ACTUALLY, IT'S

PHYTO-PLANKTON!

Proudly supported by:

ADVANCE QUEENSLAND | Queensland Government

RESOURCE PACK

EPISODE 6

The Real World!

www.go2qurious.com

GO2Qurious

EPISODE SIX RESOURCE PACK

ACTUALLY, IT'S PHYTO-PLANKTON!

It's the Olsen Twins! I mean, it's Dr Erin Urquhart (PACE Project Applications Coordinator) & Joel Scott (PACE Project Applications Deputy Coordinator). We ask them, "Who and how will NASA's PACE Mission actually help once it's in space?"

What is applied science and NASA's PACE Early Adopters?

It's satellite data in action!
Unlike basic science, which is all about the scientific process and theories, applied science and NASA's PACE applications take what we know from basic science and uses it to build tools and inventions that help humans make better decisions for healthy environments and healthy people. The PACE early adopters are a group of folks who are doing exactly that. They're bridging the gap between science that comes from NASA's PACE Mission and the choices, management and policies that shape the way we all live. Click here to learn more about NASA's PACE Mission Early Adopters or follow @NASAOcean on Twitter.

Is it an oil slick? YES! How can NASA's PACE help?

NASA's PACE satellite will have cutting edge technology onboard that will allow scientists to see things in the ocean from space like never before. The tech on board will allow scientists to tell if patterns and colours in the ocean are phytoplankton blooms, whale poops, oil slicks, or maybe even heaps of turtles! NASA's PACE Mission will be there to help mitigate damage from oil slicks by showing the extent of spills because the satellite has the ability to scan the entire Earth in 2 days.
Meet Chuanmin Hu, an early adopter who will use NASA's PACE data to detect oil slicks in the ocean.

AHHHHH Volcano! NASA's PACE Mission to the rescue.

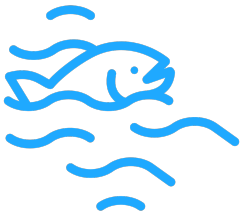
When a volcano erupts it sends ash, soot, sulphur dioxide and a whole bunch of other harmful particles (aka nasty aerosols) 10's of kilometers up into the atmosphere. Although volcano eruptions have a geological purpose in our Earth's system, those nasty aerosols are really bad for our lungs. Plus, sulphur dioxide can be extremely harmful to aeroplanes and their jet engines. Aeroplane jet engines run SUPER hot and will melt sulphur dioxide inside the jet engine. The real danger, however, is when sulphur dioxide resolidifies it fuses to the turbines as it leaves the jet engines. This clogs the engine and causes it to fail. AHHHHHHHHH! This can literally make planes fall out of the sky. NOT COOL. The good news is NASA's PACE Mission can help. NASA's PACE satellite will have two multi-directional instruments onboard that can look at a volcano plume from a bunch of different angles and be able to figure out where, how high, and what direction that plume and its toxic aerosols are heading. With this information from NASA's PACE, air traffic controllers can route planes around these dangerous aerosols and keep them from losing engines and falling out of the sky. A good thing? YAHHHH We think so!

Get out in the field now with Eye On Water Australia

Remember how Dinophysis can give you diarrhea? How will NASA's PACE Mission help marine parks to fish and farm in healthy places?

DINOPHYSIS
Die-no-fye-sis

It's very important for shellfish farmers to be aware of harmful and potentially toxic algae near their shellfish operations. Along with other phytoplankton species such as Alexandrium, Dinophysis has been responsible for shellfish closures particularly off Cape Cod Massachusetts USA in recent years. The advanced technology aboard NASA's PACE satellite will help scientists see "who's who" in terms of phytoplankton communities and allow them to identify Dinophysis in the water, and how long it's sticking around. This will help farmers to decided when to plant and harvest shellfish, which will ultimately save a lot of money and keep a lot of people from getting diarrhea. PHEW!!! Meet Damian Brady and Marié Smith; early adopters who will use NASA's PACE to select farming sites for seafood.



Did you know fish LOVE to eat phytoplankton? Nom Nom Nom….
We don't want to overfish phytoplankton rich waters, so will PACE make it easier for marine parks to manage overfishing?

