Standing Watch on our Changing Planet

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UNOLS Annual Meeting
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is our ocean community fully addressing global climate disruption & how to respond thru policy?

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Drawn from.....

- White House Office of Science & Technology Policy
- John Holdren, Assistant to the President for Science and Technology
- Interagency efforts
- Weatherunderground

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High Priority Areas

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- **global climate disruption**

Global Climate Disruption: Looking Back at 2010

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2010 Extremes

- Tennessee had a 1-in-1000 year flood kills 30, $2.4B damages
- Columbia had heaviest rains ever recorded, over 500 killed, $1.1B damages
- Australia's Queensland rainiest on record, $30B damages

2010 Extremes

- 2010 tied 2005 for the warmest year
- 20 countries set all-time extreme heat records
- Amazon rainforests experienced second 100-year drought in 5 years
- Extreme summer heat waves in Russia led to death, crop loss, and fire

2010 Extremes

- Arctic polar vortex broke down – extreme cold spilled southwards
- Yet Canada had its warmest and driest winter on record
- Arctic sea ice volume lowest on record
- Greenland saw record high air temperatures & calving of a 100 square-mile ice island
- Snow pounded the Eastern U.S. & Europe – NYC recorded 3 & Phila. 4 of their top-ten snowstorms

2010 Extremes

- Atlantic tropical cyclones - third busiest season
- Typhoon Megi was in the top 10 of most intense ever recorded, Cyclone (Phet) worst ever to hit Myanmar, first ever Cat 5 in the Arabian Sea & rare tropical storm formed in the South Atlantic
- Most powerful storm hit SW U.S. with record low pressures
- Stongest non-coastal storm in U.S. history

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It Continues in 2011

- Record-breaking summer temperatures
- Major flooding in NE U.S.
- Yet drought covers 1/3 of the lower 48
- Wildfires in Texas

The New Normal?

some now say it is irresponsible not to describe climate change in the context of extreme weather events

"....this "new normal" won't last. Each additional ton of carbon dioxide that's spewed into the atmosphere contributes to further warming, thus increasing the risk of violent weather."

E. Kolbert, The New Yorker, 2011

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“AND these events drive policy

