Impact of NASA Satellite Data and Models on U.S. Coast Guard's Decision Support Tool for Search and Rescue in the Northeastern Pacific Ocean

3-Year: Sept. 2008-Aug. 2011 (-Aug. 2012)

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Application Partner:

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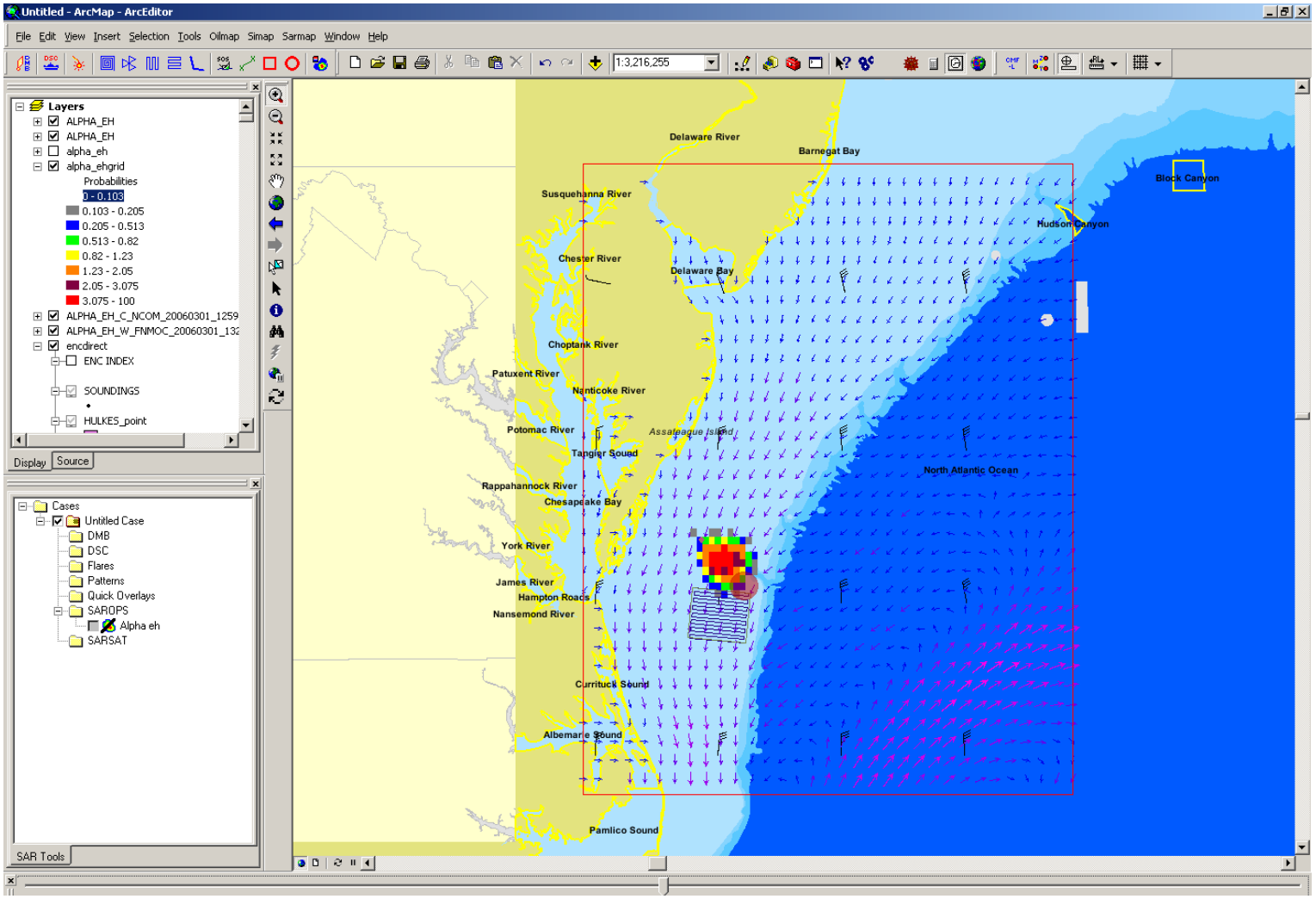
Search And Rescue (SAR) Problem

- Create a SAR case when alerted
- Gather information about case
- Get environmental data & uncertainties
- Determine search area (knowledge, model)
- Estimate resource availability and capability
- Plan and perform the search
- Evaluate the completed search
- Repeat above until survivors are found and rescued

US Coast Guard Search and Rescue (SAR) Operations Statistics

FY	Cases	Lives Saved
2005	29,780	5,648
2006	28,323	5,290
2007	27,090	5,175

Decision Support Tool: Search and Rescue (SAR) Operations (SAROPS) used by US Coast Guard developed by designated industry contractor-ASA

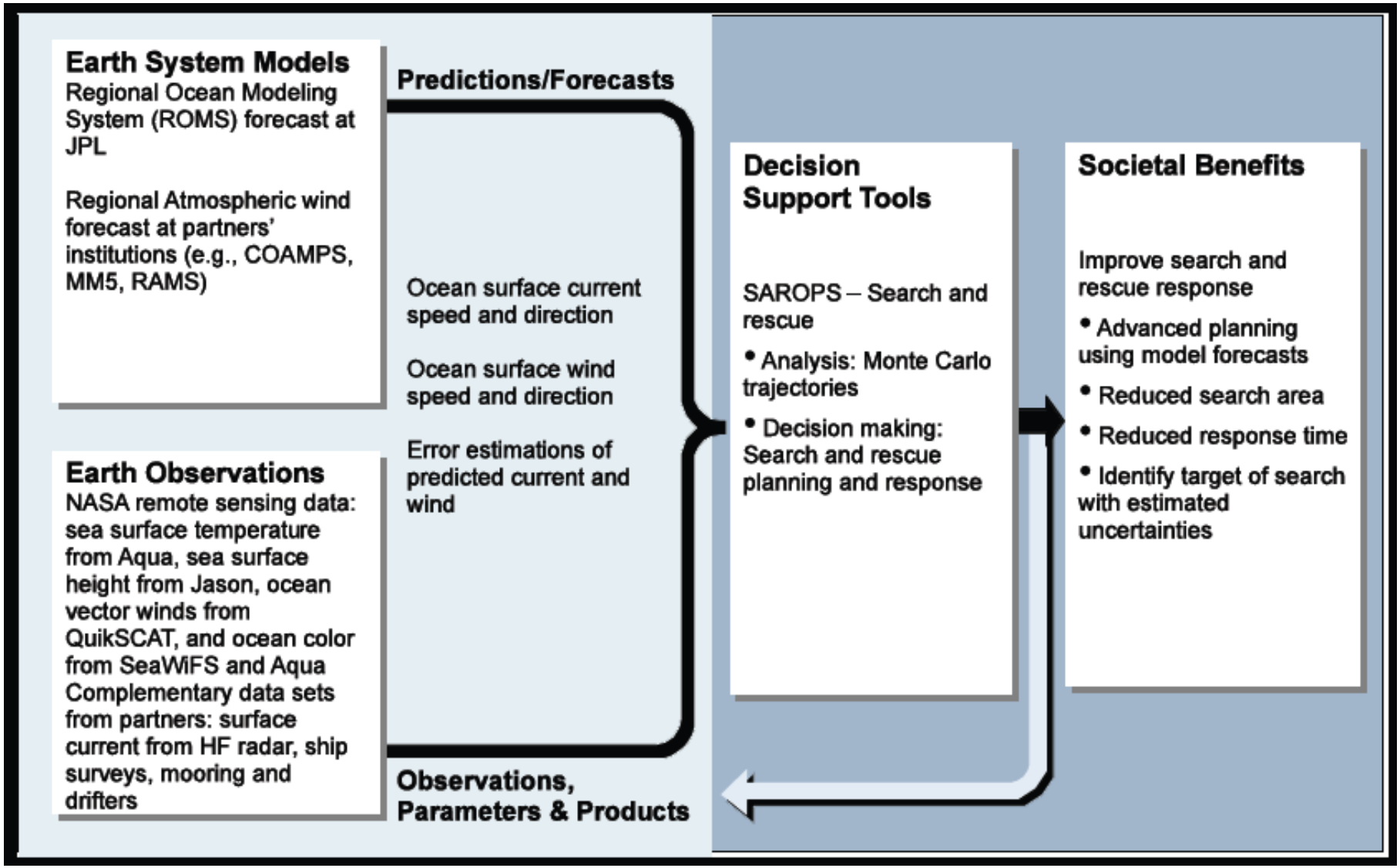


Data must be certified in the right place and right format

NASA Project Objective

- Our primary objective is to work with our U.S. Coast Guard (USCG) partner to provide improved real-time, high-resolution ocean current and wind observational data as well as ocean circulation forecasts with error estimates for inclusion in the USCG Decision Support Tool (DST) known as Search and Rescue Operations (SAROPS).