Overfishing is a huge threat to our oceans, and it can really hurt all kinds of sea life. When fishermen remove fish from the water faster than they can reproduce, it leads to that species becoming underpopulated which has bad consequences for the environment and marine ecosystem. It completely throws off the food chain. While NASA's PACE will not be able to "see" individual fish from space, it will provide important data to be used in marine ecological forecasting models. What does that mean? Scientists take physical ocean information like water temperature and ocean currents and combine that with what NASA's PACE sees (like phytoplankton and light in the water column). With information from NASA's PACE, fish stocks in marine park designated fishing areas can be better monitored. This helps marine parks ensure fishermen are following the rules, and endangered species are protected.

Bush Fire Smoke! Can I go outside safely?

Bush fires release heaps of ash and soot (aerosols) in their smoke plumes that can block the sun, change the colour of the sky, and effect the air we breathe. Bush fire smoke can also drift across entire oceans and effect the air quality both locally, near the fire and continents far away. When bush fire plumes are high in the atmosphere, they don't directly effect the air we breathe, but as gravity pulls them back to Earth, these particles can become very dangerous to our lungs and health. NASA's PACE will be able to track plumes of fire ash and soot as they rise into the atmosphere and fall out over the ocean and land. NASA's PACE data will be used by air quality managers and forecasters so they can advise you if it's safe to go outside or if you should mask up before heading out. Meet Heather Holmes, an early adopter who will use NASA's PACE data for bush fire/smoke forecasting and air quality monitoring.

Meet all the NASA PACE Mission Early Adopters

ACTUALLY, IT'S PHYTO-PLANKTON!

RESOURCE PACK

GO2Qurious

PROUDLY SUPPORTED BY: ADVANCE QUEENSLAND | Queensland Government

PACE Applications

Disasters

Hazard Assessment & Aviation Safety

Aviation operations can be negatively impacted by **volcanic ash**. Timely and accurate information about a volcanic ash plume's location, altitude, and magnitude can ensure aviation safety after an eruption.

Who Cares and Why?

Iceland's Eyjafjallajökull volcano began erupting on April 14th, 2010. Plumes of volcanic ash were ejected several high into the atmosphere, posing a risk to aviation. According to the International Civil Aviation Organization, more than 100,000 commercial flights were cancelled across western and northern Europe in response to these eruptions. This was the largest shutdown of European air traffic since World War II, resulting in GDP losses in excess of $5 billion. More accurate ash plume prediction, guided by PACE observations, can reduce the impact of events such as this.

Volcanoes inject water, sulfur dioxide (SO_2) and ash into the atmosphere. The latter, primarily composed of silicates, can melt inside a turbine engine, and fuse onto blades and guide vanes. This can lead to engine failure, such as was the case with KLM flight 867 from Amsterdam to Tokyo on December 15th, 1989. An unexpected ash plume from Mount Redoubt in Alaska caused a four engine failure.

The NASA Reponse

HARP-2 & SPEXone

- *Multi-angle polarimeters*
- *440, 550, 670, 870 nm (HARP-2)*
- *386-770 nm (2-4 nm steps; SPEXone)*
- *3 km; 2.5 km at nadir*

PACE's two polarimeters will enable identification of ash particle size and concentration, discrimination between water and ice clouds from volcanic plumes, and separation of volcanic ash from sulfate aerosols.

PACE Ocean Color Instrument (OCI)

- *5 nm hyperspectral resolution*
- *UV (345 nm)- SWIR (2260 nm)*
- *1-2 day overpass*
- *1 km at nadir*

OCI will be able to determine the height of features such as dust storms and volcanic ash clouds, which is key for hazard avoidance and predicting how they will move.

PACE Applications

Air Quality

Particulate Matter Concentration

How do we monitor air quality in regions where there are no ground measurements of **particulate matter concentration** (PM)?

Who Cares and Why?

Particulate matter (surface-level aerosols) are a major global cause of death and disease and are responsible for ~3.2 million deaths per year. It has been shown that small particles are especially harmful since they can penetrate deeper into the lung, and sometimes into the bloodstream. Children, elderly, and individuals with pre-existing heart/lung conditions are most at risk for adverse effects of particle pollution exposure.

