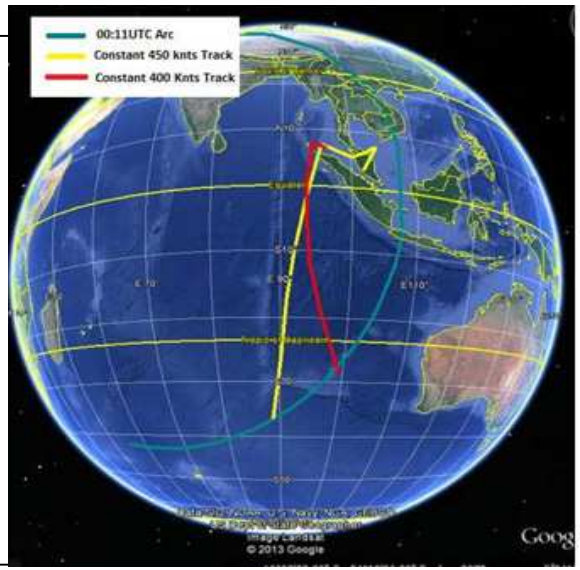
Search for MH370 - media



The search for missing flight MH370 continues as one of the greatest unexplained transport disasters of all time. This fuelled intense media coverage and a thirst for knowledge about the ocean currents and bathymetry – both of which are data products relying on altimetry.

- David Griffin
- CSIRO
- 2014
- General public
- mass media, TV, radio, websites
- many
- English and other

Wealth from our oceans

Science for decision makers

www.csiro.au/oceans | June 2014

News from CSIRO's Wealth from Oceans National Research Flagship

- **HUNT FOR MH370** ocean science critical to search
- **WHITE SHARK** life and death secrets revealed
- **OCEAN HEAT** latest climate report out
- **PREDICTING** Irukandji blooms just got easier
- **NEW FLAGSHIP** announced in CSIRO reform
- **CATCH QUOTAS** research to help industry

Feature > Missing planes and oil spills

Image: Department of Defence

Science is a crucial part of modern day incident and disaster response. When disaster does strike, our routine data collection, modelling and analysis provide a platform for the science-based decision making required to guide operations.

In March this year a team of our oceanographers, experts on the Indian Ocean's currents and eddies, began advising the Australian Maritime Safety Authority (AMSA) on the search for missing Malaysian Airlines flight MH370.

CSIRO has a Memorandum of Understanding with AMSA that facilitates the provision of scientific knowledge and technical support during maritime incidents such as oil spills, search and rescue, and shipping accidents. In the case of MH370, the support involved modelling and projecting the track of any potential debris spotted by satellites and planes during the search for the aircraft.

The models and data we used in the search for MH370 provided information on how floating material is transported by ocean currents. In the case of an oil spill, our science extends to monitoring technologies, plus environmental and ecosystem models and data. The ocean's vast debris issue was highlighted when items spotted and found proved to be unrelated to the aircraft.

Our science was applied to monitor the 2010 Deepwater Horizon oil spill in the Gulf of Mexico, and to support environmental monitoring strategies after the cargo ship MV Tycoon foundered against a cliff off Christmas Island in 2012. More on the MH370 search inside.

Need to know

Predicting deadly Irukandji blooms just got easier

Using collated medical records of stings and reviewing past local weather conditions, we have discovered the connection between Irukandji blooms and trade winds – or lack thereof. The results could directly benefit northern Australia's communities, industry and tourists alike. On the Great Barrier Reef, we found a clear connection between recorded Irukandji 'sting days' and days when there was little to no trade wind activity. These conditions are consistent with theories long held by local communities and provide a basis for designing management interventions that have the potential to eliminate the majority of stings.

New Oceans and Atmosphere Flagship

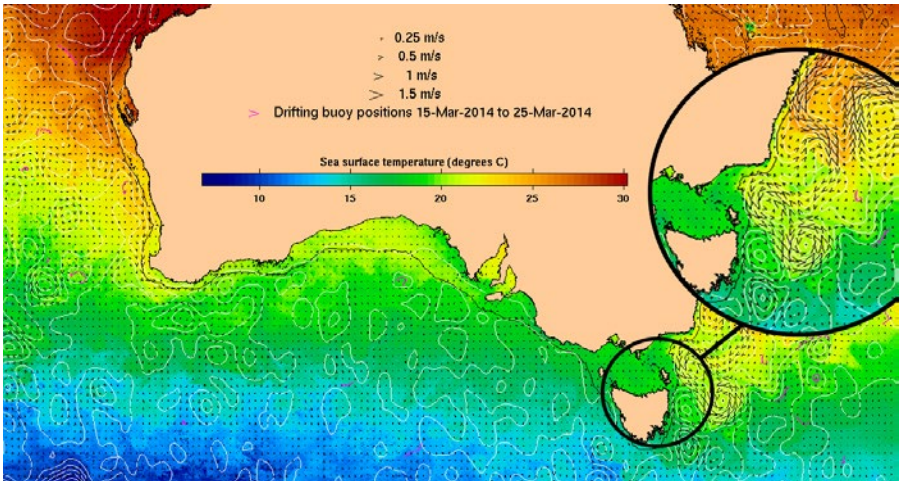
Dr Ken Lee has been announced as Director of CSIRO's new Oceans and Atmosphere Flagship. The focused research of the Flagship will provide the information to plan for and respond to weather and climate related natural hazards, future growth of marine industries, and sound management of Australia's marine estate.