Proposed Architecture for the Search and Rescue Decision Support Tool



NASA & Universities: JPL, UCSB, CU; Non-profit: AOOS; Industry: ASA; Partner: USCG

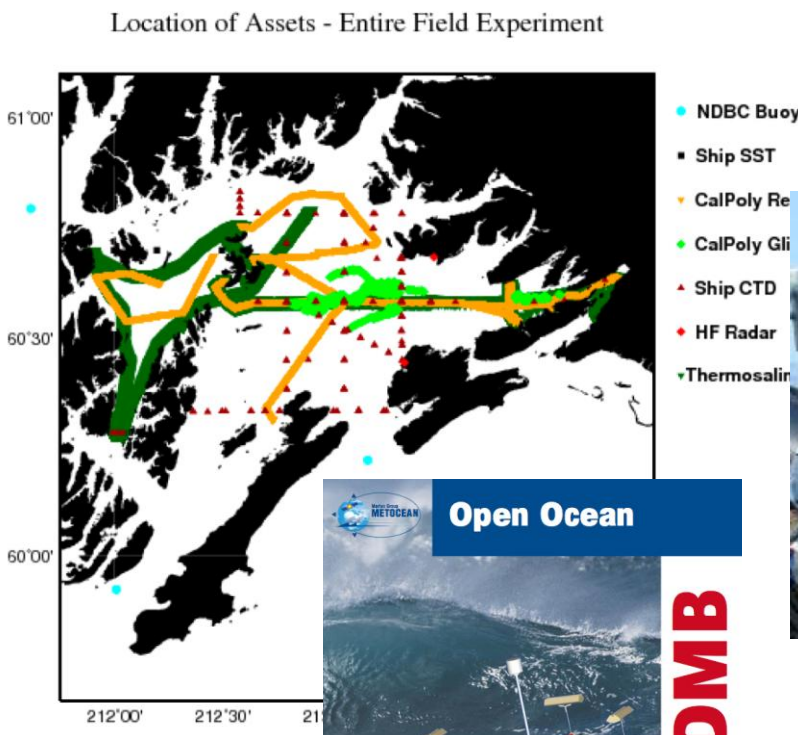
3-Year Work Plan

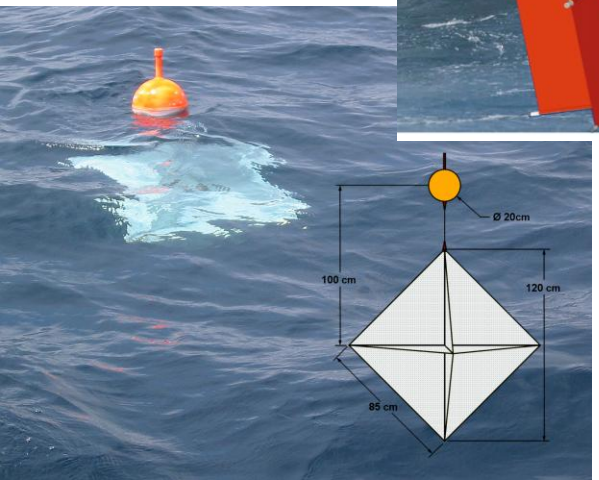
- Year 1: Establish baseline performance (benchmarking)
  - Data collection during a field experiment; Model testing and verification/validation; Benchmarking Decision Support Tool (DST)
- Year 2: Component refinement and integration
  - Understand data and model; Refine and improve the forecasting system; Explore and ultimately use new NASA satellite data
- Year 3: Quantify the improvement and Transition from research to operations
  - Data collection during another field experiment, and compare with the year 1 field experiment benchmark to quantify the improvements enabled by NASA data and model; deliver our developed data and model forecast in real-time to the decision maker (i.e., US Coast Guard) through our industry partner ASA, the designated contractor for US Coast Guard, in the right place and format; Transition from research to operations to demonstrate actual decision making with improved results (e.g., reduction of response time, reduced search areas, planning for adequate resources) and socioeconomic benefits.

Year 1: Establish baseline performance

- Research & Development
  - Data collection during a field experiment
  - Model testing and verification/validation
- Benchmarking Decision Support Tool (DST)

Field Experiment: July 18-Aug 3, 2009





Co-sponsors: Alaska Ocean Observing System; Prince William Sound Science Center

View Nowcast and Forecast

July 2009

Su	M	T	W	Th	F	S
			01	02	03	04
05	06	07	08	09	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

<< < > >>

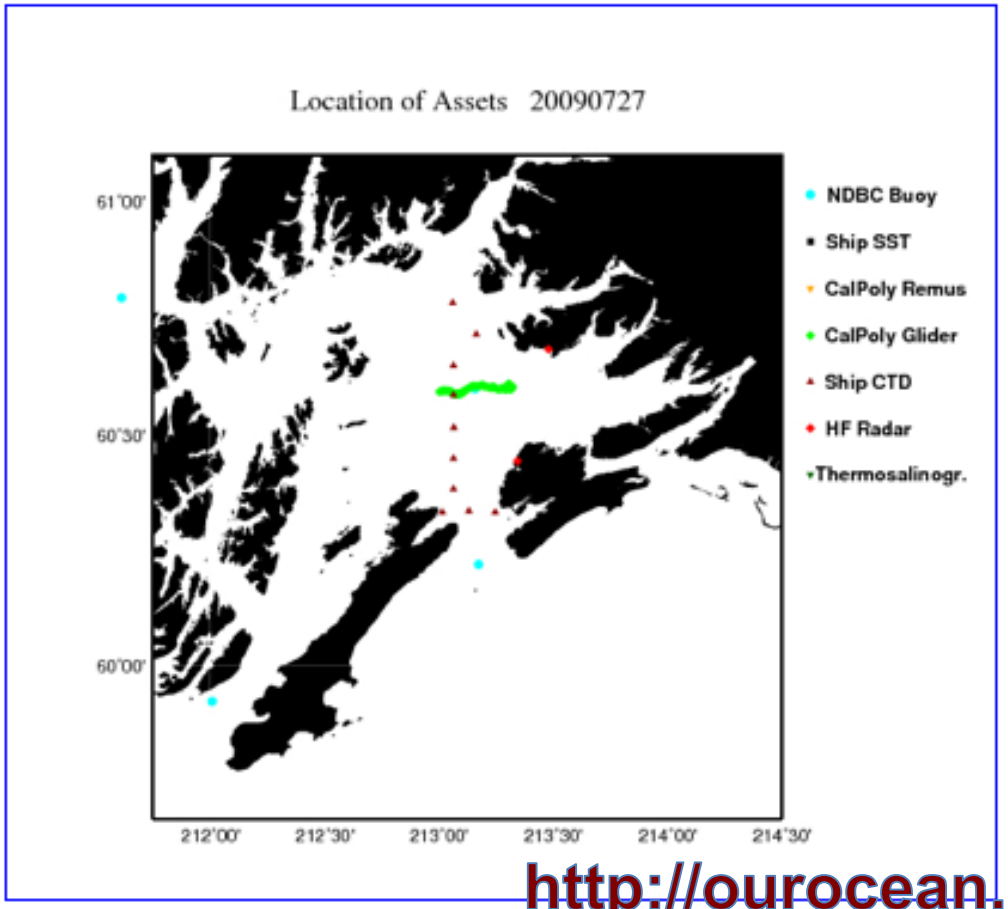
- ROMS Nowcast
  - Temperature
  - Salinity
  - Current
  - Sea Surface Height
- ROMS Forecast
  - 3D Output
- WRF
  - Wind
- ROMS vs. Data
  - Tide Gauge
  - Glider Profile
  - Ship CTD
  - REMUS
  - HF Radar
  - Sea Surface Temperature
- Drifter Trajectory
  - Observation
  - Prediction
  - Ensemble Prediction

