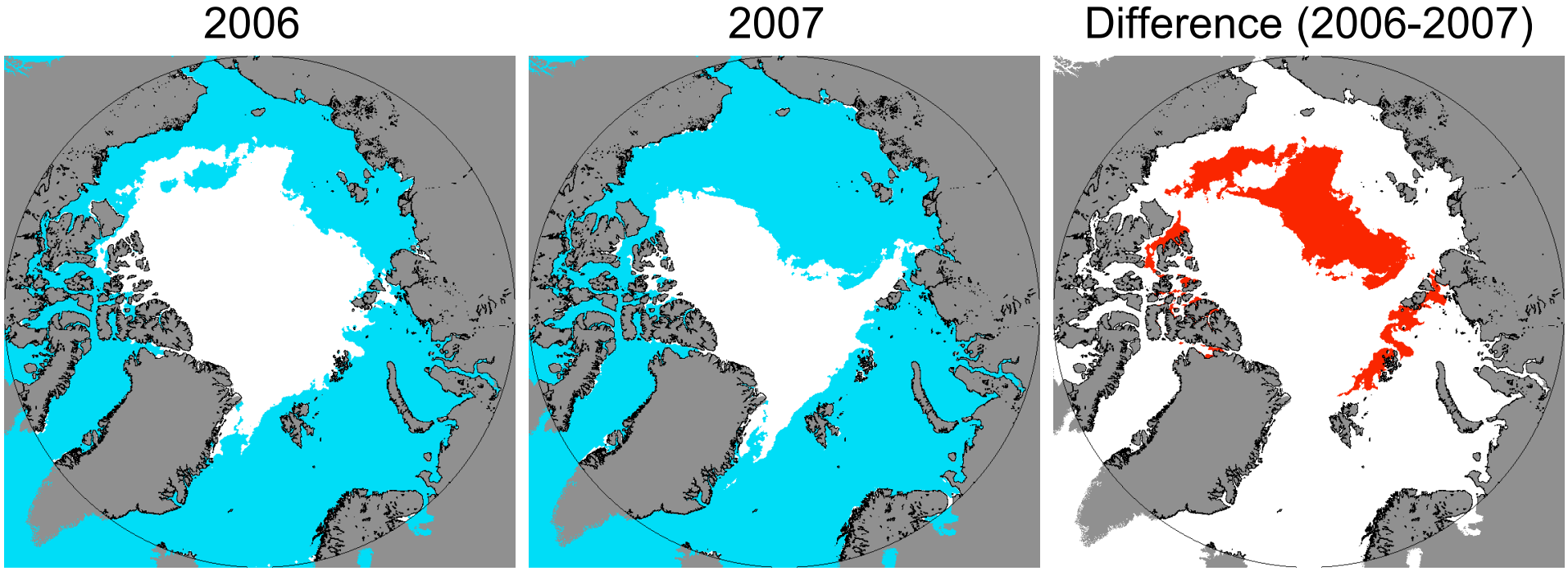




NASA's Ocean Biology and Biogeochemistry Program: Arctic Field Campaign 2010 & 2011