Oceanography and the search for MH370

In March this year CSIRO assisted with the search for the missing Malaysian Airlines flight MH370. The support involved modelling and projecting the track of any potential debris spotted by satellites and planes during the initial search in the Indian Ocean.

Why were we involved in the search?

CSIRO has a Memorandum of Understanding with AMSA that allows them, during a maritime incident, to call on us for scientific knowledge and technical support. Incidents include oil spills, search and rescue, shipping accidents and in the case of MH370, modelling and projecting the track of debris spotted by satellites.



Reading ocean models: The white lines are the contours of the ocean. The black arrow heads show the eddies and current direction and strength. The different colours shows the sea surface temperature (blue is cold, red is warm).

What did we do?

To assist AMSA with the search a task force of oceanographers, led by our own Dr David Griffin and Dr Andreas Schiller, carried out two main tasks: back-tracking the items spotted by satellite to a possible common origin (a possible crash site), and forward-tracking to guide on-water searches. We were helping to locate items seen by satellites several days previous, and to direct boats and planes to where the items could have drifted.

To do this, we used a number of ocean models that all run routinely in real-time, as part of our existing ocean monitoring and modelling projects and collaborations. We focused this capability on the southern Indian Ocean.

How did the modelling work?

Our modelling worked in two ways. First, if a piece of debris was located our systems helped to 'hindcast', or backtrack, to the original location, or the possible crash site. Secondly, if a piece of debris was located by satellite, our systems helped the boats and planes by forecasting its potential future locations

The debris tracking used advanced models of ocean currents around Australia including BLUElink, a collaboration between CSIRO, the Bureau of Meteorology and the Australian Navy over the past decade.

The critical data required by the models comes from the Global Ocean Observing System and Australia's Integrated Marine Observing System (IMOS), a national, collaborative infrastructure facility set up eight years ago. IMOS has become an international leader in ocean observing and is now the critical observational foundation for much of Australia's marine science.

Three satellites (Jason-2, Cryosat-2 and SARAL) are particularly crucial to our oceanographic work. The satellites are equipped with altimeters, which map ocean-surface topography, or the hills and valleys of the sea surface, with accuracy better than 5-centimetres. We also use data from several additional satellites which measure the temperature of the surface of the ocean as an additional source of information.

Royal Australian Navy (RAN) vessel *Ocean Shield* searches for MH370 (image supplied RAN).

The Indian Ocean challenge

The ocean is vast and conditions are continuously changing. The Indian Ocean is known for strong winds, large waves and turbulent eddies. Debris can potentially travel up to 50 kilometres a day. There are eddies in the Indian Ocean which are about 100 kilometres wide and where the water is moving around these at about 0.5 metres a second, or one knot.

We collect data about the marine environment 365 days of the year from satellites, ocean buoys and moorings and ships, so that in times of emergencies like this we are able to provide prompt and accurate information to the relevant authorities.

Secrets of white shark unlocked with ‘close kin’ genetics

We want to know if white shark numbers are going up or down. Population estimates and trends are needed to assess the effectiveness of Australia’s national white shark recovery plan, the impact of fishing, and policies such as shark control programs.

We have developed a unique method to measure, for the first time, Australia’s two white shark populations. The method is part of a new toolkit combining tagging, aerial surveys, DNA fingerprinting and advanced statistics.

The initial challenges include finding at least one count of shark abundance, determining when and how often they breed, how many pups they have and how many young and adult sharks die each year.

Measures of abundance, sex and death have never before been included in white shark population estimates, because no-one has been able to provide them.

A direct count of breeding adults and how often they breed is being provided through ‘close kin’ genetics.

This technique, which has been used to measure southern bluefin tuna stocks, is likely to revolutionise the way that fish (and other animal) populations are assessed worldwide, largely because it bypasses the use of imperfect data such as fishery catch records.

It uses DNA fingerprinting to find the proportion of juveniles in a population that are related.

This number can reveal the overall number of breeding adults: a smaller population will be brimming with half and full brothers and sisters, and vice versa.

