

# CICE Consortium

## Arctic Workshop

Elizabeth Hunke

June 26, 2017



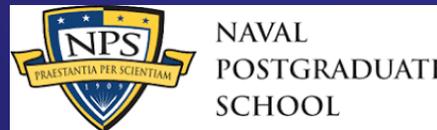
# Outline

- Mission
- Participants' uses for CICE
- Organization and design
- Near- and longer-term development
- Summary

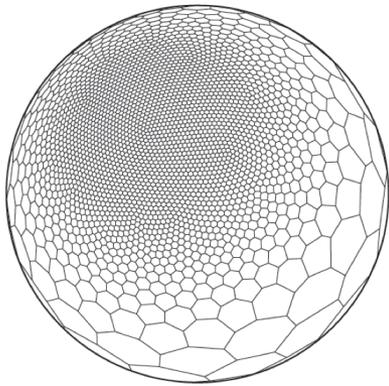
# Mission

to enhance sea ice model development  
for and by the community

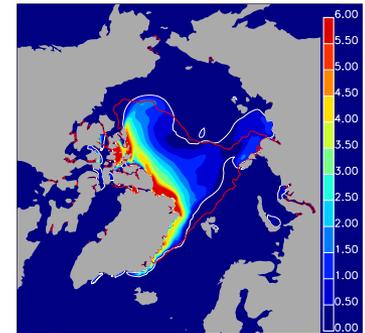
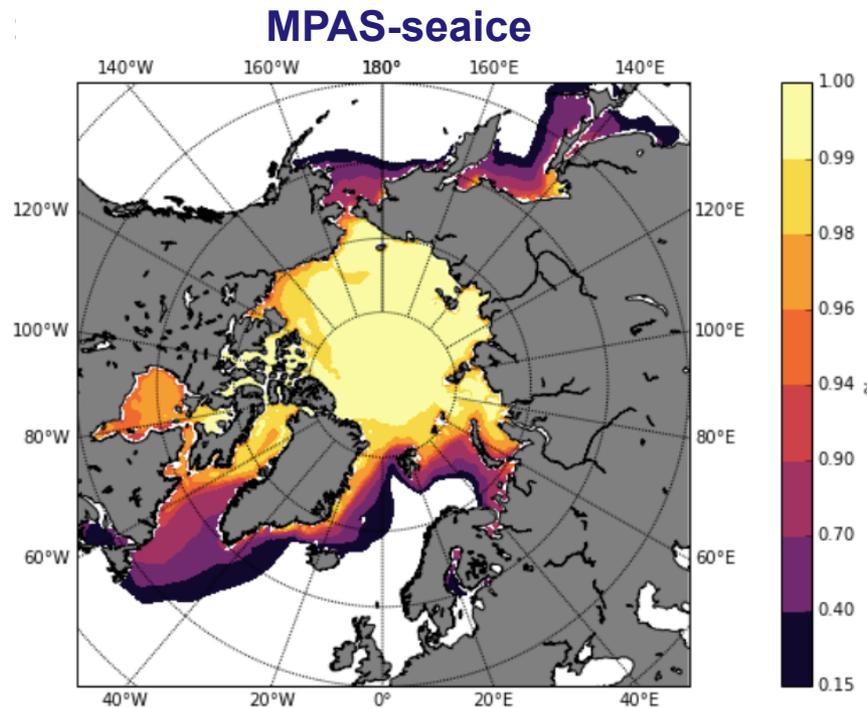
- Acceleration of scientific development
- Acceleration of R&D transfer to operational use
- Vehicle for collaboration and sharing



- Unstructured grid enables focused resolution
- **Column physics identical to CICE (common code)**



Ice concentration (JFM, years 0014-0033)



