ALASKA OCEAN OBSERVING SYSTEM

Sound Predictions 2009

Ocean observing and its applications in Prince William Sound, Alaska

AOOS

Prince William Sound Field Experiment July 19 – August 3

FACT SHEET

The Alaska Ocean Observing System, with Oil Spill Recovery Institute, the UAF School of Fisheries and Ocean Sciences, and a host of other partners, is sponsoring **Sound Predictions 2009**. This is a field experiment using high-tech tools and ecosystem models to find out:

1) *How do weather and currents influence Prince William Sound?*
2) *How well do scientific models predict atmospheric and oceanic conditions?*
3) *What are the costs and benefits of the Alaska Ocean Observing System modeling the trajectory of an oil spill?*

Field Events

- The experiment will take place from July 19 – August 3, 2009. A variety of sensors will be used to compare actual "real-time" conditions with model predictions.
    - Upland weather stations, weather buoys, and oceanographic moorings (anchored to the ocean floor) are already in place.
    - High-frequency radar will be deployed in mid-July to begin determining the velocity and direction of surface currents.
    - Beginning on July 19, oceanographers will cruise the Sound on transect lines to profile the temperature and salinity of the water column from top to bottom. They will also deploy a SLOCUM glider and a REMUS 100 that will be operated remotely as autonomous underwater vehicles (AUVs) to collect continuous measurements of temperature and salinity.
    - On July 21 and again on July 29, drifters will be deployed in the central Sound that will beam data to a satellite about their speed, location, and direction.

Why the Sound?

- Modeling the Sound is a challenge due to its mountainous surroundings, notoriously stormy seas, and a complex system of freshwater flows from the land interacting with flows between the Sound and the Gulf of Alaska through a narrow entrance.
- Prince William Sound has one of the most dense networks of observation platforms in the world. These platforms feed data into models:
    - Data from 20 weather stations over a 40-square-mile area are fed into a Weather Research and Forecasting (WRF) model which forecasts weather at a scale of about seven square miles.
    - Ocean circulation in the Sound is driven by an intricate mixture of buoyancy, wind, tidal, and other forces. The Regional Ocean Modeling System (ROMS) simulates the behavior of ocean currents, tides, salinity, and temperatures at different scales from that of the Gulf of Alaska down to a resolution of about two square miles.
    - The Simulating Waves in the Nearshore (SWAN) model forecasts the height of waves throughout the Sound, accurate to within 500 yards.

Why is monitoring important?

- Better scientific understanding can help prevent disasters. The need for accurate forecasting is underscored by the 20th anniversary of the *Exxon Valdez* oil spill in the Sound. NOAA scientists will test their GNOME model that predicts the route of spilled oil (GNOME = General NOAA Operational Modeling Environment).
- Improved predictions for waves, winds, and weather will also benefit the Sound's commercial fishing fleet who catch world-famous Copper River red salmon, the Coast Guard's search-and-rescue operations, recreational boaters, and commercial shippers who bring large amounts of Alaska's marine freight in and out of Prince William Sound ports.