When several years of data are analysed, these relationships in turn reveal how often the adults breed. For example, if a one-year old shark and a two-year old shark sampled in the same year have the same mother, that adult must have pupped in successive years.

To estimate juvenile death rates, more than 50 youngsters have been fitted with acoustic tags at the two known white shark nurseries (Port Stephens, NSW, and Corner Inlet, Victoria) and are being tracked along the east coast. Helicopter surveys have been used to count juvenile sharks near Port Stephens.

CSIRO has been researching white sharks for over 20 years and there are currently over 250 white sharks tagged in Australian waters.

With measures of the number of juveniles and their death rates, the annual births can be calculated. When combined with the number of pups born per shark this can provide another estimate of breeding females.

For Australia’s eastern white shark population, most of the detective work is done and scientists will soon get their first look at DNA fingerprints to see how close to they are to providing a population estimate.

In the west, the challenge is to find nursery areas at which the new techniques can be applied. Aerial surveys will be conducted along the South Australian and Western Australian coastline, and white sharks will be fitted with acoustic and satellite tags to locate nursery areas.

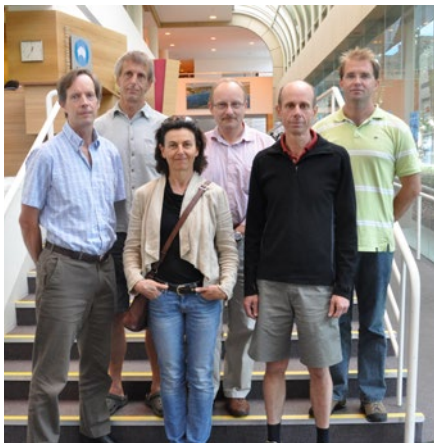
It will be months of investigation, in the air and on the water, before the various parts of the puzzle are coaxed from the sea.

Research in NSW on the east coast has been supported by the Hunter-Central Rivers Catchment Management Authority and the Melbourne Aquarium and has involved the NSW Department of Primary Industry, the University of Technology, Sydney and Tag-For-Life.

The expansion of the research to the west is a collaboration between CSIRO and the Department of Fisheries Western Australia, funded by the Australian Government’s National Environmental Research Program Marine Biodiversity Hub (NERP Hub).

Our research team tagging ‘Columba’ – a 3.5m female white shark – at the Neptune Islands.

Quick bite >



Meet our experts

MH370 task team leaders

CSIRO's MH370 task team of ten oceanographers, a few of whom are pictured above, were led by David Griffin (far left) and Andreas Schiller (third from right).

David specialises in phenomena including eddies, fronts and boundary currents such as the East Australian Current. Andreas' expertise in large-scale ocean physics and modelling ranges from climate research to ocean forecasting.

www.csiro.au/DavidGriffin
www.csiro.au/AndreasSchiller

Collaborating for impact

Science-informed catch quotas

In recent years blue-eye trevalla catch quotas have dropped by 50 per cent. Together with the Victorian Department of Primary Industries and the Fisheries Research and Development Corporation we are researching blue-eye trevalla stock size and biology with the aim of informing decisions around a bigger and sustainable catch quota. A greater confidence in the stock assessment will ensure a sustainable catch for Australia's fishing industry.

Baseline environmental data off North Western Australia

CSIRO is partnering with the Australian Institute of Marine Science, Shell and INPEX to develop comprehensive environmental baselines to monitor the health of waters off North Western Australia to help protect the environment in the event of an oil spill.

... just a nibble

Air and ocean temperatures across Australia are now, on average, almost a degree Celsius warmer than they were in 1910, with most of the warming occurring since 1950, CSIRO and the Bureau of Meteorology stated in the third annual State of the Climate report. More at www.csiro.au/State-of-the-Climate-2014

We've undertaken a three year collaborative research project in the Kimberley, working with local indigenous groups to monitor turtle and dugong populations. As well as environmental outcomes, the project is providing employment and training opportunities for local communities. Watch a video about this important work at tv.csiro.au

Interested in doing business?
Contact robert.seymour@csiro.au or +61 (0) 7 3833 5754.

More >

- The sea trials of the Marine National Facility RV *Investigator* are in progress. For more news, photos and video visit csirofrvblog.com
- The next generation water quality forecasting system for the Great Barrier Reef has been released for researchers and marine managers, more at www.bom.gov.au/marinewaterquality
- Hear about how we helped Petronas protect their subsea pipelines, get the basics on ocean acidification and see the biggest Irukandji jellyfish ever found on tv.CSIRO.au
- Our changing climate could create growth opportunities for Australia's seafood industries, if we take a holistic look at seafood supply chains. Find out more at blogs.csiro.au/climate-response

This document is a hard copy version of CSIRO's Wealth from Ocean's e-news. Subscribe online at www.csiro.au/ocean-enews.