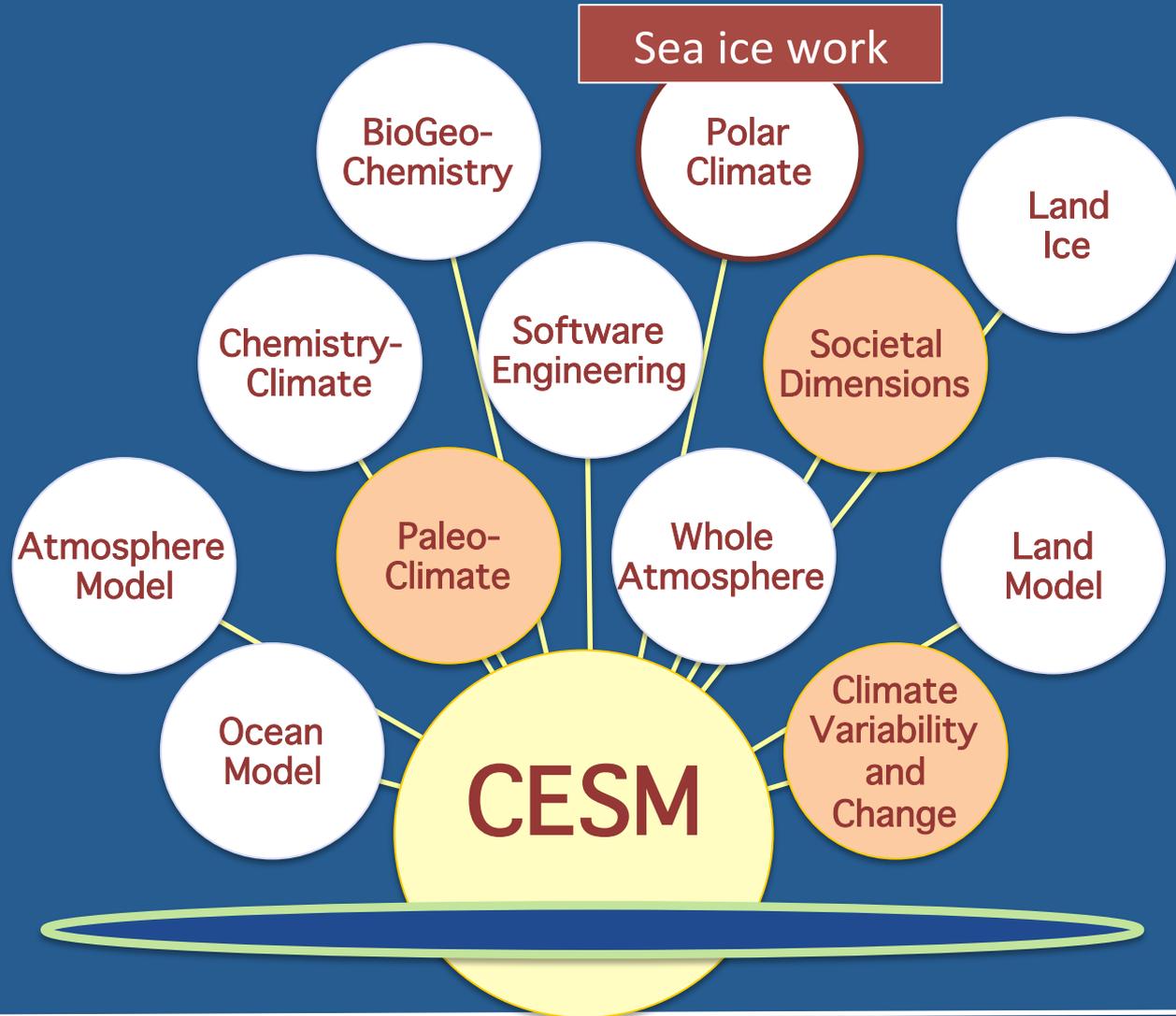
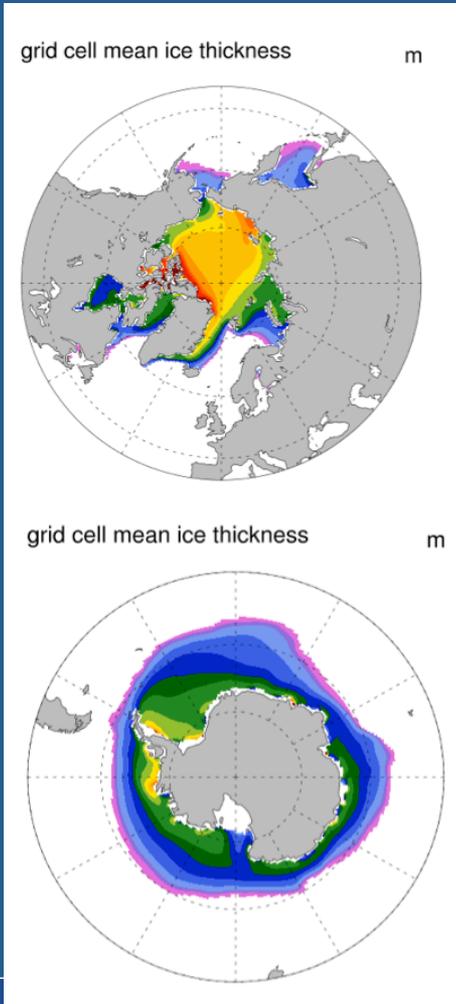
**CICE**  
CONSORTIUM



# Community Earth System Model Project

>400 Registered Developers,  
~5100 Registered Users for  
2010-2015 from all continents