Prince William Sound Field Experiment

The JPL OurOcean portal user guide

07/27/2009 *- The dominant features on the weather scene today are a high pressure ridge extending northward along the east side of the GOA and a low pressure center rapidly approaching the Alaska Peninsula. Larger-scale forecast models are having difficulty with this low and as a result today's PWS-WRF run was not initialized especially well. In addition, as we enter a period of weaker winds, PWS-WRF is struggling a bit with forecasting wind direction. Winds today have decreased to between 5 and 15 knots over much of the PWS. For the most part, the wind direction continues to be from the east to southeast. PWS-WRF forecasts call for a general continuation of this moderate east to southeast flow through the coming 24 hours, but note that this is a relatively low confidence forecast due to difficulties handling the approaching low pressure center. The flow within much of the PWS as revealed by drifter trajectories and ROMS nowcasts/forecasts continues to be generally northward to northwestward. In addition, ROMS has been suggesting for several days that this flow - which enters through the Hinchinbrook Entrance - has been exiting through the Knight Island Passage/Montague Strait entrance. This flow pattern has been confirmed by recent drifter trajectories, including one released in the Knight Island Passage. The tidal range at all stations continues to slowly decrease from its recent peak. The ROMS ensemble forecast was delayed today, otherwise there were no significant operational issues.*

Click here to view a more detailed PWS daily summary.