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Australia is founding its future on science and innovation. Its national science agency, CSIRO, is a powerhouse of ideas, technologies and skills for building prosperity, growth, health and sustainability. It serves governments, industries, business and communities across the nation.

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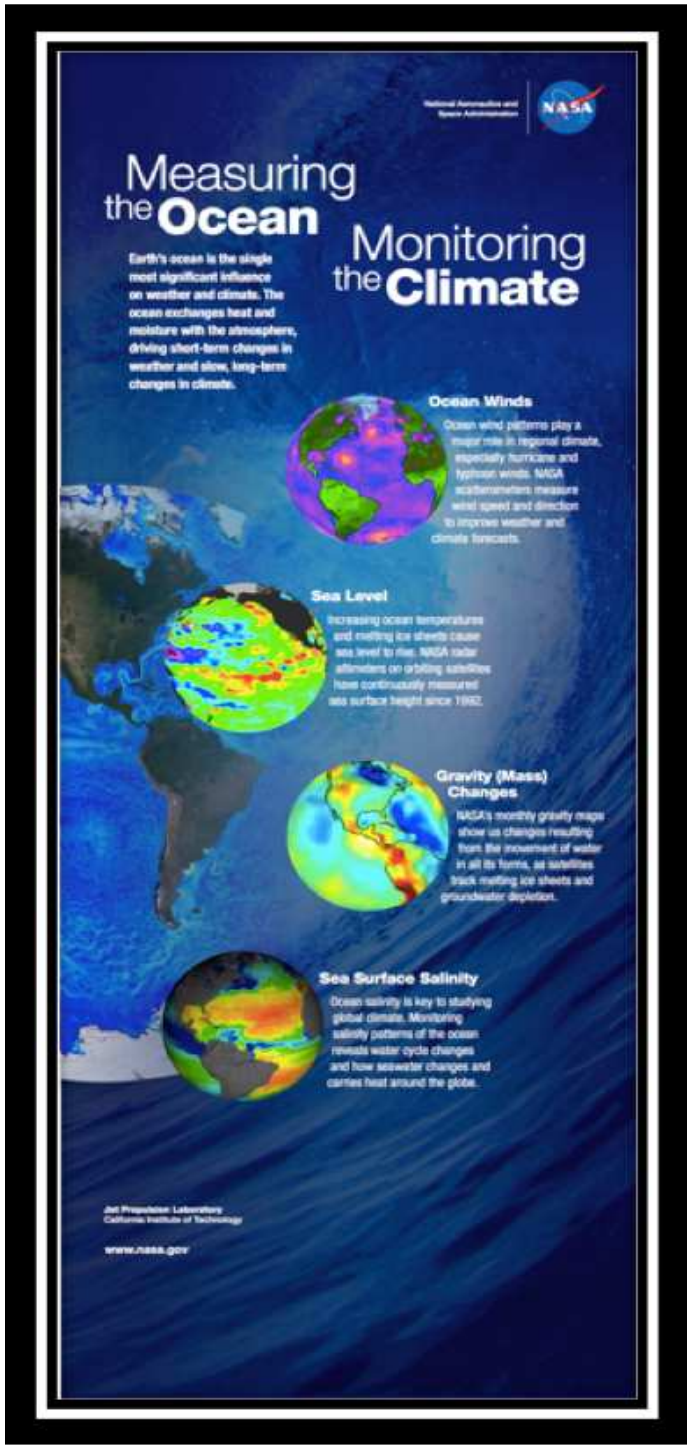