CESM2 development



<http://www.cesm.ucar.edu/management>

Marika Holland  
mholland@ucar.edu

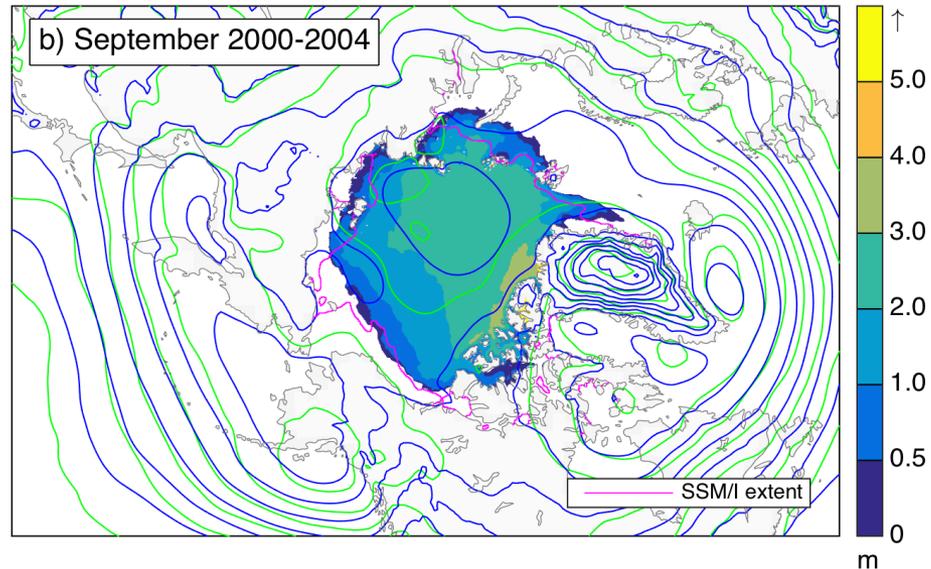
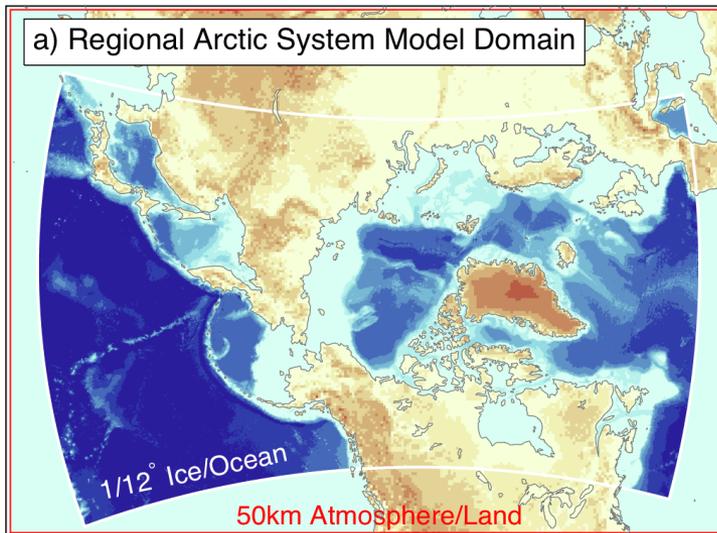




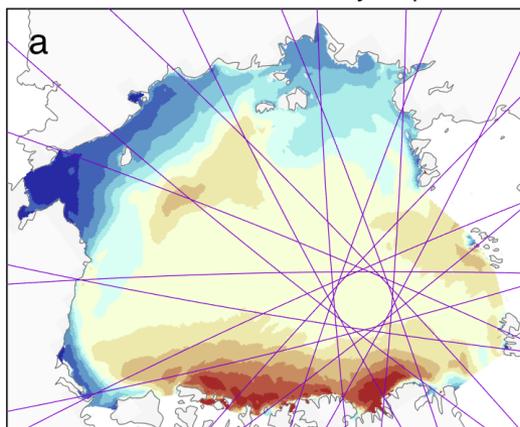
# Naval Postgraduate School



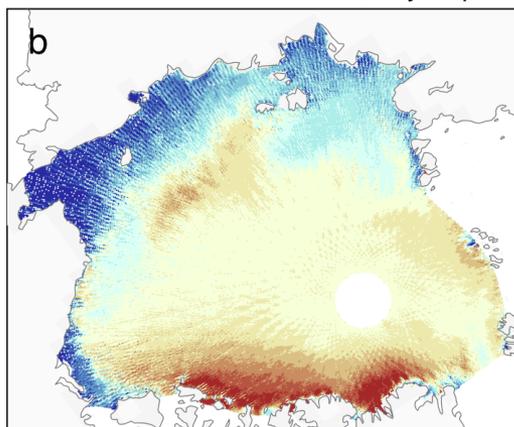
## Fully coupled Regional Arctic System Model (RAS)