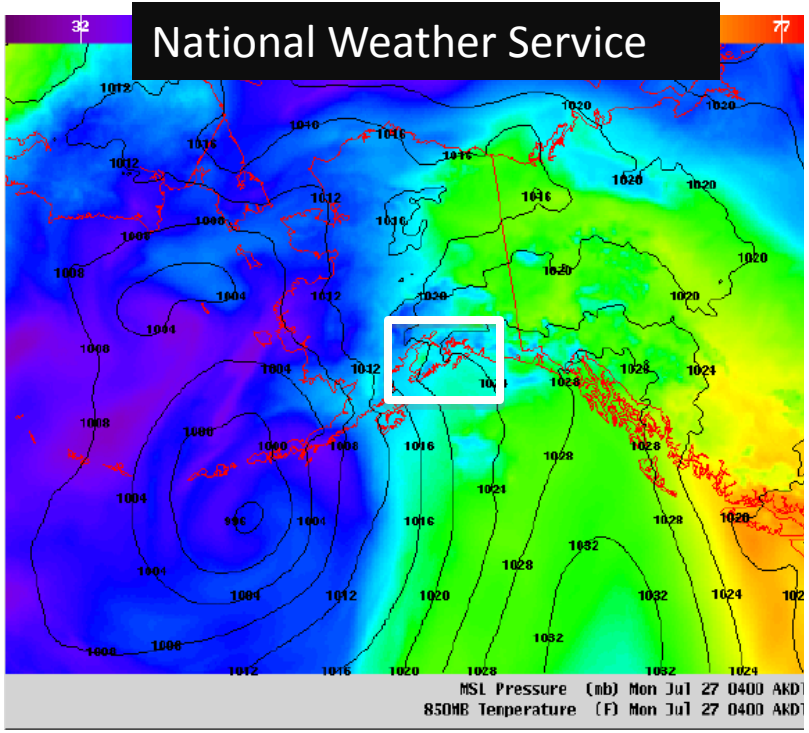
JPL ROMS Analysis & Forecast

End-to-End Integration for Data and Models

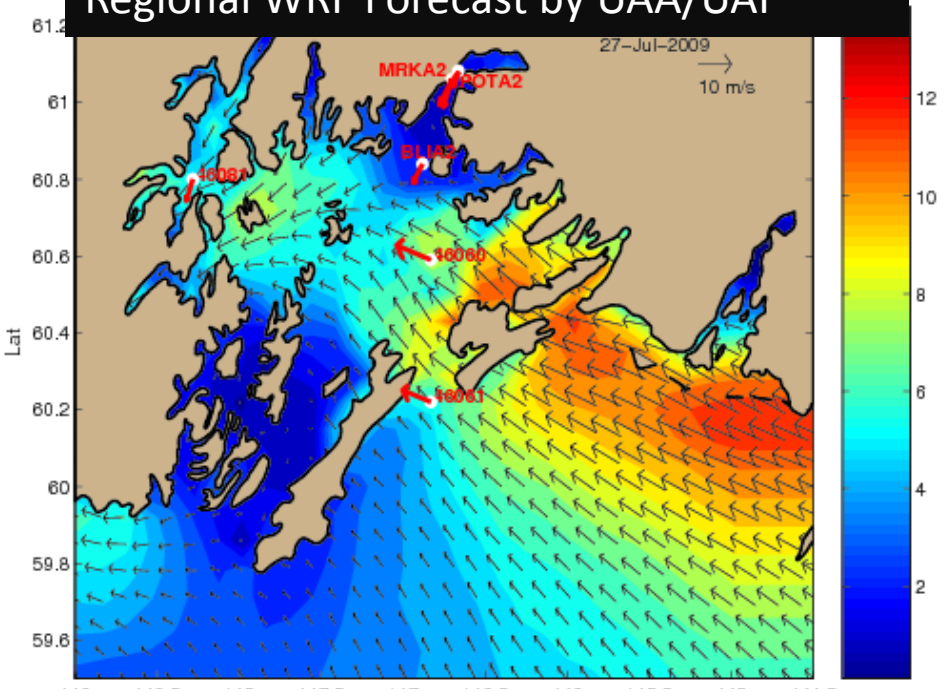
One-Stop Portal

http://ourocean.jpl.nasa.gov/PWS09

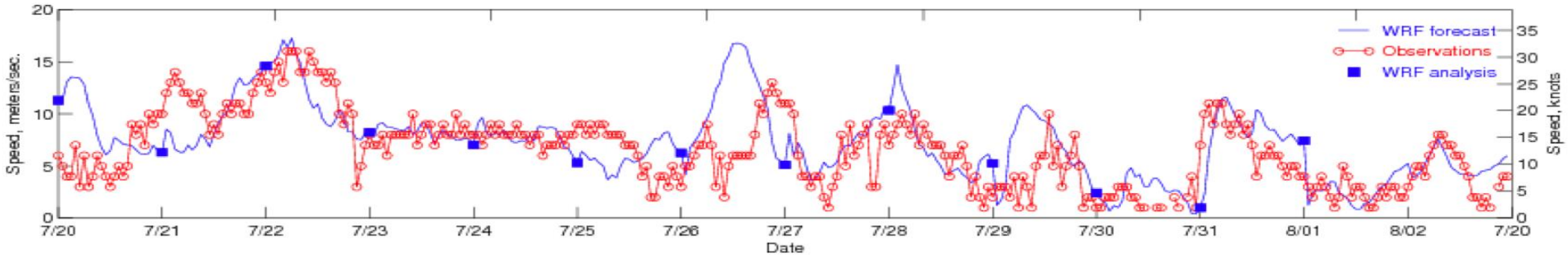
National Weather Service

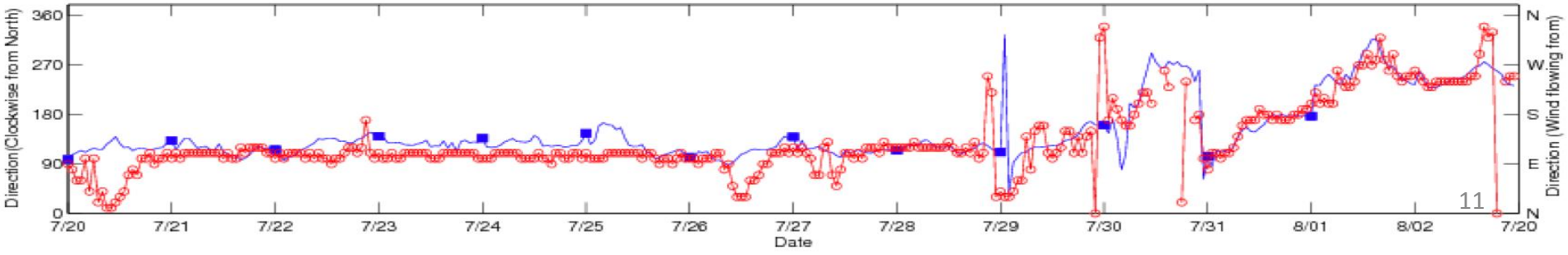


