Prince William Sound …

- contains approximately 3,500 miles of coastline, including hundreds of islands;
- has two major entrances: Montague Strait (west) and Hinchinbrook Entrance (east);
- is used extensively by transoceanic shippers, oil tankers, state ferries, fishing boats, cruise ships, sailboats, and kayaks;
- is relatively protected from severe weather in the adjacent Gulf of Alaska; and
- takes in large, seasonal additions of fresh water from rivers and melting glaciers that result in rich marine habitat for plankton, fish, marine mammals, and people.

Since the mean tidal range in Prince William Sound is about three meters, all mariners need to consider the currents created by the ebb and flood of the tides. When winds and waves are also factors, the velocity of the currents can magnify waves to dangerous heights. Currents are also important in the set and drift of vessels in the tanker traffic corridor leading to the Port of Valdez, as well as the trajectory of drifting debris, icebergs and oil spills.

We have been working with state, federal and private groups to strategically establish and maintain moored weather buoys and ocean sensors, as well as land-based surface current radar and SnoTel stations all over the Sound. These measure phenomena such as the speed and direction of wind and ocean currents, water temperature, salinity, and precipitation. We use these data to create complex numerical simulations, or models, of the atmosphere and ocean. We are now refining the models to the point where they can more accurately mimic the phenomena indicated by the observed data—and then forecast what will happen if a variable changes.

This information will be used in products needed by fishers, boaters, recreationists, resource managers and others to make better decisions about how to use the ocean environment.

Our partners in Prince William Sound include Chugach Regional Corporation, the National Data Buoy Center, the National Resources Conservation Service, the Prince William Sound Aquaculture Corporation, the Prince William Sound Regional Citizens' Advisory Council, the University of Alaska Fairbanks, the US Coast Guard, the US Forest Service, and the Village of Tatitlek.

The rocky shores and temperate rainforests of the Sound are home to many species of seabirds. Photo: Exxon Valdez Oil Spill Trustee Council

Glaciers provide huge seasonal inputs of fresh water to the Sound and influence coastal currents. Photo: Exxon Valdez Oil Spill Trustee Council

The intricate coastline of the Sound contains many small bays and islets, presenting a challenge to mappers and modelers. Photo: Exxon Valdez Oil Spill Trustee Council

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Alaska Ocean Observing

A Pilot Project in Prince William Sound

Improving our ability to observe and forecast changes in Alaska's oceans

The Alaska Ocean Observing System is building a network of observation platforms and forecast models that will provide information products and tools to improve our understanding of Alaska's ocean ecosystem and allow us to make better decisions about our use of the marine environment.

AOOS
Alaska Ocean Observing System
www.aoos.org

End-to-End Demonstrations of Ocean Observing: Observe ► Forecast ► Use

Observe: Land- and sea-based platforms record data

Buoys and Moorings

Telemetered weather buoys operated by NOAA's National Data Buoy Center provide real-time data for modeling ocean circulation. In winter, non-tidal circulation in the Sound results primarily from strong winds and small inputs of fresh water. Summertime non-tidal circulation in the region is driven by buoyancy (freshwater) related effects: winds are weak and freshwater inputs are large from melting glaciers and other runoff from streams.

Oceanographic moorings are located along the continental shelf and at entrances to key embayments to measure seasonal and interannual variation in exchange rates of coastal waters.

High-Frequency Radar

Two High-Frequency (HF) radar stations have been established at Knowles and Shelter Bays to map surface currents. The remote locations of these stations require the installation and maintenance of independent power sources such as wind turbines, solar panels, and propane generators (Forest Service regulations forbid the use of diesel fuel as a power source). The stations are most useful when both are working; however, maintaining a consistent power source and protecting the instruments from severe weather is an ongoing challenge.