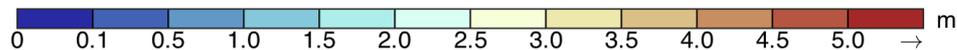
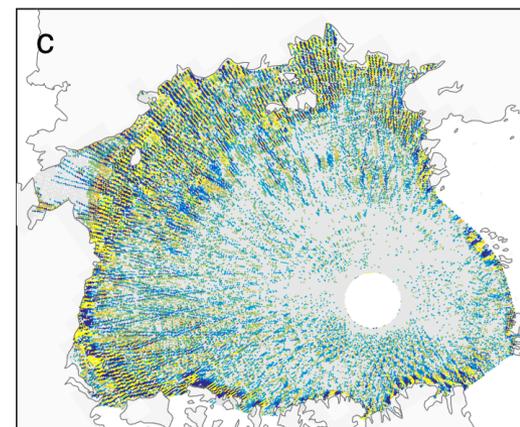
True model mean, July-Sept



ICESat2-Sim model mean, July-Sept



Difference, RMSE = 0.30 m

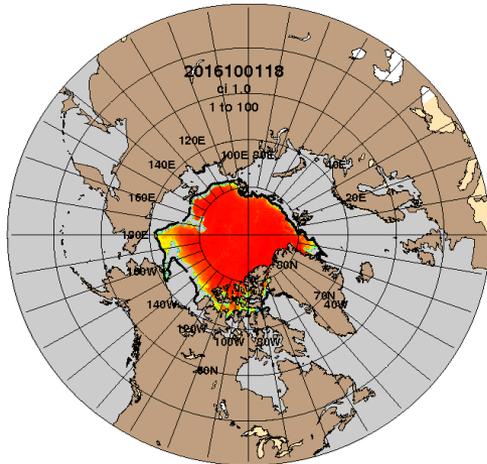


# Arctic Cap Nowcast/Forecast System (ACNFS) Global Ocean Forecast System (GOFS)

Similar to ACNFS, GOFS 3.1 produces ice forecasts in the Northern Hemisphere and also in the Southern Hemisphere.