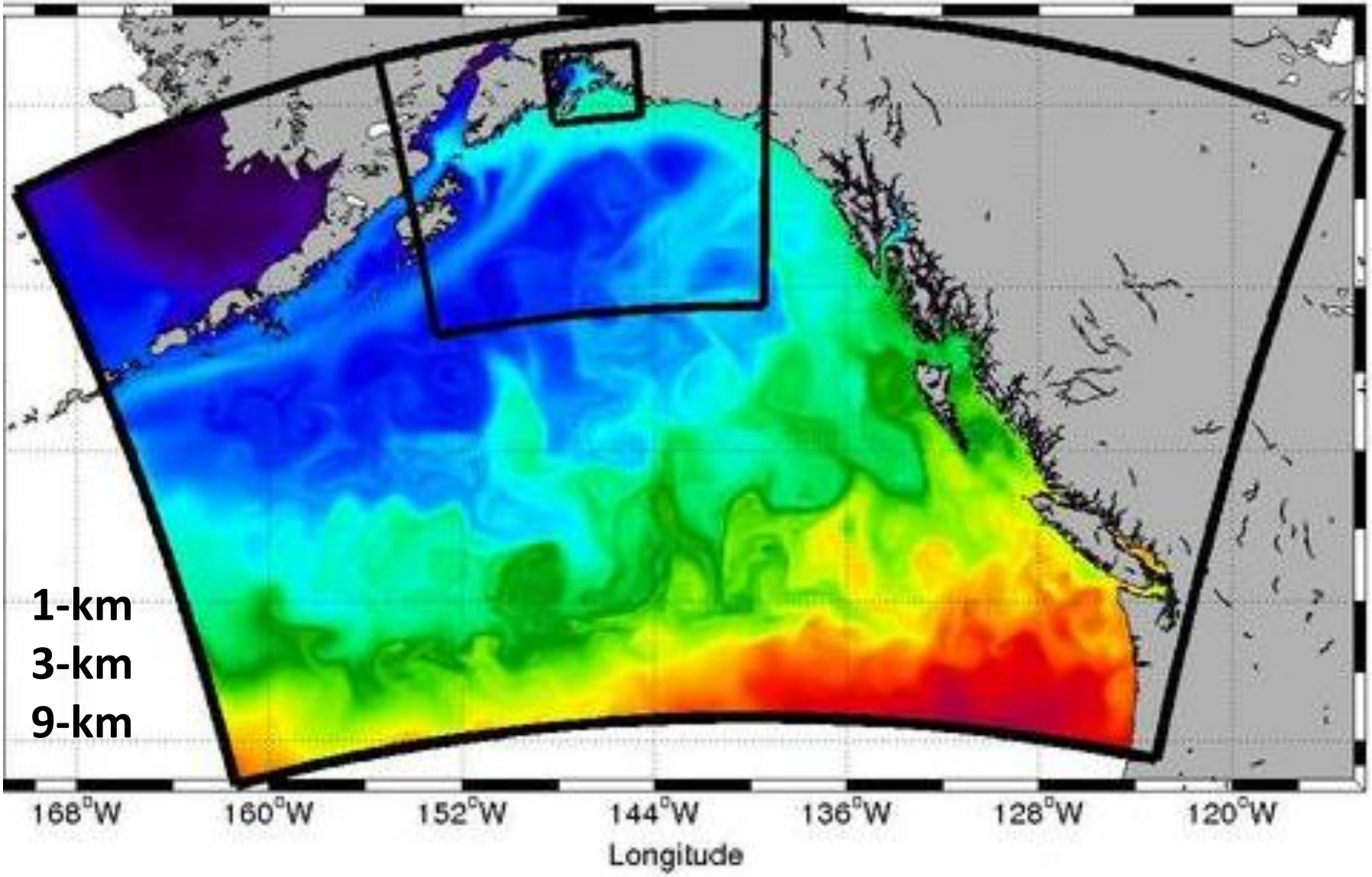
Regional WRF Forecast by UAA/UAF



Wind Speed/Direction between WRF and Observation at station 46060

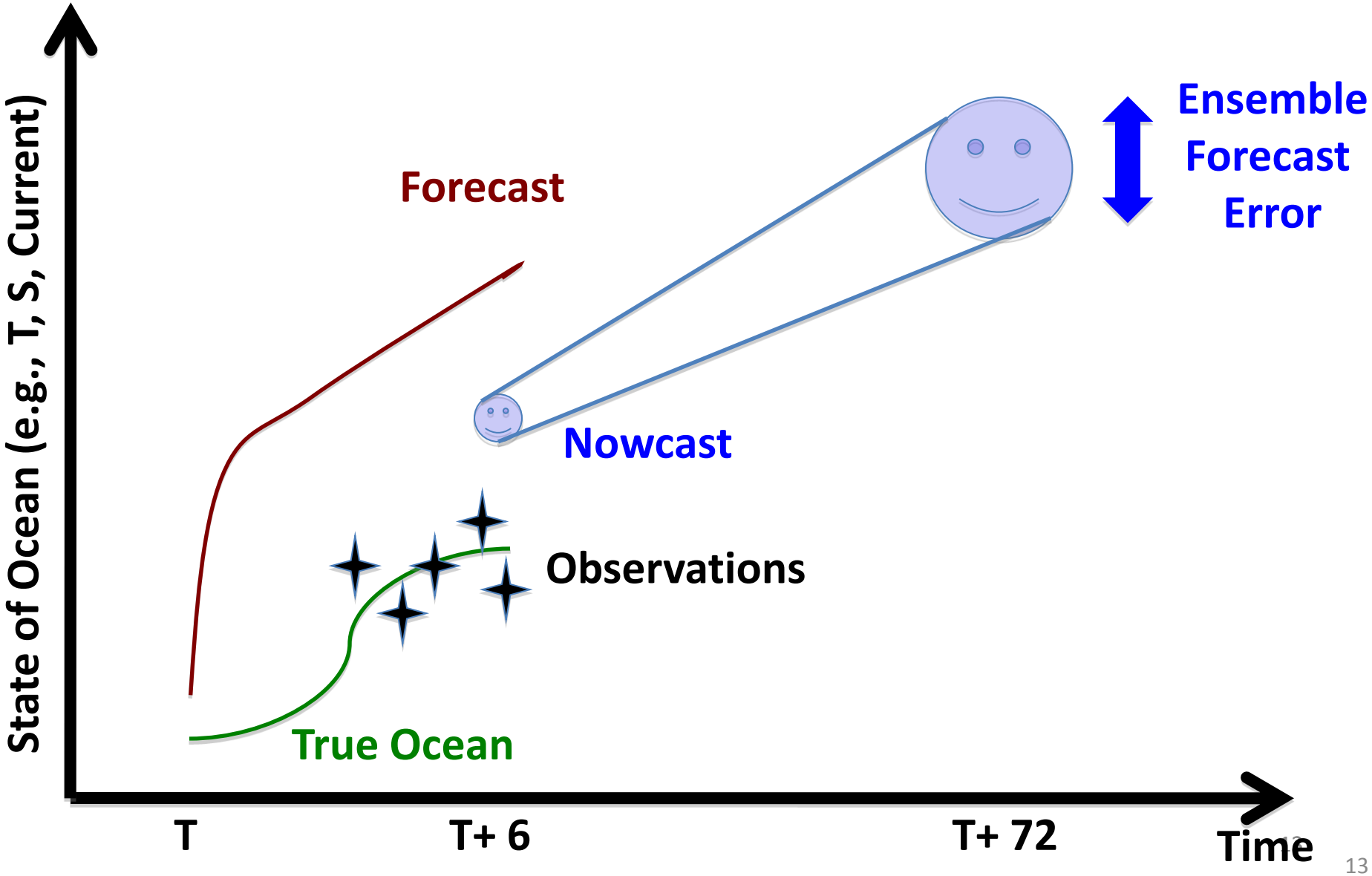


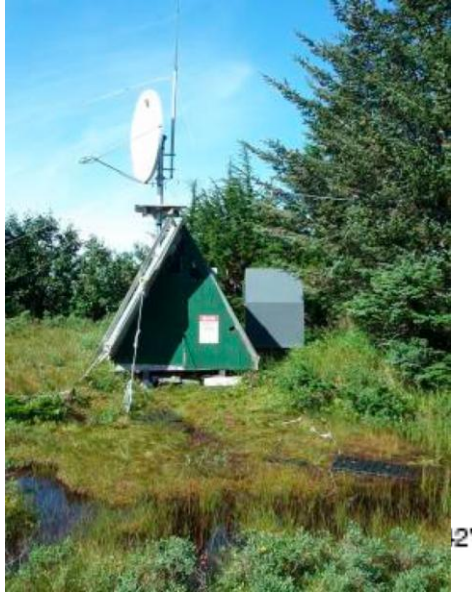




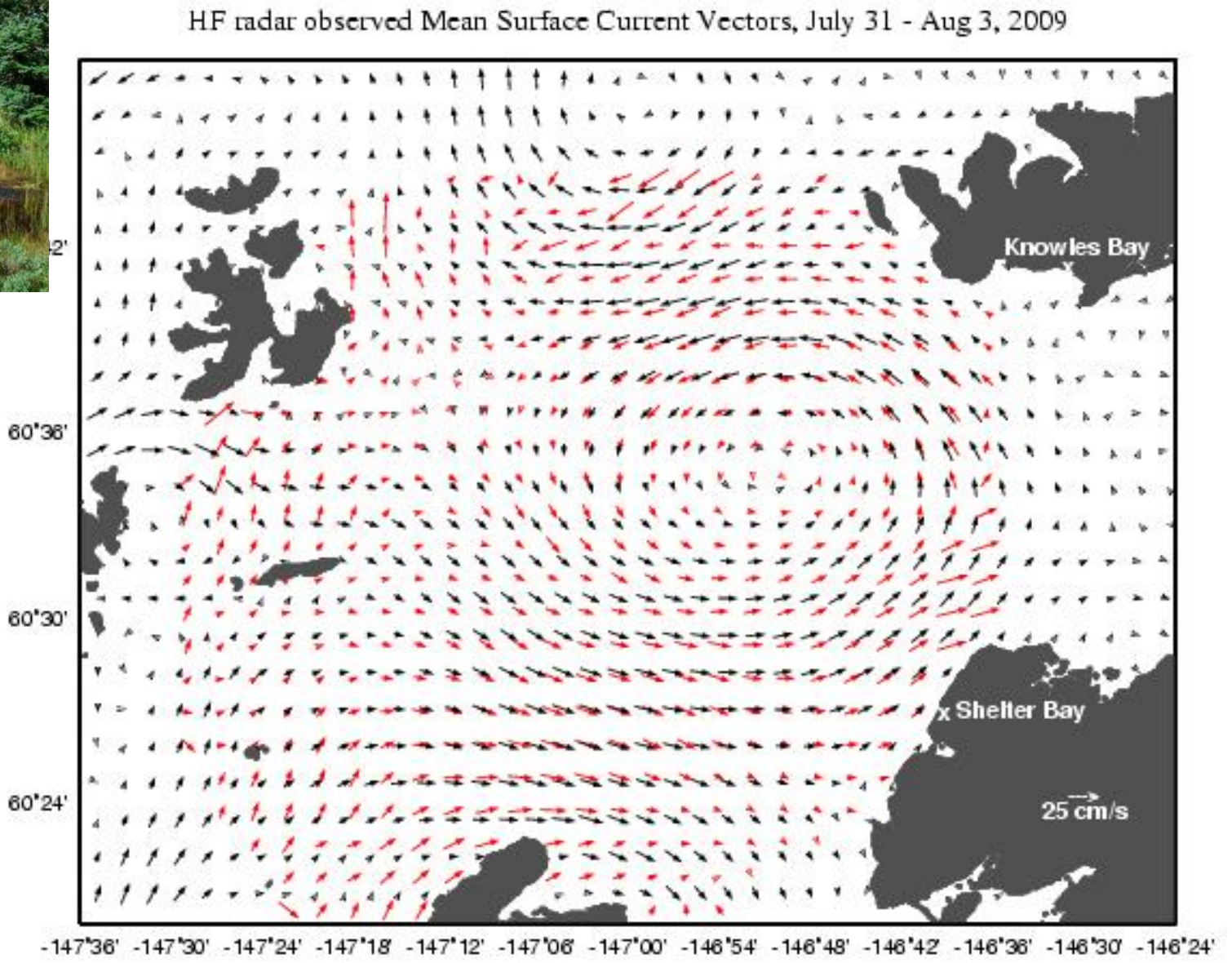
Regional Ocean Modeling System (ROMS)