Outreach Events and More Information

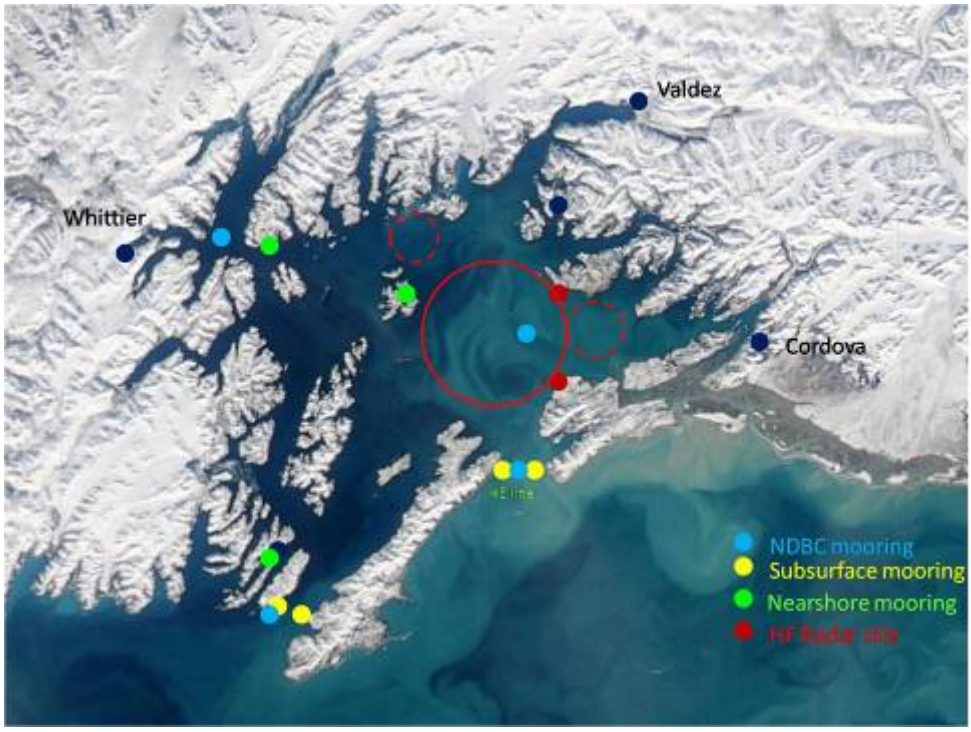
Project Launch Media Event: July 16, 1:00 pm, AOOS Conference Room, 1007 W. 3rd Ave., Suite 100, Anchorage

Public Event: July 28, 11 am, Valdez Convention Center; noon, Valdez Harbor

Blogs, Podcasts and Real-time Data: Links to daily blog, picture of the day, and podcasts at **http://www.aoos/**
Real-time data and comparison to model predictions through the "Data Portal" on **www.aoos.org.**
For more information: contact Darcy Dugan at dugan@aoos.org; 907.644.6718, or Molly McCammon at mccammon@aoos.org; 907.644.6703.

Location of the Experiment

The main study area is within the red circle.



Project Timeline

Mar 9	Nearshore moorings deployed
Mar 30	Entrance moorings deployed
July 15	High-frequency (HF) – radar deployed
Jul 19	*Auklet* loads, deploy glider, and initial CTD surveys
Jul 20	*Vixen* and *Alena K* load and depart to provide initial surveys, service nearshore moorings
Jul 21-25	Central Sound drifter deployment
Jul 26-28	Short experiments, balloon surveillance demonstration and PI meeting in Valdez
July 28	Public event in Valdez
July 29-Aug 2	Central Sound drifter deployment
Aug 3	End of experiment

Project Participants

Alaska Ocean Observing System	Molly McCammon, Project Leader	mccammon@aoos.org
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NASA Jet Propulsion Lab	Yi Chao, Modeling Lead	yi.chao@jpl.nasa.gov

Other Participating Scientists from:
University of Alaska Fairbanks
University of Alaska Anchorage
California Polytechnic State University, San Luis Obispo
Texas A & M
University of California Santa Barbara
University of Maine
Natural Resources Conservation Service

Other contributors and involvement in data applications:
Micro Specialities, Inc.
NOAA National Buoy Data Center
NOAA GNOME Project (oil spill trajectory model)
U.S. Coast Guard (search and rescue model)

*For more information about participants, see http://www.aoos.org/fieldexp/team.html

For more information on data management and models:

- Data (http://www.aoos.org/fieldexp/tools/datamgmt.html)
- ROMS (http://www.aoos.org/fieldexp/tools/ocean.html)
- SWAN (http://www.aoos.org/fieldexp/tools/wave.html)
- WRF (http://www.aoos.org/fieldexp/tools/forecasts.html
  http://ak.aoos.org/fieldexp/tools/weather.html

Note: Many of these technologies did not exist 20 years ago, and advances in oceanography, computer modeling and electronics now make these tools accessible and affordable.

Observing System Technology

Moorings

- Moorings consist of large buoys with attached sensors which are anchored to the floor of the ocean. During the experiment, data will be collected from two ocean moorings in the entrances to Prince William Sound and from three nearshore buoys at Sawmill Bay, Esther Island, and Naked Island.