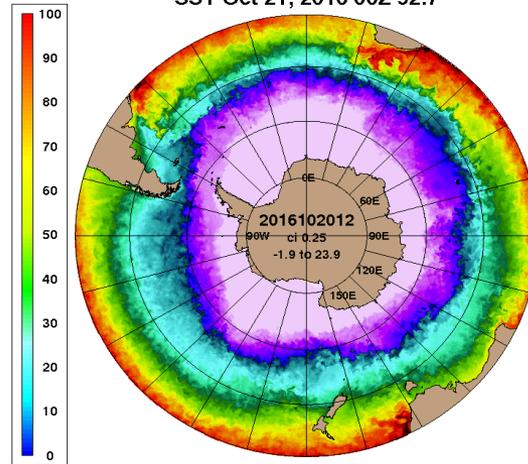
## ACNFS Ice Concentration

ARCc0.08-04.6 Ice Concentration (%): 20160929



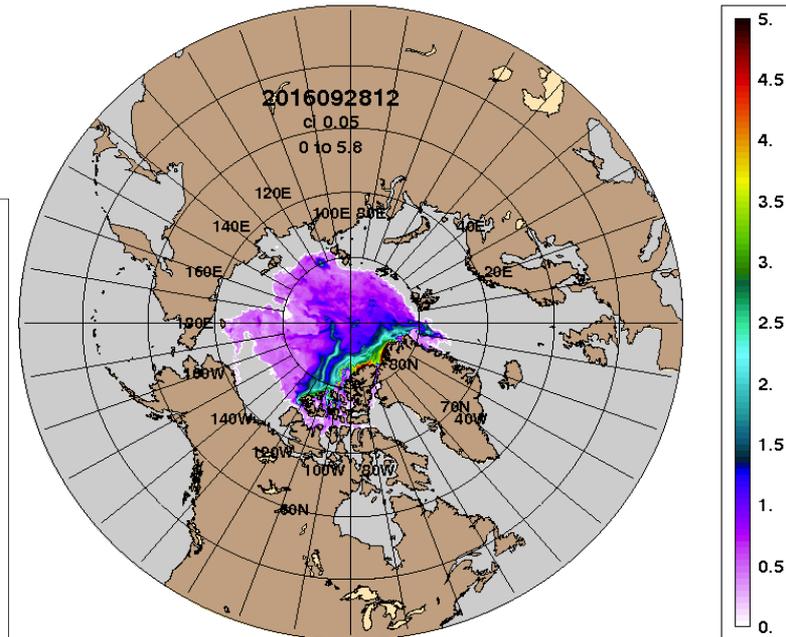
## GOFS 3.1 Sea Surface Temp

SST Oct 21, 2016 00Z 92.7



## GOFS 3.1 Ice Thickness

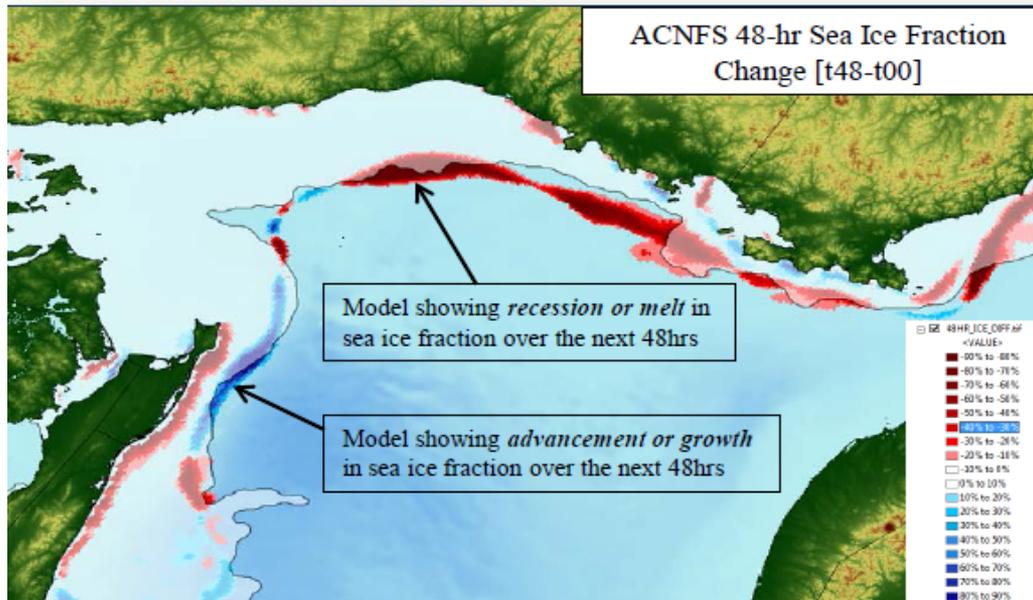
GLBb0.08-92.7 Ice Thickness (m): 20160929



**ACNFS:** Ice Model CICE v4 + Ocean Model HYCOM) + Data assimilation: NCODA + Prescribed atmospheric forcing from Navy's Global Environmental Model (NAVEM)

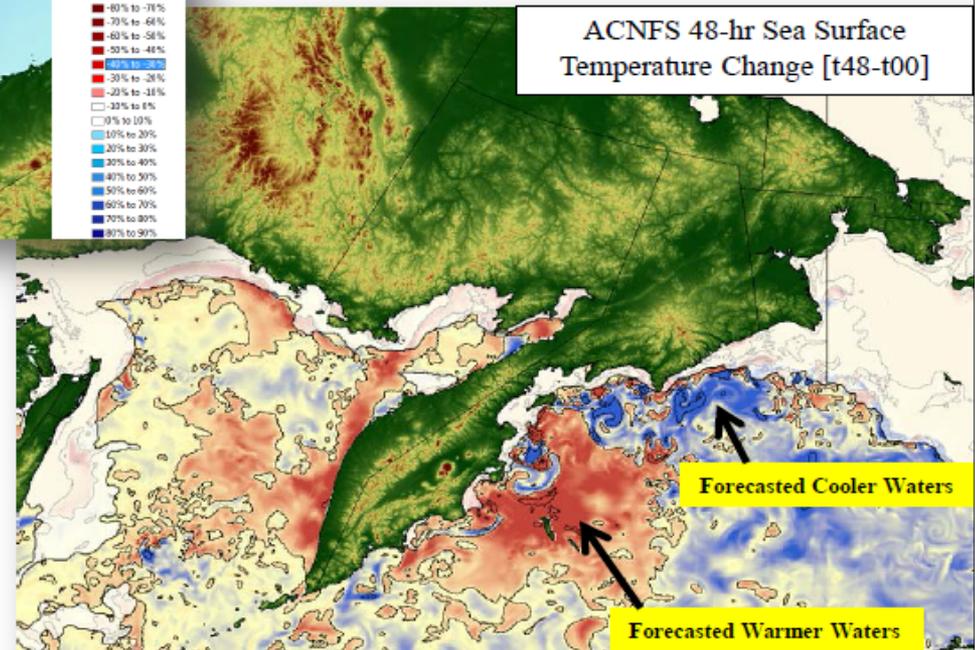
- Nowcast/7-day forecasts of ice concentration, ice thickness, ice drift, SST, SSS and ocean currents
- Products pushed daily to the U.S. National Ice Center (NIC) and NOAA