Fred Lipschultz
NASA Headquarters

New ice-free pelagic habitat

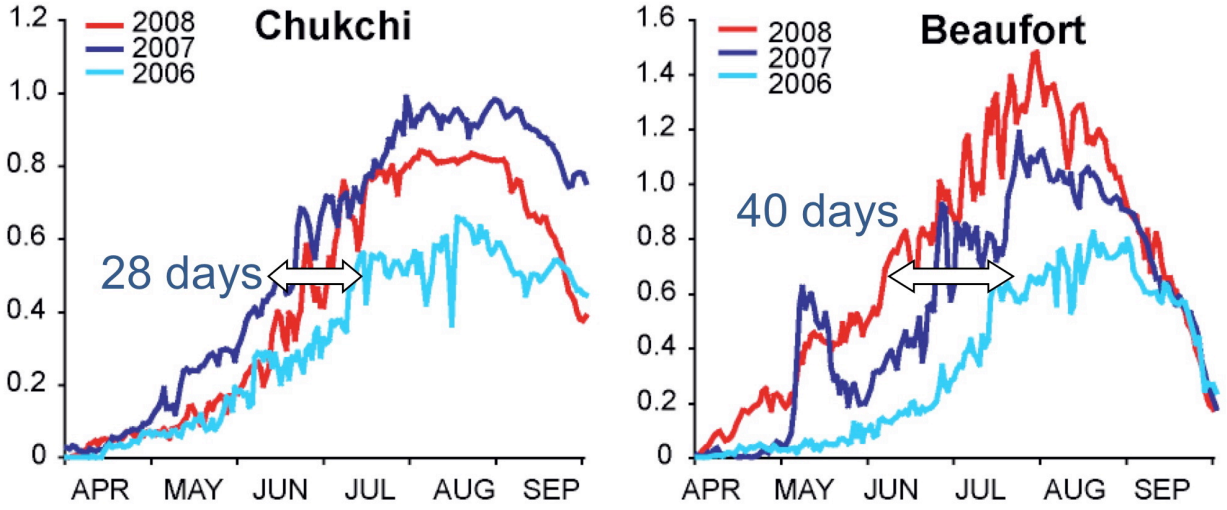


Large area of Arctic Ocean was exposed for first time
Approximately 1.3 x 10^6 km^2 (area in red)

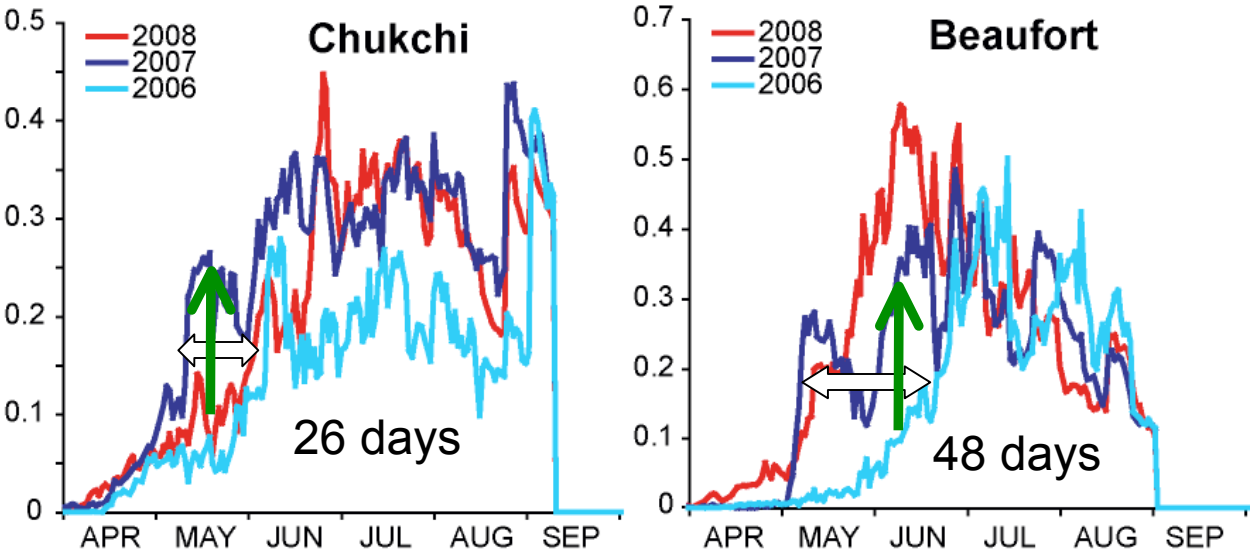
Arrigo et al. (GRL, 2008)