- Measurements of water temperature and salinity at three different depths on the ocean moorings will help identify periods of exchange of deeper water (which tends to be colder and saltier) between Prince William Sound and the Gulf of Alaska and determine the amount of freshwater coming into the Sound from the Copper River Delta and glaciers around the Sound. Mounted fluorometers will detect the movements of plankton. (http://ak.aoos.org/fieldexp/tools/ocean-moorings.html)

- Instrumentation placed on nearshore buoys will provide information of the variability of the temperature, salinity, and chlorophyll content of ocean water in the nearshore areas of the Sound. (http;//ak.aoos.org/fieldexp/tools/nearshore_moorings.html)

High-frequency radar (http://ak.aoos.org/fieldexp/tools/radar.html)

- High-frequency radar measures the direction and speed surface currents.
- Radar towers will be set up in Knowles and Shelter Bays with biodiesel generators. Data will be transmitted to satellites hourly.

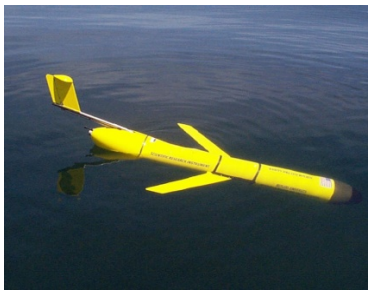
Hydrographic Surveys

- Hydrographic surveys will take place from boats during the drifter release experiments.
- Research vessels will follow north-south transects in the central Sound and make "CTD casts" at fixed points. The Conductivity-Temperature-Depth (CTD) instrument measures conductivity and temperature to produce a profile of the temperature and salinity of the water column from top to bottom.

AUVs (Autonomous Underwater Vehicles) **(**http://ak.aoos.org/fieldexp/tools/auv.html)

- AUVs will be launched to provide nearly continuous measurements of temperature and salinity along a 65 km path in the Sound and thus, a regional scale view of the water column to complement the measurements being made through hydrographic surveys.
- After retrieval of the vehicle each mission, the data will be sent to the server at Cal Poly via cell phone modem for use in modeling.
    - The Slocum glider is an autonomous underwater vehicle (AUVs) that is operated remotely by communications through a computer modem or global satellite phone to a GPS. Gliders move vertically in the ocean by changing their density by inflating/deflating a bladder to adjust their volume to weight ratio. Forward momentum is achieved with a pair of fixed wings and pitching the glider upward or downward by shifting a battery pack aft or fore of the vehicle. Sideways shifts of the battery pack also

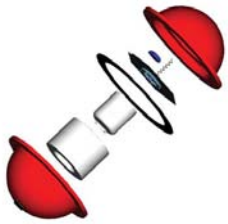
allow the glider to roll and execute turns. The Slocum glider is a 1.8 m long torpedo-shaped winged vehicle built by Webb Research Corporation (WRC) of East Falmouth, MA. The operating range using batteries is about 500 km with a maximum depth of 200 m. The glider will carry a sensor for chlorophyll concentrations in addition to a CTD. The vehicle provides data when it surfaces (approximately every 3 hours), which will then be provided to the modeling groups.



- The REMUS-100 AUV is a propeller driven platform with a standard length of 160 cm, 19 cm in diameter, with a weight of 37 kg. It can travel distances of greater than 80 km at ~3 knots. The vehicle can respond to data collected to adjust to adjust for currents and calculate its position in real time while navigating.

Drifters (http://ak.aoos.org/fieldexp/tools/drifters.html)

- Drifters are buoys designed to float at the surface and thus track current speed and direction. Drifters have three parts: 1) a sphere or floater just below the ocean surface with an antenna for sending information to a satellite orbiting above the Earth, 2) a drogue which hangs down below and acts like an underwater sail which helps the drifter move with the flow of the current (rather than the wind and waves), and 3) sensors to measure ocean conditions continuously and send the data to the satellite.
- Drifter experiments in 2004 provided an unexpected result that the models that existed at that time did not predict. The circulation in the central Sound turned out to be cyclonic (i.e., a counterclockwise circle) so that drifters went north and west. The 2009 experiment will be an important test of the improved circulation model for the Sound.
- Five different types of drifters will be deployed during the Prince William Sound experiment, which differ in their shape, the depth of their drogues, and the destination of their data. Each deployment will release two groups of at least three of each style of drifter at two different starting locations (north and south).



Argosphere Drifter
Designed to track floating oil on water.

SVP Drifter with “holeysock” drogu

Coast Guard SLDMB Drifter