# ACNFS Difference Fields



## Change detection from ACNFS

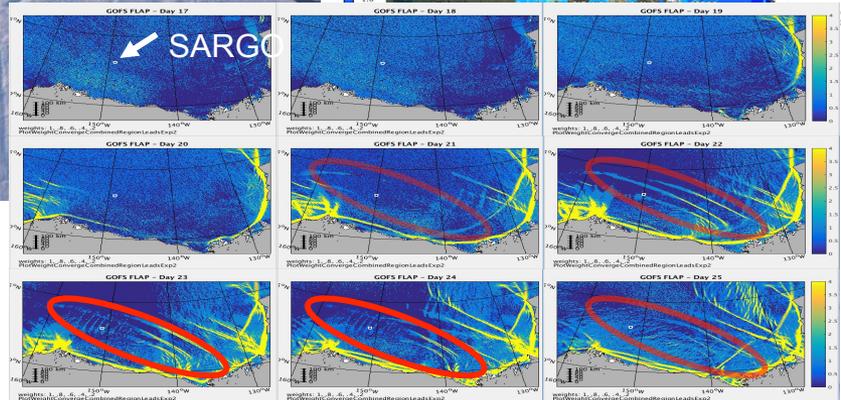
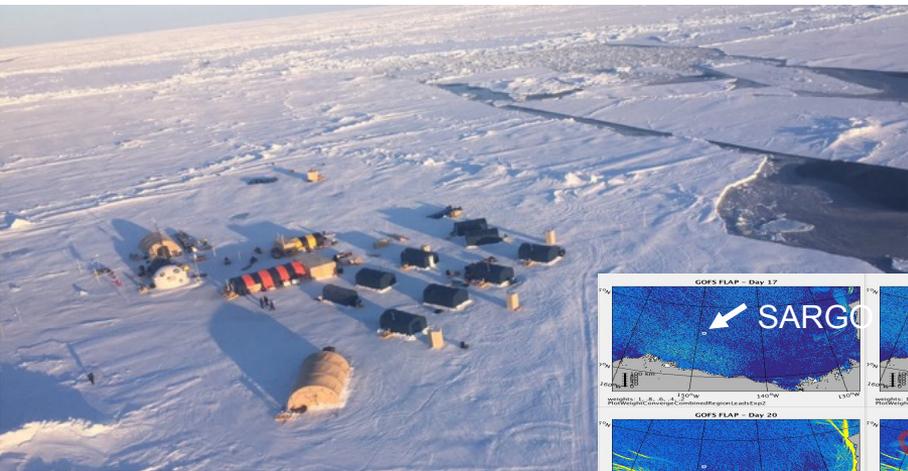
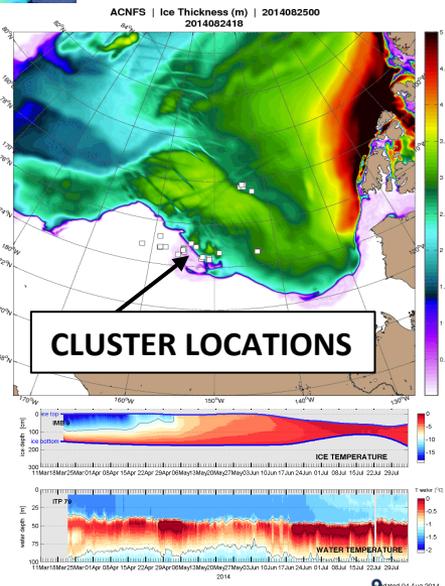
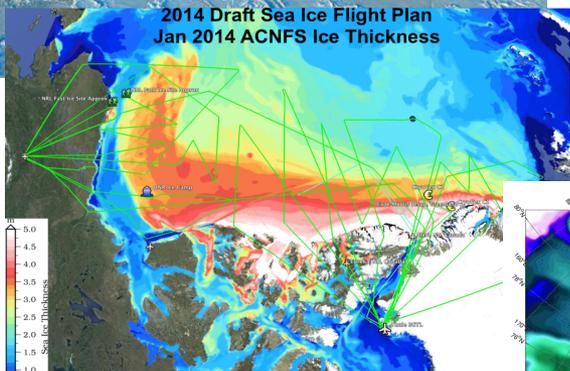
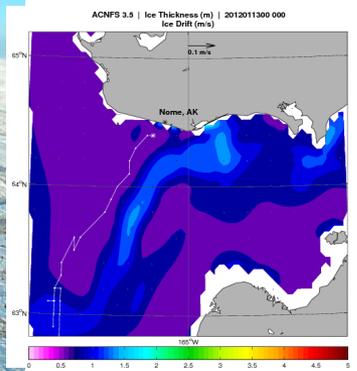
- Produce 1-7 day difference fields
- Difference layers more precise and uniform
- Can be difficult to visually interpolate small differences
- Less prone to interpolation errors