ROMS Data Assimilation to enable forecasting

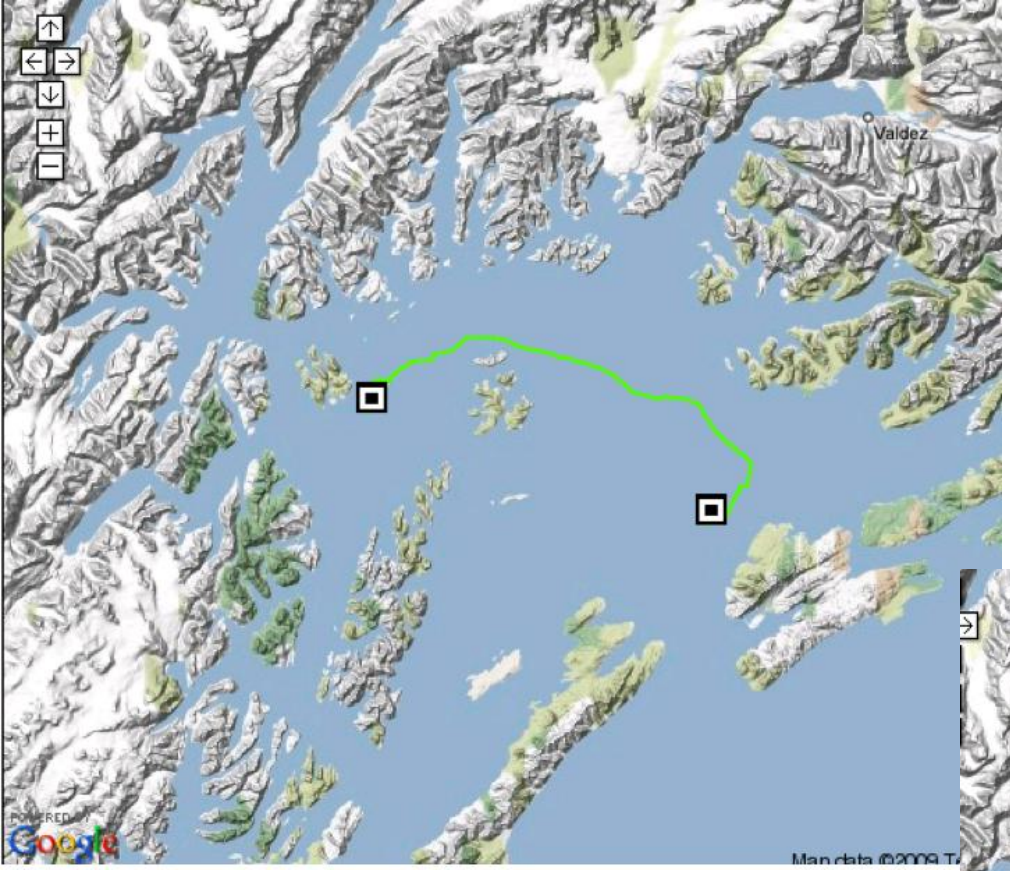


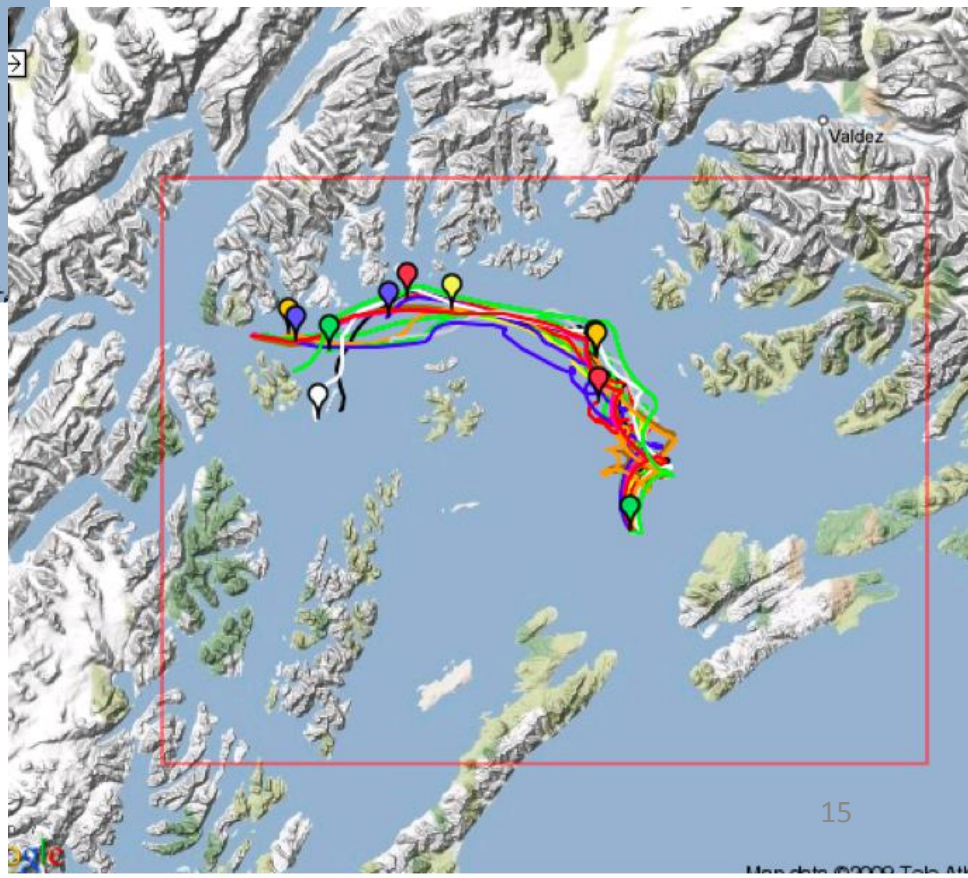


Model Verification

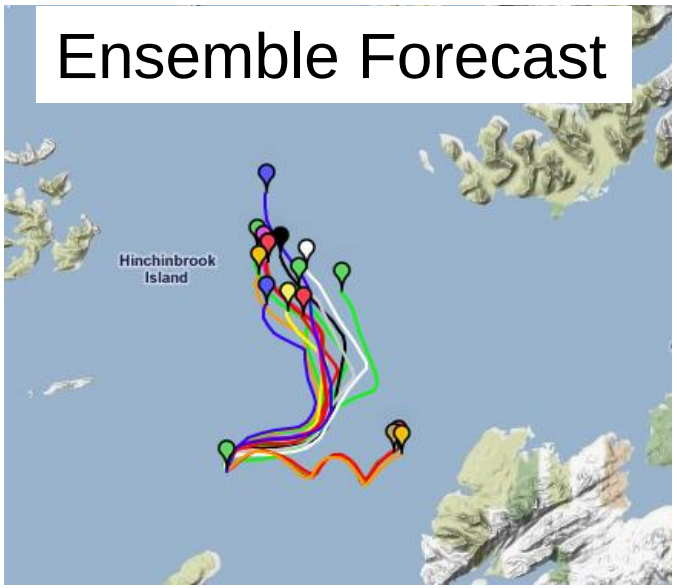


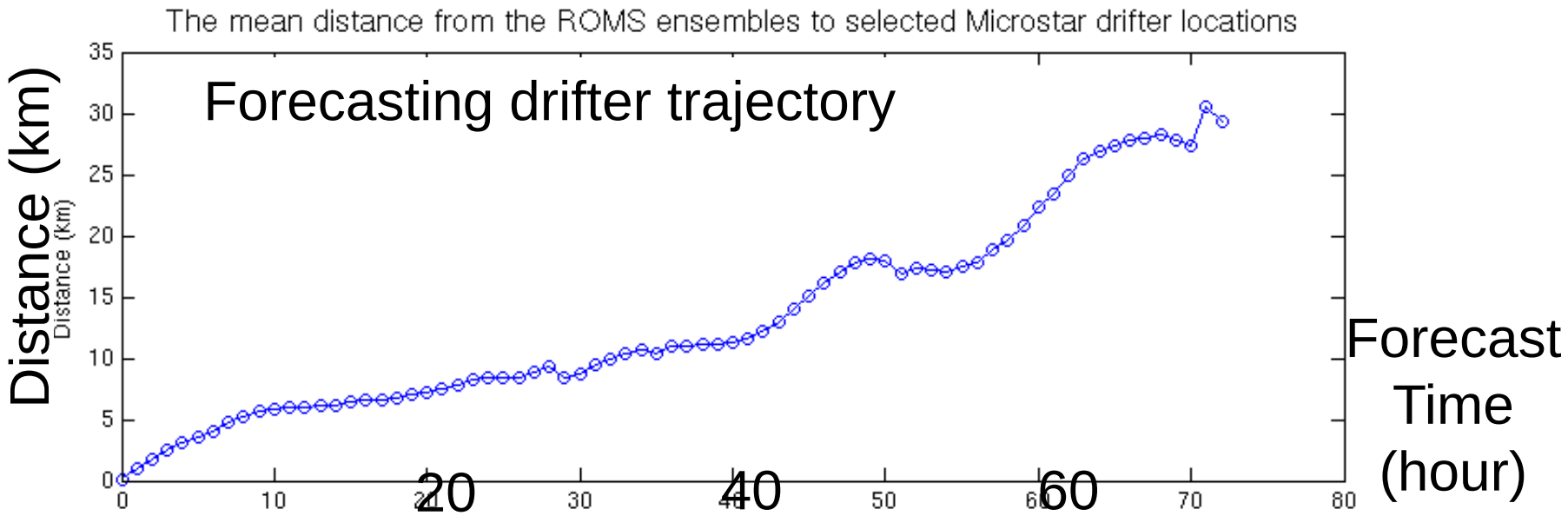
Ensemble Forecast
&
Error Estimation





ROMS Forecast Skill



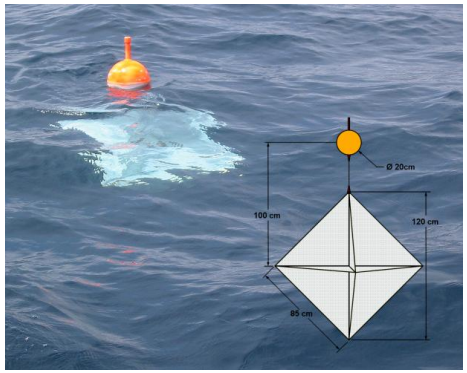


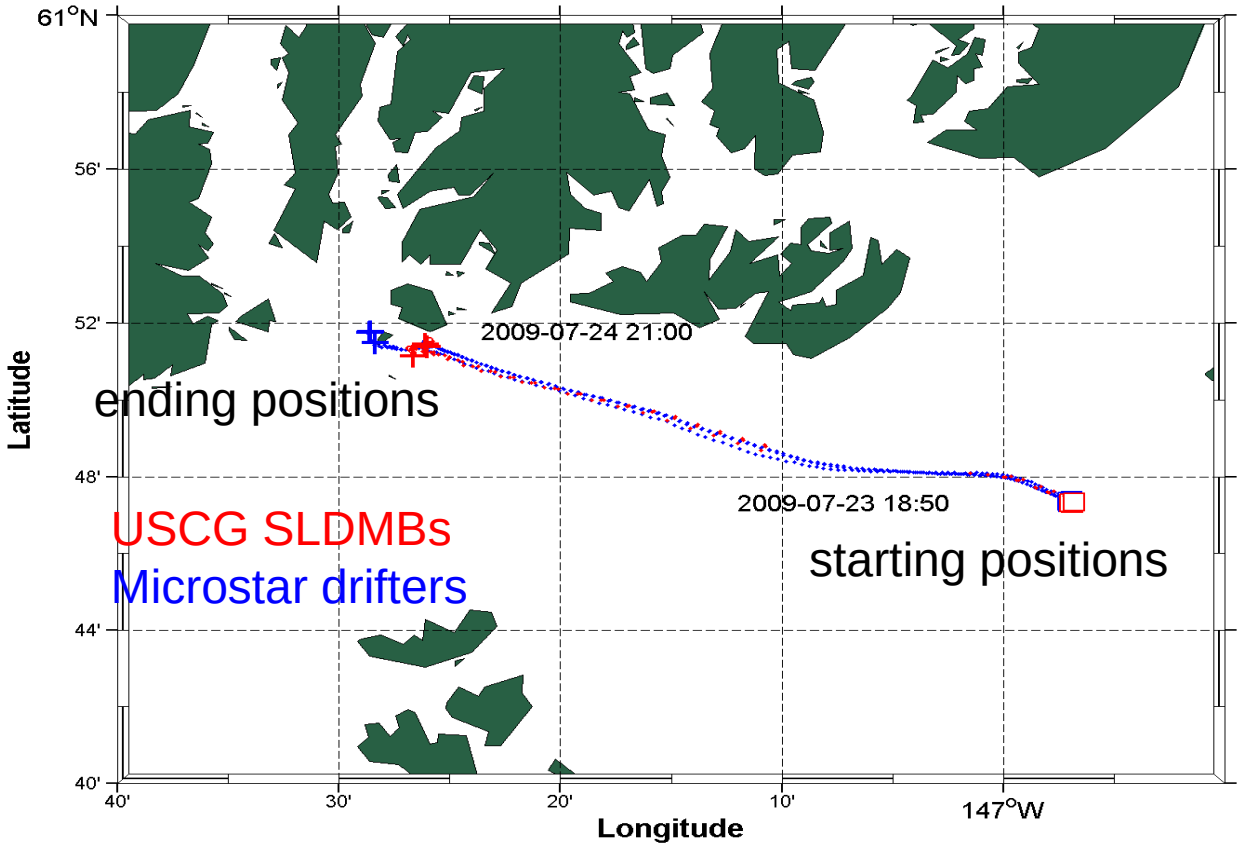
Year 2 Work in Progress

- Field experiment reanalysis & publications
  - Schoch and Yi Chao (2010) Ocean Observing System Demonstrated in Alaska, EOS, Transactions, American Geophysical Union (AGU), Vol. 91, No. 20, 181-182.