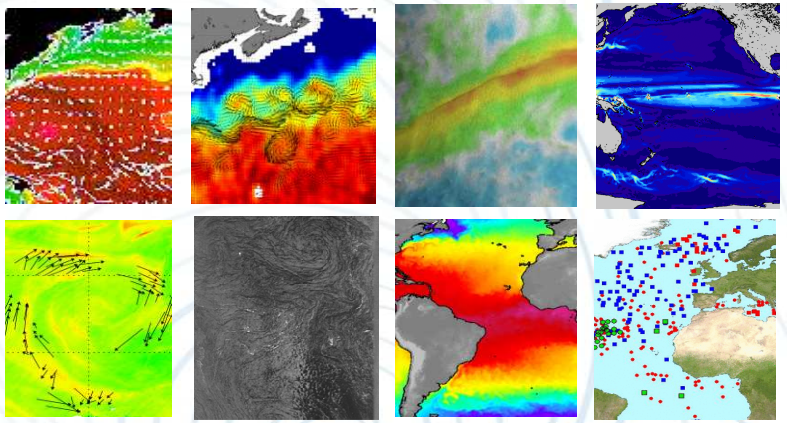
Multi-Mission "Pull-up" Display

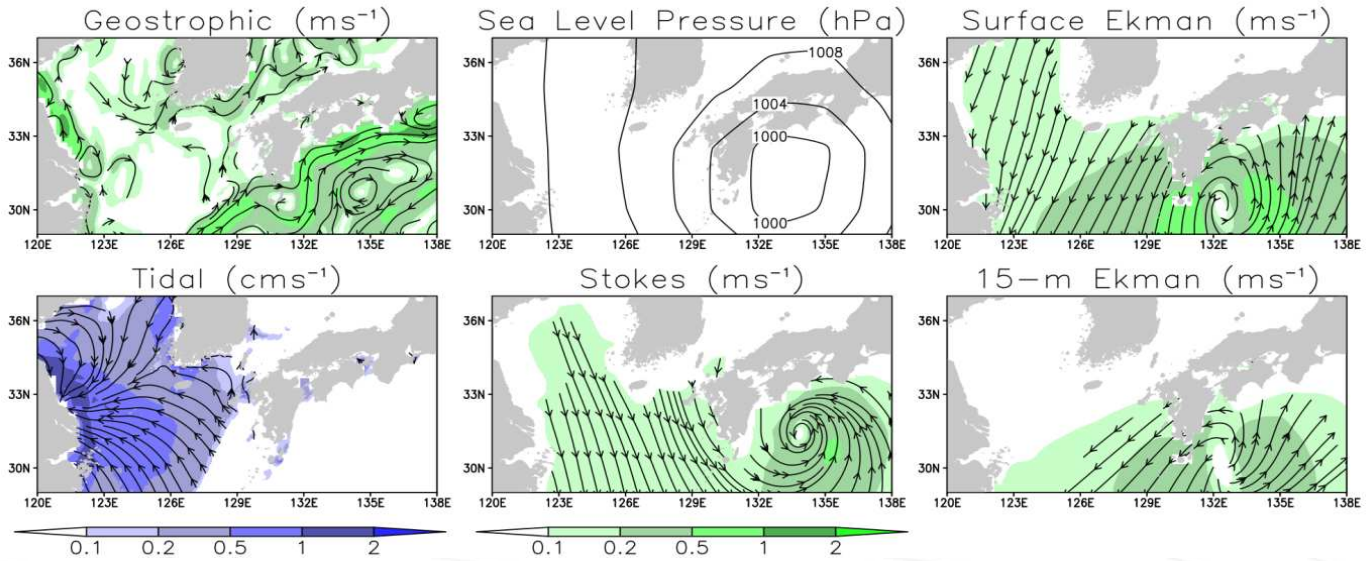
This is a "Pull-up" or "Window-shade"-type display showing a theme of how spaceborne measurements of ocean physical properties provide data and information for monitoring climate change. Jason (sea level), RapidScat (ocean winds), GRACE (gravity), and Aquarius (sea surface salinity) measurements are featured.

- Author: Ocean Outreach Team
- NASA/JPL and Univ. of Maine, USA
- Year: 2014
- Target Audience: General Public
- Medium: Bannerstand display
- Size: 0.91 m x 2.44 m (3 ft x 8 ft)
- Language(s): English

The GlobCurrent project (2013-2016) aims to re-map the world's ocean surface currents from a growing synergy of past and present Earth Observations and conduct a series of user-led case studies that resolve high spatial and temporal variability and the underlying processes that govern surface current dynamics.