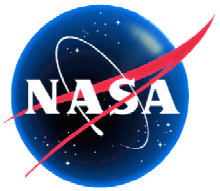
New habitat earlier in summer means increased Arctic Productivity

Changes in the timing of increase in open water area (10^6 km^2)

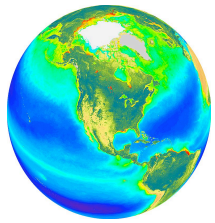


Changes in the timing and magnitude of the spring bloom (10^9 g C d^{-1})





Investigations of Climate and Environmental Change on Arctic Pacific Shelves (ICECAPS)



Central science question:

What is the impact of climate change (natural and anthropogenic) on the biogeochemistry and ecology of the Chukchi and Beaufort seas?

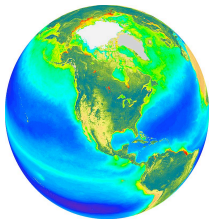
Three components

1) Field Campaign in late summer 2010 & spring 2011

2) Data Synthesis, Assimilation, Modeling Program

3) Biological and Biogeochemical Impacts of Melting Ice

Investigations of Climate and Environmental Change on Arctic Pacific Shelves (ICECAPS)

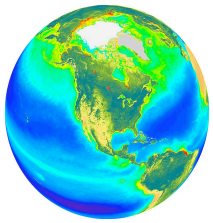


A. Characterize and quantify the interactions and feedbacks of water and sea ice photobiology and photochemistry with above-water, in-water, and ice radiation fields and their effect on ocean and sea ice biology, ecology, and biogeochemistry.

Example questions:

- *What impact does changing atmospheric composition (e.g., clouds, aerosols) and surface albedo have on PAR and UV radiation, and how does this influence ocean productivity and biogeochemistry?*
- *What are the (seasonal) relationships between algal and bacterial metabolism with above-water, in-water, and ice radiation fields (apparent and inherent optical properties)?*
- *What are the pathways of optically active dissolved organic matter in land, water, and sea ice, as detailed by optical and chemical observations, and their effect on land, sea, and sea ice biogeochemical interactions?*

Investigations of Climate and Environmental Change on Arctic Pacific Shelves (ICECAPS)



B. Understanding the mechanisms controlling the fluxes of CO_2, CH_4, DMS, and other radiatively or biologically important gases, under different sea ice conditions, surfactants, meteorological conditions, and upper ocean turbulence regimes.

Example questions include:

- *What will be the effect of a change in the strength of the biological pump due to sea ice, land, and ocean interactions (e.g., nutrients, dissolved inorganic carbon, DIC) on the air-sea flux of CO_2?*
- *How are gas fluxes affected by the radiation field, sea ice and riverine input, first year vs. multi-year sea ice fields, cycling of DOM and CDOM, changes in temperature, DIC and alkalinity, permafrost thawing, and other land-sea interactions?*
- *How do in-water, air-sea, and through-ice biogenic fluxes of CO_2, CH_4, and other climatically relevant gases compare under varying sea ice radiation*?

Potential Cruise Track

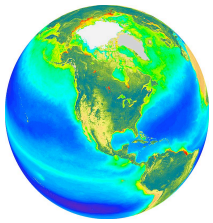
Draft Sampling Plan :

- Across the Chukchi Sea and Beaufort Sea on the shelf and shelf break - full water column CTD/hydrocast stations

- For shelf break sampling - rapid, high resolution CTD section to accurately characterize the physical setting before bio-optical measurements.

- In the Canada Basin - reach multi-year ice in order to sample beneath and over the sea-ice. Once in the ice, along with conducting CTD casts, ice camp work could be conducted several hundred yards from the ship, sampling the undisturbed mixed layer through the ice

Collaborations



- MALINA – French expedition in 2009
  - Same bio-optical focus
  - Plan joint science meetings
- Canadian Investigators from ArcticNet
- NSF Arctic Science Program?