  - Schoch and Chao et al., An Ocean Observing and Forecasting Experiment in Prince William Sound, Alaska, Bulletin of American Meteorological Society (BAMS), to be submitted Oct. 2010
  - Continental Shelf Research (CSR) special issue, with guest editors: Schoch and Chao, manuscripts (~12) due Jan. 2011, final publication late 2011 or early 2012

Year 2 Work in Progress (cont.)

- Component refinement and integration
  - Understand data (two different in situ sensors)

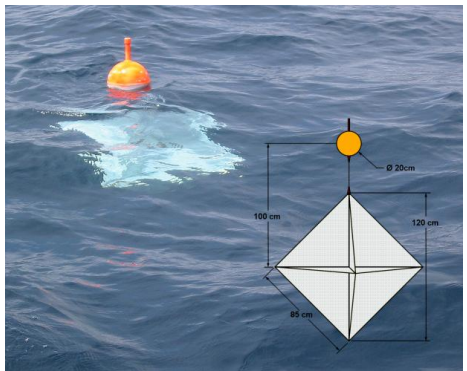


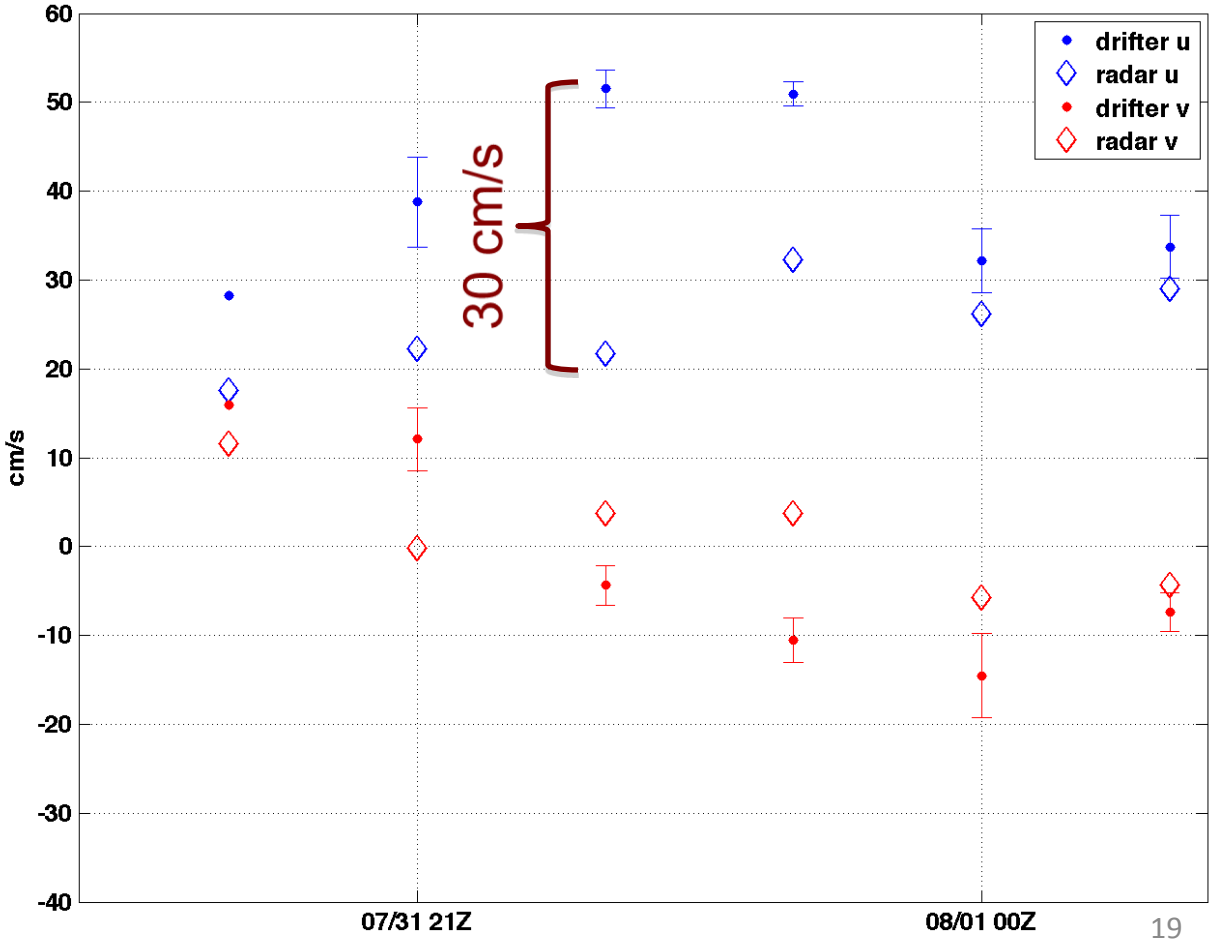


Year 2 Work in Progress (cont.)