GLOBCURRENT





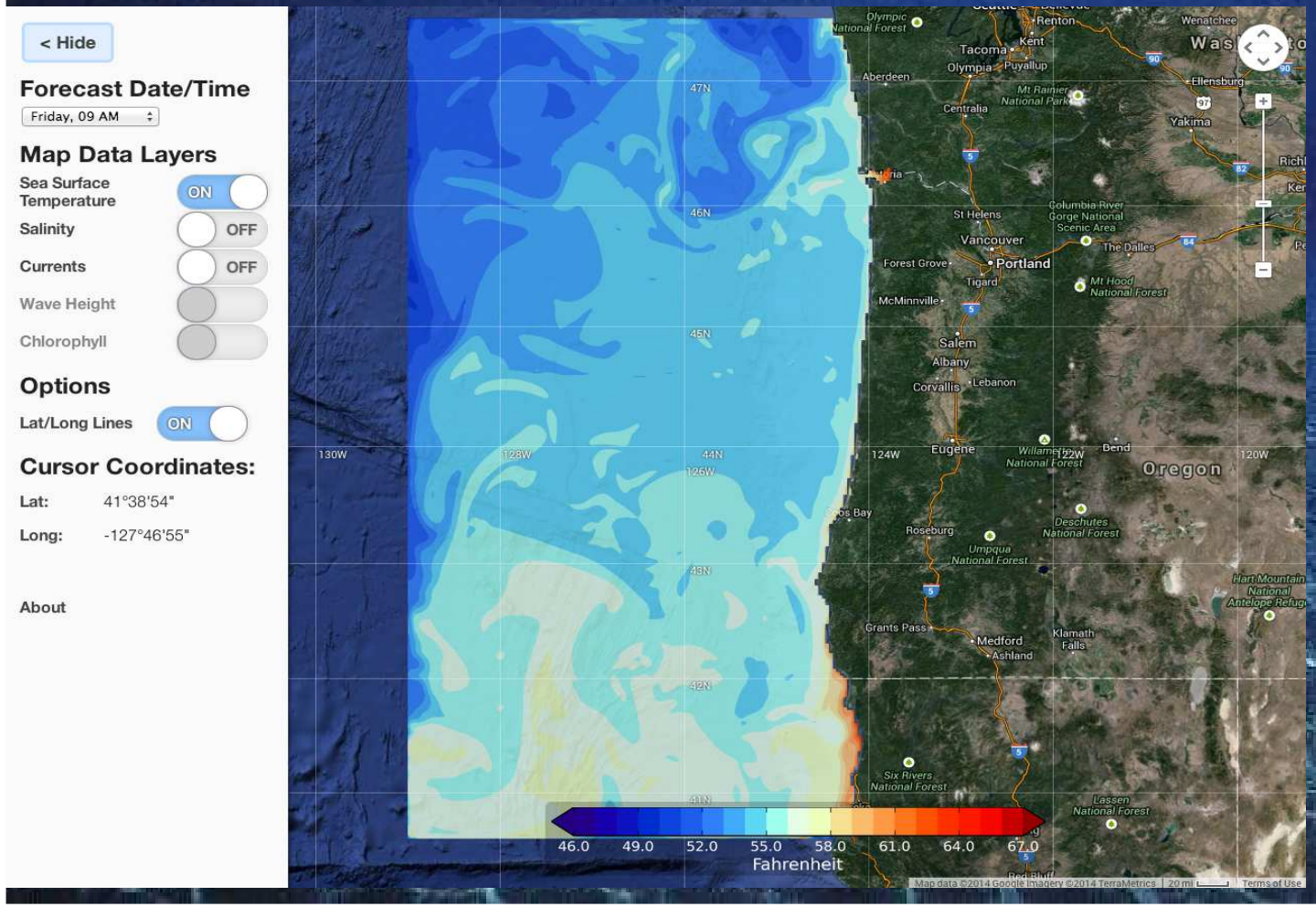
A vibrant user group is helping forge the satellite exploitation framework.

See poster session (Quartly et al.) and www.globcurrent.org

Cooperative Product Development – Scientists & Commercial Fishermen Applications for Coastal Ocean Forecasts (Assimilating Altimetry and Other Data)

Colin Duncan (MS Student), Flaxen Conway & Ted Strub (CEOAS, Oregon State University)

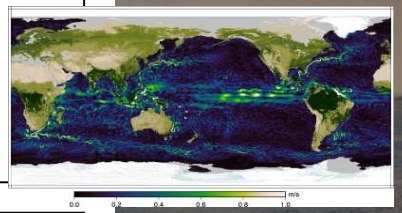
- Work with local fishermen to develop a tool that allows them to visualize the fields from a data-assimilating ocean forecastt model (Alexander Kurapov, OSU).
- Views forecasts of SST, currents, etc.; zoom into regions; before/during fishing ops.