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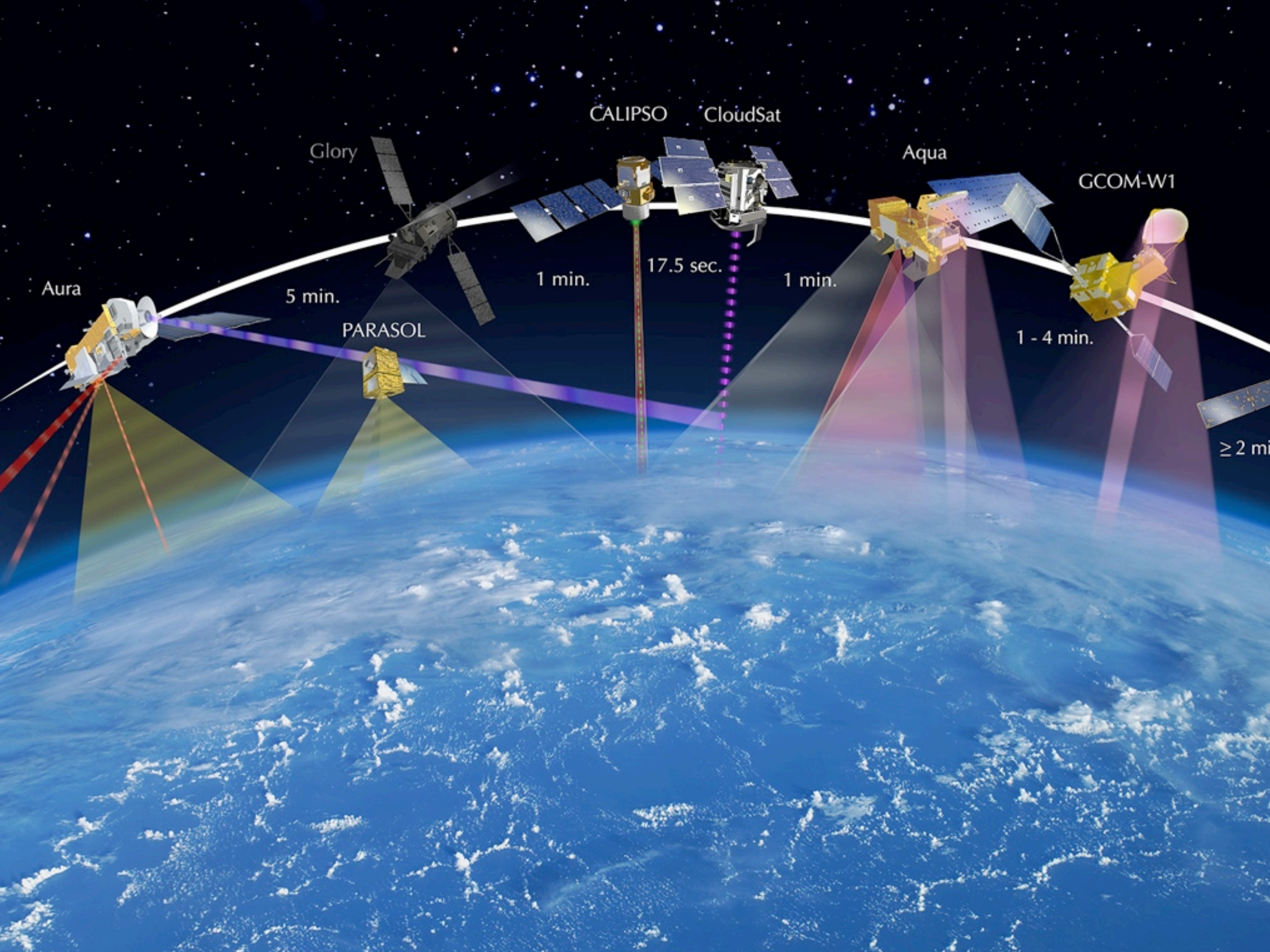
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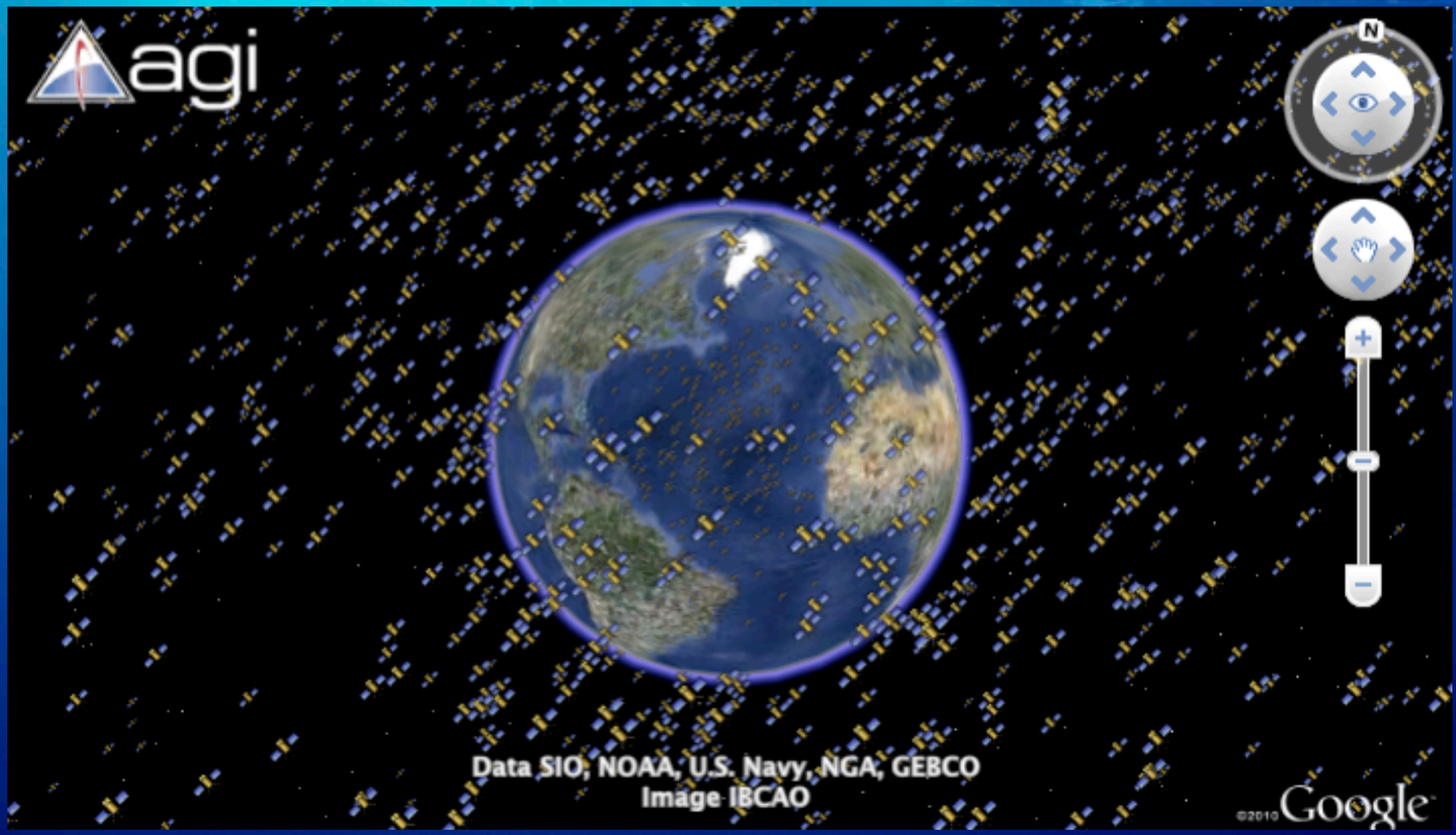
Earth Obs from Space