In regions lacking ground measurements of PM, international and federal agencies like the Environmental Protection Agency (EPA) have limited knowledge of the extent of air pollution. An absence of proper air quality advisories places public health at serious risk of exposure. Satellite measurements of aerosol optical depth can be used to estimate PM, which can then inform public air quality advisories.

The NASA Reponse

HARP-2 & SPEXone

- *Multi-angle polarimeters*
- *440, 550, 670, 870 nm (HARP-2)*
- *386-770 nm (2-4 nm steps; SPEXone)*
- *3 km; 2.5 km at nadir*

PACE's two polarimeters will complement existing ground-based measurements, resulting in enhanced accuracy, and improved spatial coverage, of predicted PM levels.

PACE Ocean Color Instrument (OCI)

- *5 nm hyperspectral resolution*
- *UV (345 nm)- SWIR (2260 nm)*
- *1-2 day overpass*
- *1 km at nadir*

PACE OCI will provide measurements of total column aerosol amount. When combined with other data from instruments such as lidars, dropsondes or trajectory and chemical transport models we can better predict the impacts of air quality on human health.

PACE Applications

Water Resources

Marine Fisheries

How can we improve monitoring of our global **ocean resources** and their habitat, to ensure productive and sustainable **fisheries**, safe sources of seafood, the recovery and conservation of protected resources, and healthy ecosystems?

Who Cares and Why?

The international trade in coastal and marine fisheries contributes $70 billion annually to the United States economy. Yet, according to the Food and Agriculture Organization of the United Nations, 70% of the world's fish stocks for which assessment information is available are reported as fully exploited or overexploited and, thus, require effective and precautionary management.

A wide range of users from the private and public sectors, including National Oceanic and Atmospheric Adminstration, fisheries, regional Fishery Management Councils, local health departments, global conservation organizations, and private fish forecasting companies, are interested in assimilation of earth observation data into fisheries research and management. Among their major goals is to: provide services for safe and sustainable fisheries; assess the status of fish stocks; ensure compliance with fisheries regulations; and support conservation of protected species.

The NASA Response

PACE Ocean Color Instrument (OCI)

- *5 nm hyperspectral resolution*
- *UV (345 nm)- SWIR (2260 nm)*
- *1-2 day overpass*
- *24 hr data latency*
- *1 km at nadir*

PACE OCI will help refine measurements of primary productivity in coastal and open ocean environments, phytoplankton pigments and biological communities, and ecosystem structure to improve the way we use our global ocean resources.

Combined with ancillary data on ocean physical properties, PACE ocean color observations will aid in understanding essential fish habitats and the productivity dynamics of the phytoplankton that form the base of the global ocean food web.

PACE Applications

Ecological Forecasting

Harmful Algal Blooms

How can we better understand the causes and impacts of **Harmful Algal Blooms,** and how can we improve routine monitoring and ecological forecasting of HABs using ocean observations from space?

Who Cares and Why?

Coastal harmful algal bloom (HAB) events have been estimated to result in economic impacts in the United States (US) of at least $82 million each year. The impacts of HABs range from environmental (e.g., alteration of marine habitats and impacts on marine organisms), human health (e.g., illness or even death through shellfish consumption, asthma attacks through inhalation of airborne HAB toxins), to socio-economic (e.g., commercial fisheries, tourism, recreation).

US federal, state, and local agencies, increasingly require improved water quality observations to monitor and understand HAB events. To protect human health and the environment, it is imperative to provide user communities with predictive warnings so they can adequately plan and respond to the adverse effects associated with HABs.

The NASA Response

PACE Ocean Color Instrument (OCI)

- *5nm hyperspectral resolution*
- *UV (345 nm)- SWIR (2260 nm)*
- *1-2 day overpass*
- *24 hr data latency*
- *1 km at nadir*

PACE OCI will enable algorithm development for identifying and quantifying specific phytoplankton groups, thus identifying and tracking HAB evolution and variability over seasonal to interannual time scales.

Combining advanced modeling methodologies with high-quality PACE ocean color imagery and ancillary observations from various platforms will allow us to vastly improve ecological forecasting of the location and extent of HABs.