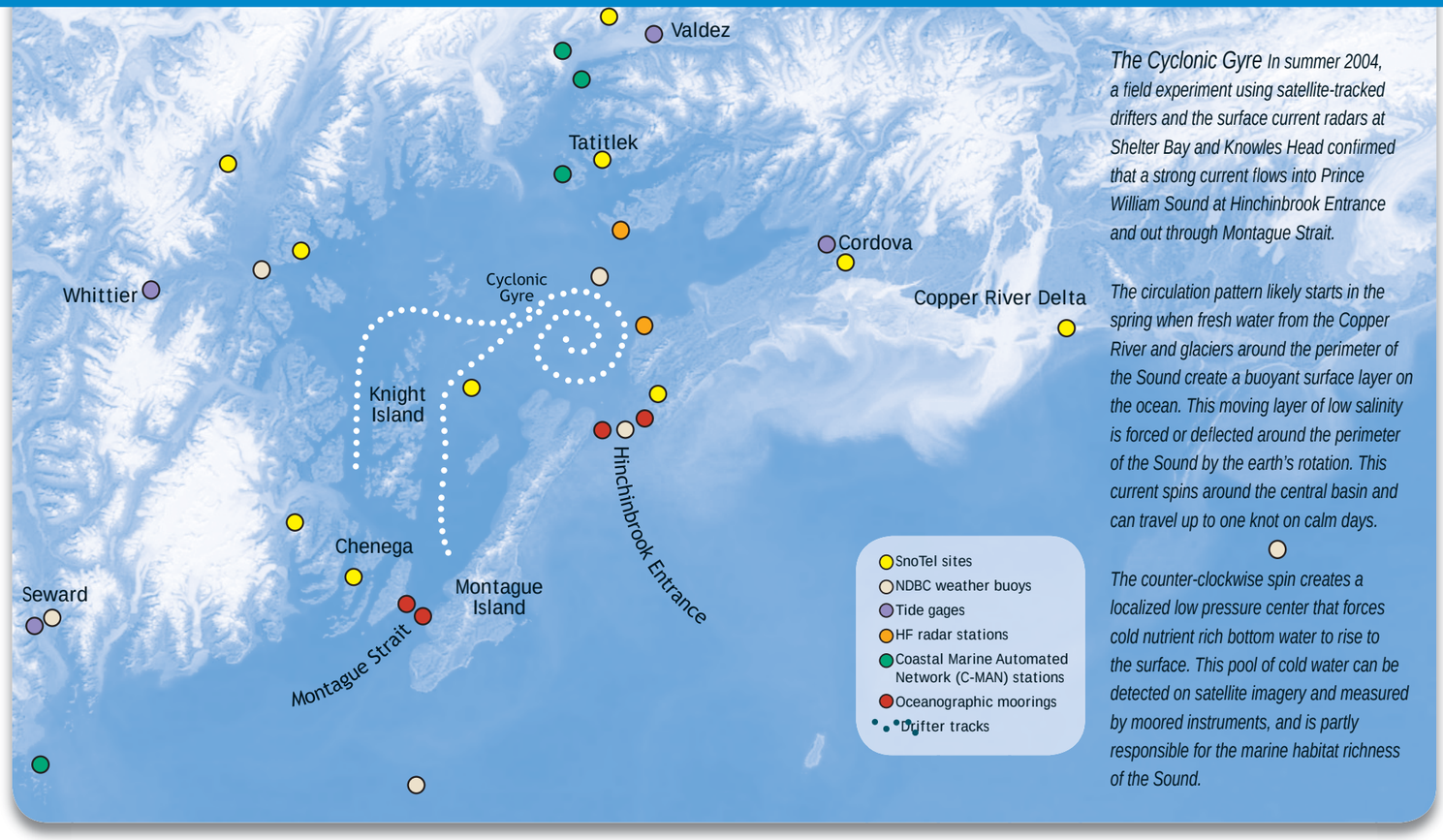
SnoTel Weather Stations

SnoTel weather stations and monthly snow surveys measure accumulated water stored as snow during the winter. The spring melt and runoff is an important driver of coastal ocean circulation and the spring plankton bloom. The stations are designed to operate unattended for one year, using meteor burst technology to communicate precipitation and weather data in near real time.

Drifting Data Collectors

The trajectories of argosphere, or "argos," drifters (deployed at the surface) and drogues (deployed ten meters underwater) are strongly influenced by wind speed and circulation. Should dispersants be used following an oil spill in the central Sound, results suggest that the trajectory and fate of subsurface oil would likely differ considerably from the trajectory and fate of untreated surface oil. Argos drifters and drogues helped reveal the presence of a summertime cyclonic gyre in the central basin of the Sound.

Cover photos: Prince William Sound, Exxon Valdez Oil Spill Trustee Council; NOAA buoy, Carl Schoch.