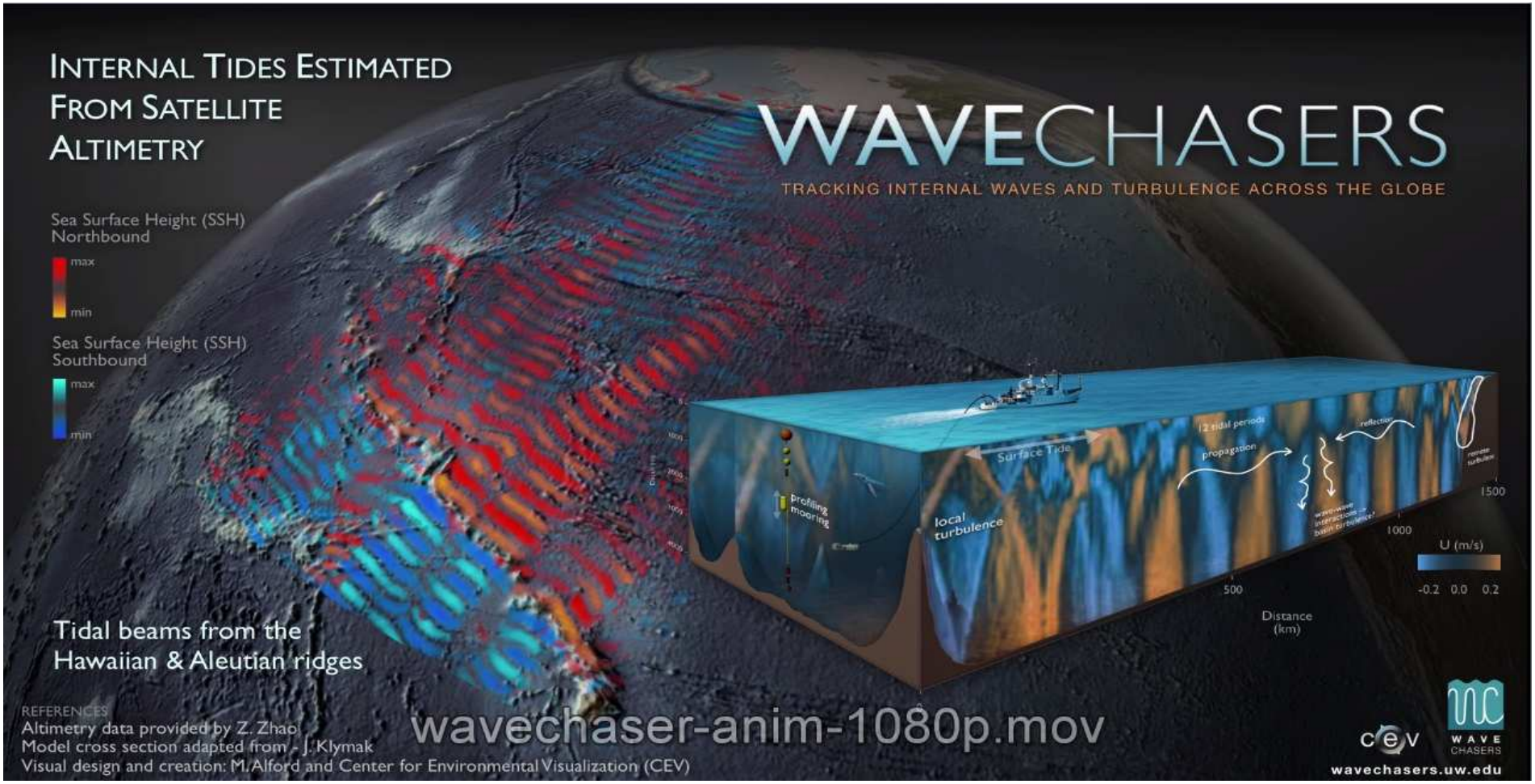
- R&D version of tool available at NOAA IOOS (NANOOS).
- Marine Resource Mgt student & Computer Science Undergrads create and modify the tool with fishermen specs and feedback.
- Add new variables (model waves) and capabilities (use at sea on smartphones), etc.

SatiSphère

Interactive sphere with a projection of global data; The sphere can be moved around.
A set of 6 global animations for the sphere was done over ocean (SST, chlorophyll, SLA, tides…) plus 9 regional animations for an accompanying (flat) screen.