– Understand data

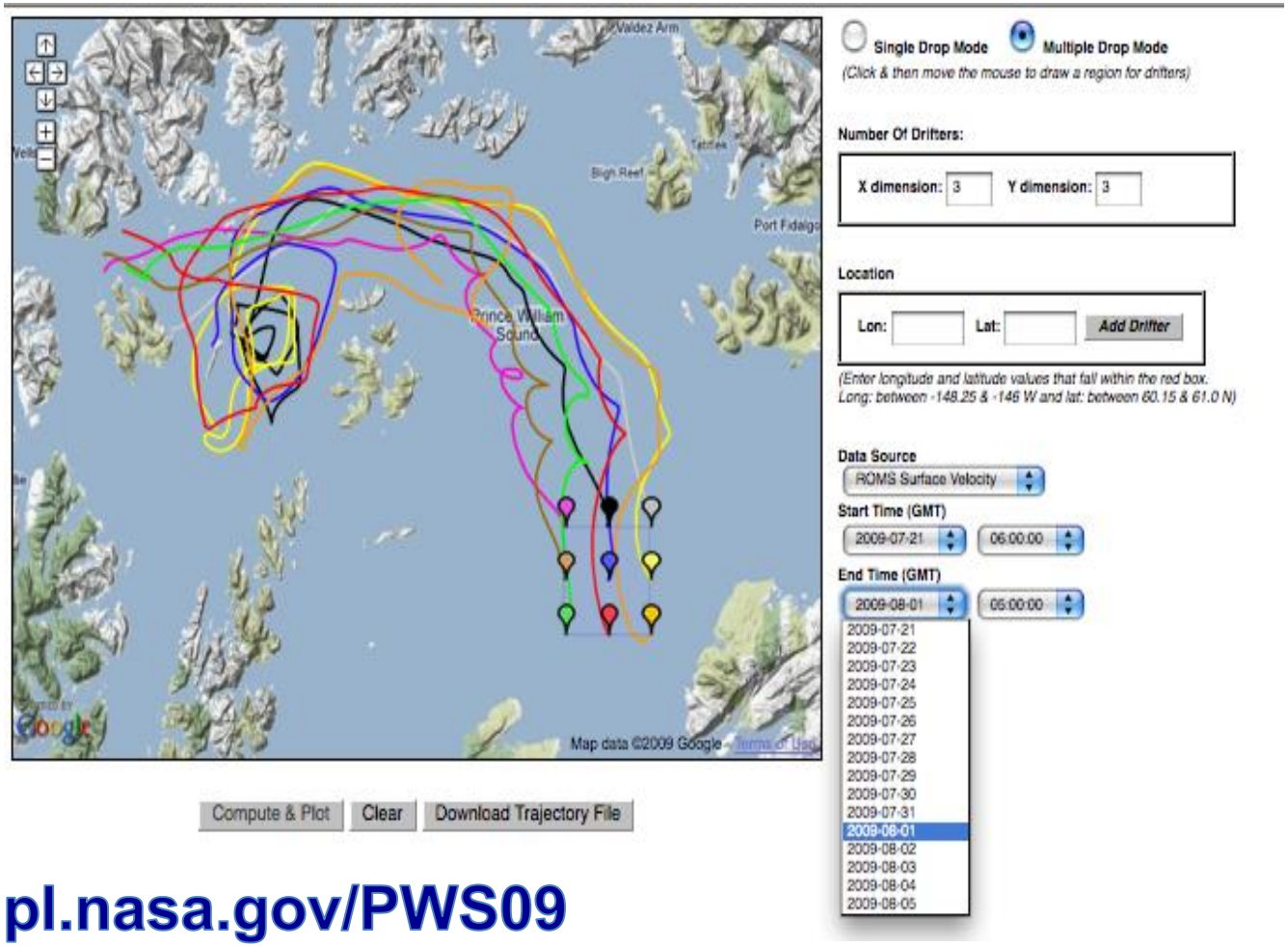
- In situ single-point vs remote sensing averaged measurements





Year 2 Work in Progress (cont.)

- Component refinement and integration
  - Understand model (spatial variability)



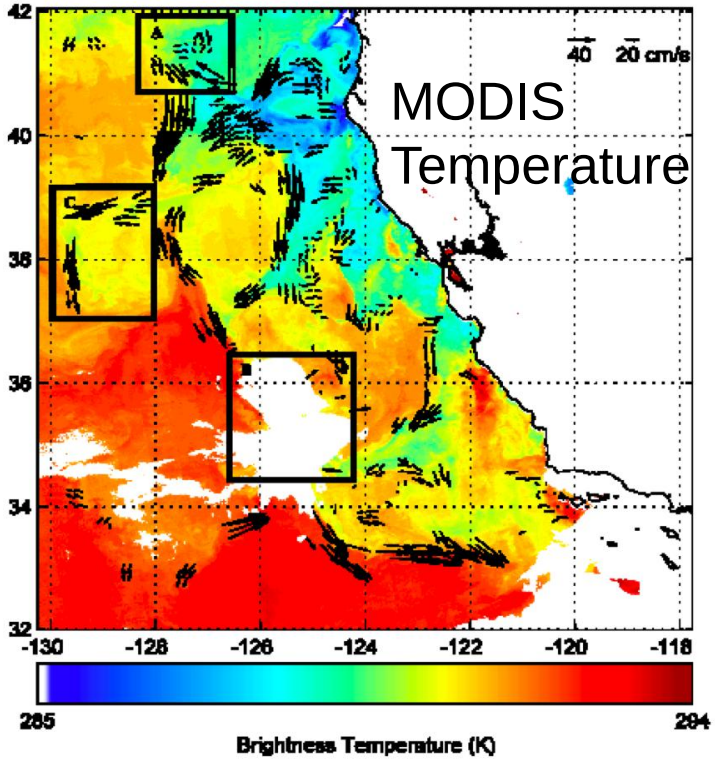
http://ourocean.jpl.nasa.gov/PWS09

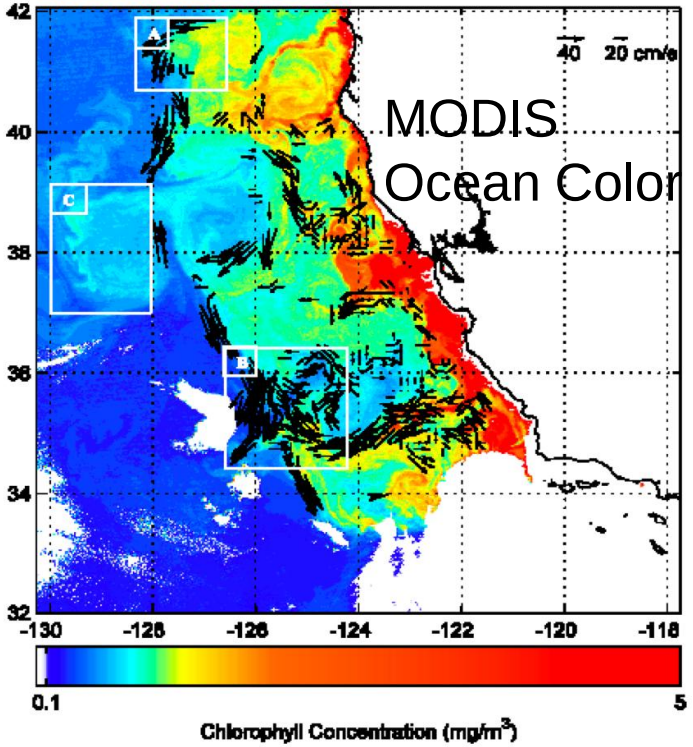
Year 2 Work in Progress (cont.)

- Component refinement and integration
  - Understand data and model
  - Refine and improve the forecasting system
    - Model configuration
    - Atmospheric forcing
    - Hydrological (fresh-water) forcing (due to rainfall, runoff, and ice/glacier melting)
    - Data quality control
    - Data assimilation
    - Model ensemble forecast to estimate errors

Year 2 Work in Progress (cont.)

- Component refinement and integration
  - Understand data and model
  - Refine and improve the forecasting system
  - Explore and ultimately use new NASA satellite data





Year 3 Work Plan

- Another field experiment is planned toward the second half of year 3
- Compare with the year 1 field experiment benchmark to quantify the improvements enabled by NASA data and model
- We will deliver our developed data and model forecast in real-time to the decision maker (i.e., US Coast Guard) through our industry partner ASA, the designated contractor for US Coast Guard, in the right place and format
- Transition from research to operations to demonstrate actual decision making with improved results (e.g., reduction of response time, reduced search areas, planning for adequate resources) and socioeconomic benefits.

Thanks & Questions?

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