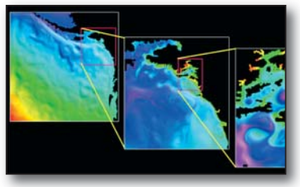


The Cyclonic Gyre *In summer 2004, a field experiment using satellite-tracked drifters and the surface current radars at Shelter Bay and Knowles Head confirmed that a strong current flows into Prince William Sound at Hinchinbrook Entrance and out through Montague Strait.*

The circulation pattern likely starts in the spring when fresh water from the Copper River and glaciers around the perimeter of the Sound create a buoyant surface layer on the ocean. This moving layer of low salinity is forced or deflected around the perimeter of the Sound by the earth's rotation. This current spins around the central basin and can travel up to one knot on calm days.

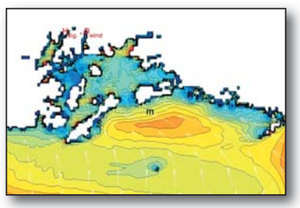
The counter-clockwise spin creates a localized low pressure center that forces cold nutrient rich bottom water to rise to the surface. This pool of cold water can be detected on satellite imagery and measured by moored instruments, and is partly responsible for the marine habitat richness of the Sound.

Forecast: Computer models forecast the dynamics of the Sound



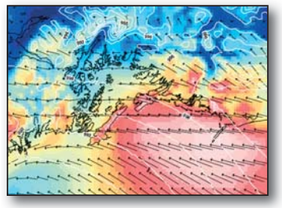
Circulation: ROMS

A data assimilation Regional Ocean Modeling System (ROMS) for the Gulf of Alaska is being developed by the University of California-Los Angeles (UCLA) and the NASA Jet Propulsion Laboratory (JPL) to simulate offshore, shelf and embayment circulation. These currents vary with seasonal cycles of winds and freshwater runoff and represent an important pathway for organisms and climate perturbations to propagate around the Gulf of Alaska and potentially into the Bering Sea and Arctic Ocean. A coupled circulation-ecosystem model capable of producing real-time and forecasted nutrient concentrations and plankton abundances is now under development at the University of Maine.



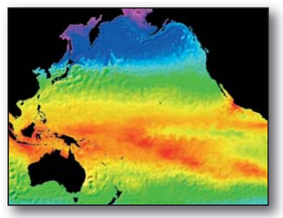
Waves: SWAN

The grid-based Simulating Waves in the Nearshore (SWAN) model is being developed by Texas A&M University. Satellite and in situ wave observations are used to validate the model and artificial intelligence techniques are being explored to improve model results.



Weather: RAMS, WRF

The Regional Atmospheric Modeling System (RAMS) and the Weather and Research Forecasting (WRF) model are numerical simulations of atmospheric circulation operated by the Alaska Experimental Forecast Facility (AEFF) at the University of Alaska Anchorage (UAA). They provide accurate meteorological information for use in ocean circulation models and National Weather Service forecasts.



El Niño Southern Oscillation: ENSO

A Pacific basin-scale numerical model was developed at JPL and will provide boundary conditions for higher resolution coastal models. These coastal models will therefore be linked by the JPL basin-scale model to track the propagation of El Niño Southern Oscillation (ENSO) signals along the coast of North America to the Gulf of Alaska.

Use: Information products are online

The AOOS website provides:

- **Data and information products** from remote observation platforms, such as weather buoys, that provide wind and current speed and direction, wave height, sea temperature and salinity, and more.
- **Weather buoy enhancements,** such as current velocity sensors, for specialized local needs.
- **Processed satellite data** that present Alaska-wide information on sea-surface temperature, ocean color (chlorophyll) and wind.
- **Surface current maps** from high frequency radar for the central basin.
- **Biological data** on fish, birds and marine mammals, the environmental effects of human activities, and any other information that can be used with the physical data to predict future changes to the ocean ecosystem.

Direct benefits to user groups

AOOS contributes to safety at sea by helping **commercial fishermen** and **transoceanic shippers** stay informed about ocean and weather conditions. AOOS also provides customized data products for the **oil spill response community** and US Coast Guard **search and rescue** teams.

We link **educators** from formal and informal settings by creating exemplary educational resources for use in and outside of Alaska. We work with **local communities,** including Alaska Native groups, that make their living from the sea by providing relevant environmental data for daily decision-making.