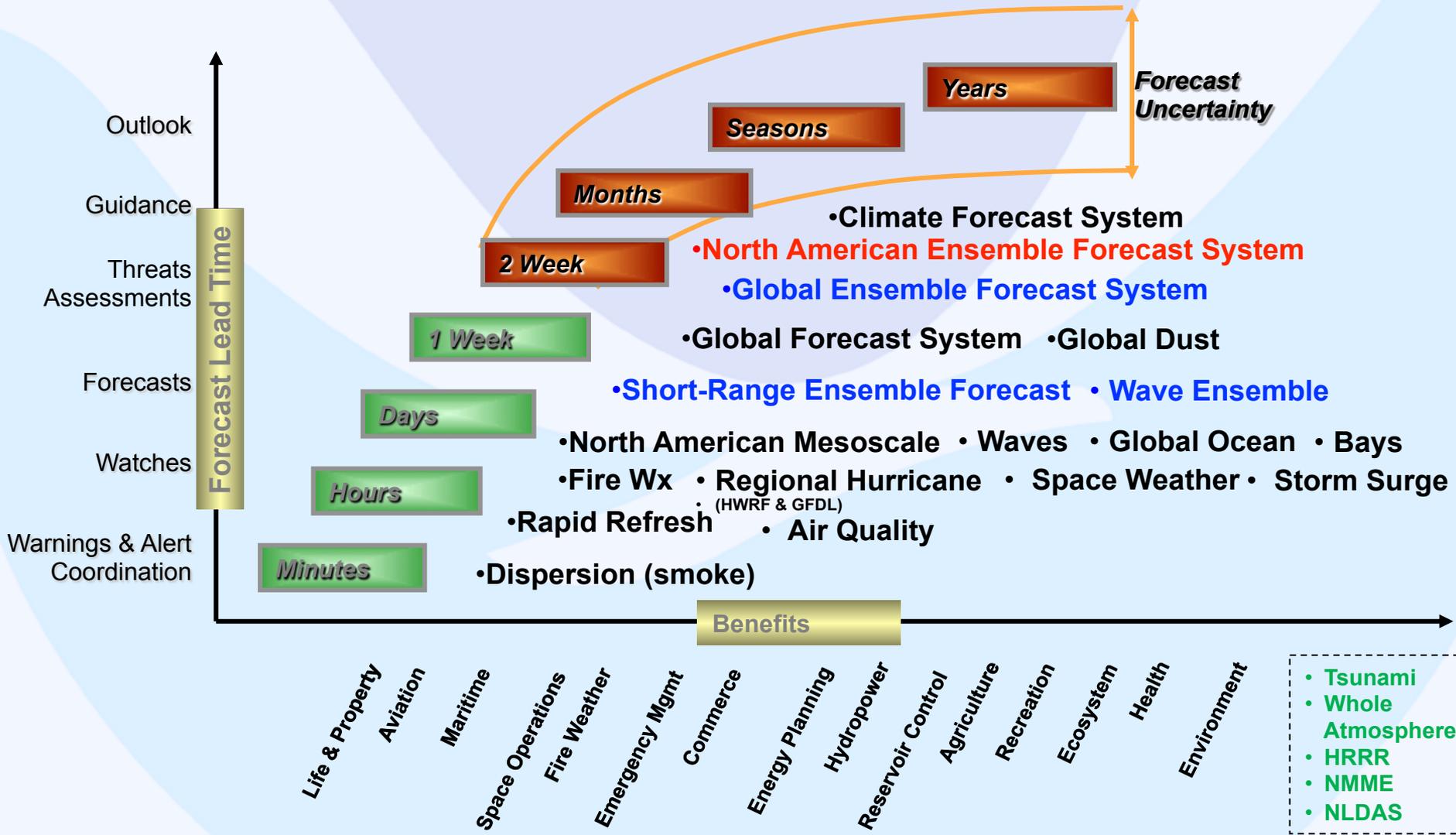
Slide insert courtesy of National Ice Center

# Products Used in Navy's Special Missions

- Guidance in Nov/Dec 2011 convoy 10.3 M gallons of fuel to Nome, Alaska
- Pre-flight planning for NASA Operation IceBridge missions
- Used in ONR field experiments: Marginal Ice Zone (2014) and Sea State (2015)
- Used in Navy's ICEX field work