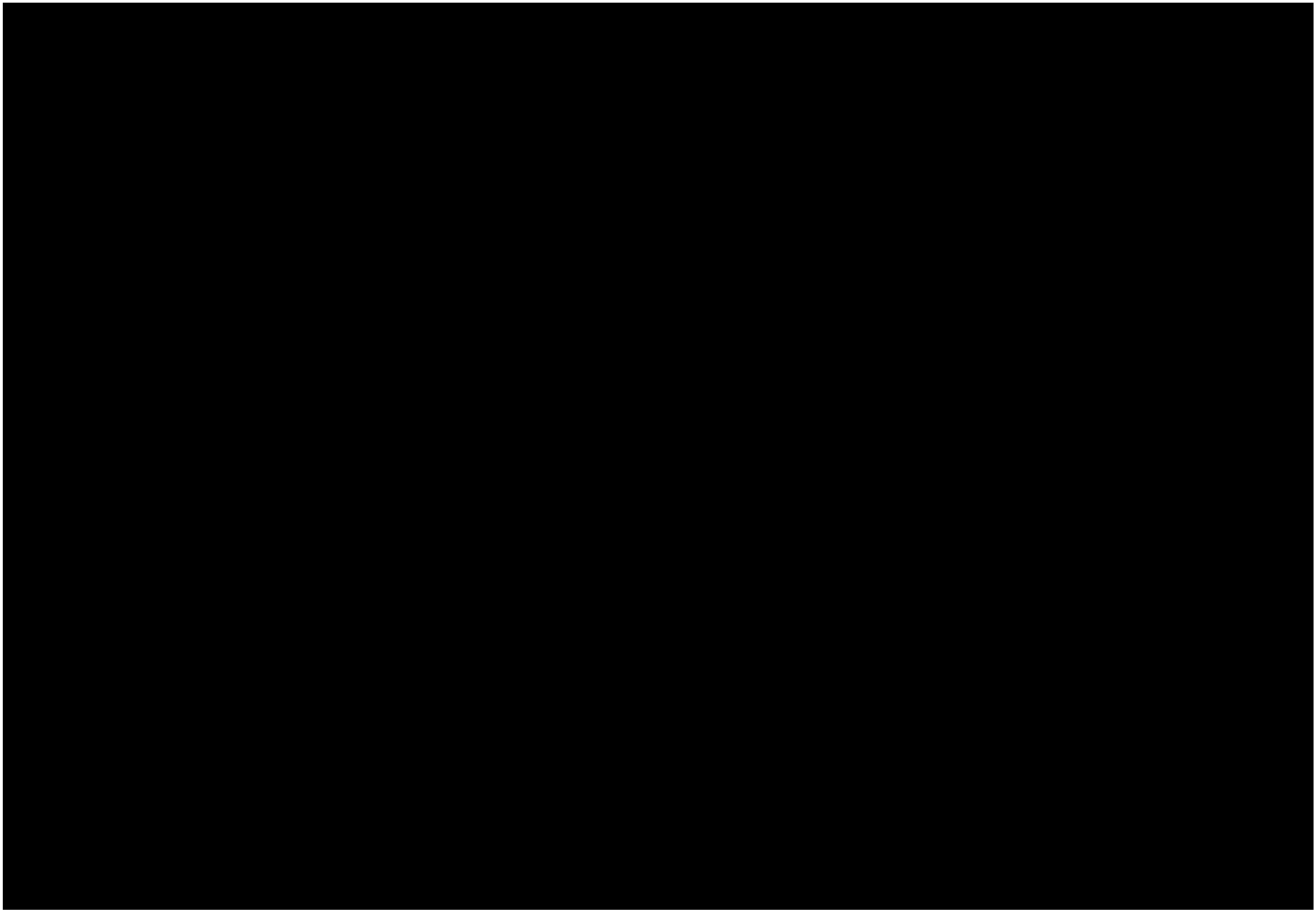


- Made for Cnes at CLS
- 2014
- Public aimed: general public
- Medium: multimedia
- Size / Format:
- Language(s): French

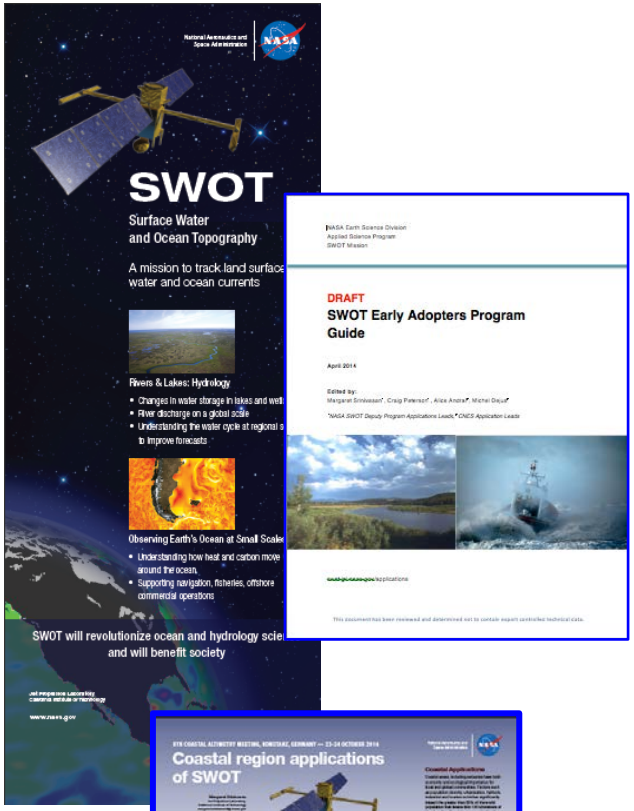


- Scripps Institution for Oceanography
- 2014
- Public aimed*:

- Medium: VIDEO
- Size / Format: .mov
- Language(s): English



SWOT Applications



SWOT science and engineering advances can be transformed into valuable services to decision makers and civic organizations focused on addressing global disaster risk reduction initiatives, and potential science-based mitigation activities for water resources challenges of the future. With the surface water measurements anticipated from SWOT, a broad range of applications may inform inland and coastal managers and marine operators of onshore and offshore conditions and currents relevant to their regions.

- NASA & CNES collaboration
- Formal program development: Plan, Early Adopter Guide
- SWOT Applications Working Group
- Funding opportunities for small studies
- Engage/expand altimetry user community
- Hydrology & oceanography
- Communication & collaboration: web, SAWG, partnerships