# Seamless Suite, spanning weather and climate



# CICE Consortium Organization

**Executive Oversight Board**  
DOE/ACME, DoD/NRL, DoD/NPS, NOAA/NWS/GFDL, NSF/NCAR, ECCC

**Lead Coordinator**  
LANL

**Co-Lead**  
[TBD]

**Software Engineer**  
NWS

**CICEdyn**  
NPS/ECCC

**Icepack**  
LANL/GFDL

**Infrastructure**  
NWS

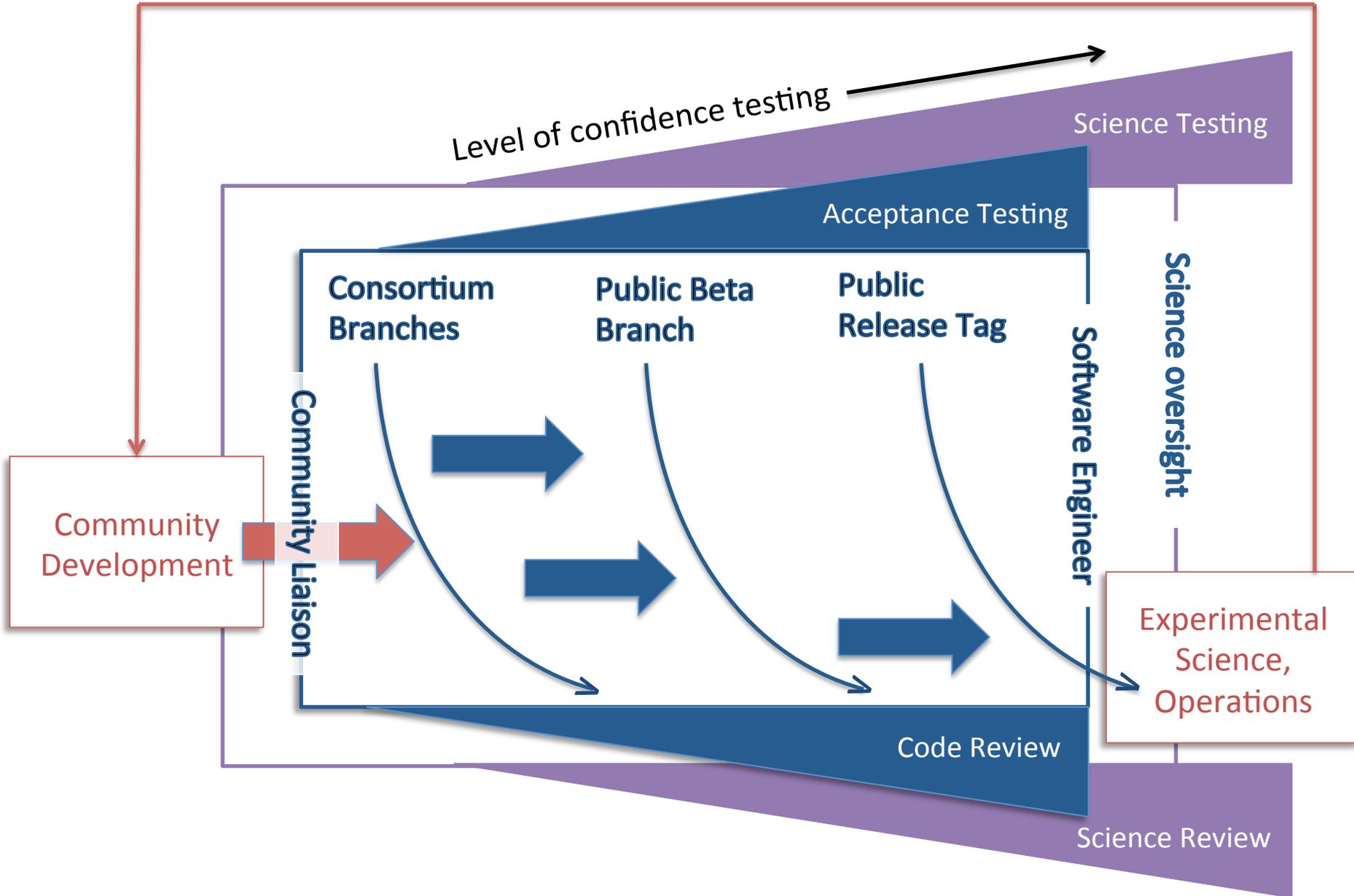
**Testing and Analysis**  
NRL

**Community Support**  
NCAR

**Repository**  
SE

Many Consortium Member institutions are contributing to multiple teams

# CICE Consortium Functional Design



# New Community Sea Ice Model Development

... that I know of

## CICE Consortium 2017:

- Independent column physics package “Icepak”
- Metrics/analysis package
- Automated testing, generation/publication of documentation
- Confidence score tracking
- Performance enhancements
- Vertical biogeochemistry (LANL)

## Future enhancements

- Fast-ice parameterization (Canada/ROMS)
- First-principals ridging and morphology (NPS)
- Snow redistribution, metamorphosis (LANL)
- Floe size distribution (UW, U Reading)
- Wave-ice interactions (UW, NRL)
- Thermodynamically consistent melt ponds (U Reading)
- Under-ice ponds (U Reading)
- Data assimilation (NRL/UW/UKMO)
- Interacting icebergs (LANL)
- C-grid capability

# What are the benefits to the agencies?

## *Operational*

- Accelerated path for R&D acceptance

## *R&D*

- Better understanding of operational needs

## *Everyone*

- More configurations run & analyzed
  - Model weaknesses identified early
- Robust testing mechanism
  - Quicker communication of issues
  - Quicker solutions through collaboration
- Reduced duplication of effort
  - E.g., access to new analysis tools

# Why build a CICE Consortium?

to enhance sea ice model development  
for and by the community

- Acceleration of scientific development
- Acceleration of R&D transfer to operational use
- Vehicle for collaboration and sharing