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Ocean Observations

- Satellites
- UNOLS & ship-based science
- Buoys
- OOSs
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Scratching the surface.....

What Ocean "Disruptions" Don't We Know About?

NASA/Goddard Space Flight Center Scientific Visualization Studio; The Blue Marble Next Generation data is courtesy of Reto Stockli (NASA/GSFC) and NASA's Earth Observatory

There's More We Need to Know

- Better understand the ocean as part of the earth system
- Better understand climate "sensitivity"
- Regional predictions of temperatures, rainfall, storms, ocean currents, ice
- Ecosystem effects of regional climate changes
- Assessments that combine predictions, mitigation and adaptation options, with social dimensions

Policy Choices

- **Mitigate:** reduce the pace & magnitude of the changes in global climate being caused by human activities
- **Adapt:** reduce the adverse impacts on human well-being
- **Suffer:** from impacts that are not mitigated or adapted to

courtesy J.P. Holdren

Mitigation

- Reduce emissions of GHG in energy sector
- Reduce deforestation; increase reforestation & afforestation
- Modify agricultural practices to reduce emissions of GHGs & build up soil carbon

Mitigation

- Reduce emissions of GHG in energy sector
- Reduce deforestation; increase reforestation & some of this is being done -
- Modify agricultural practices to reduce emissions of GHGs & build up soil carbon

Possible Mitigation

- Remove greenhouse gases & store from the atmosphere technologically
- Geoengineering to cool the planet
- Geoengineering to remove greenhouse gases

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research needed

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- Geoengineering to remove greenhouse gases

Mitigation Policy Realities

- Inertial global energy: ~$20T
- Deforestation embedded in the economies that supply food, fuel, and shelter
- To stay below 2°C: developed-country emissions must decline rapidly by 2015 & developing-countries by 2025
- Economic models: cost is 2-3% GWP in 2030 (we now spend 2.5% of GWP on defense)

Adaptation Policy

- Change agricultural patterns
- Strengthen fisheries' management practices
- Develop heat-, drought-, and salt-resistant crop varieties
- Build public-health & environmental- engineering defenses to fight tropical diseases
- New flood control & drought management
- Build resilience in at risk communities

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social & physical science research

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Reduce Suffering?

- An informed public drives policy-makers to make policy using science
- Education
- Communication: simple messages, shared broadly, and repeated often

Federal Policy

- Climate Change Adaptation
- National Climate Assessment
- Federal Sustainability
- Greengov
- Carbon Capture & Storage
- National Ocean Policy
- Arctic Policies
- Strategic STEM Education Plan

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- National Climate Assessment
- Federal Sustainability

ocean science integration

& used for policy

- Carbon Capture & Storage
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- Arctic Policies
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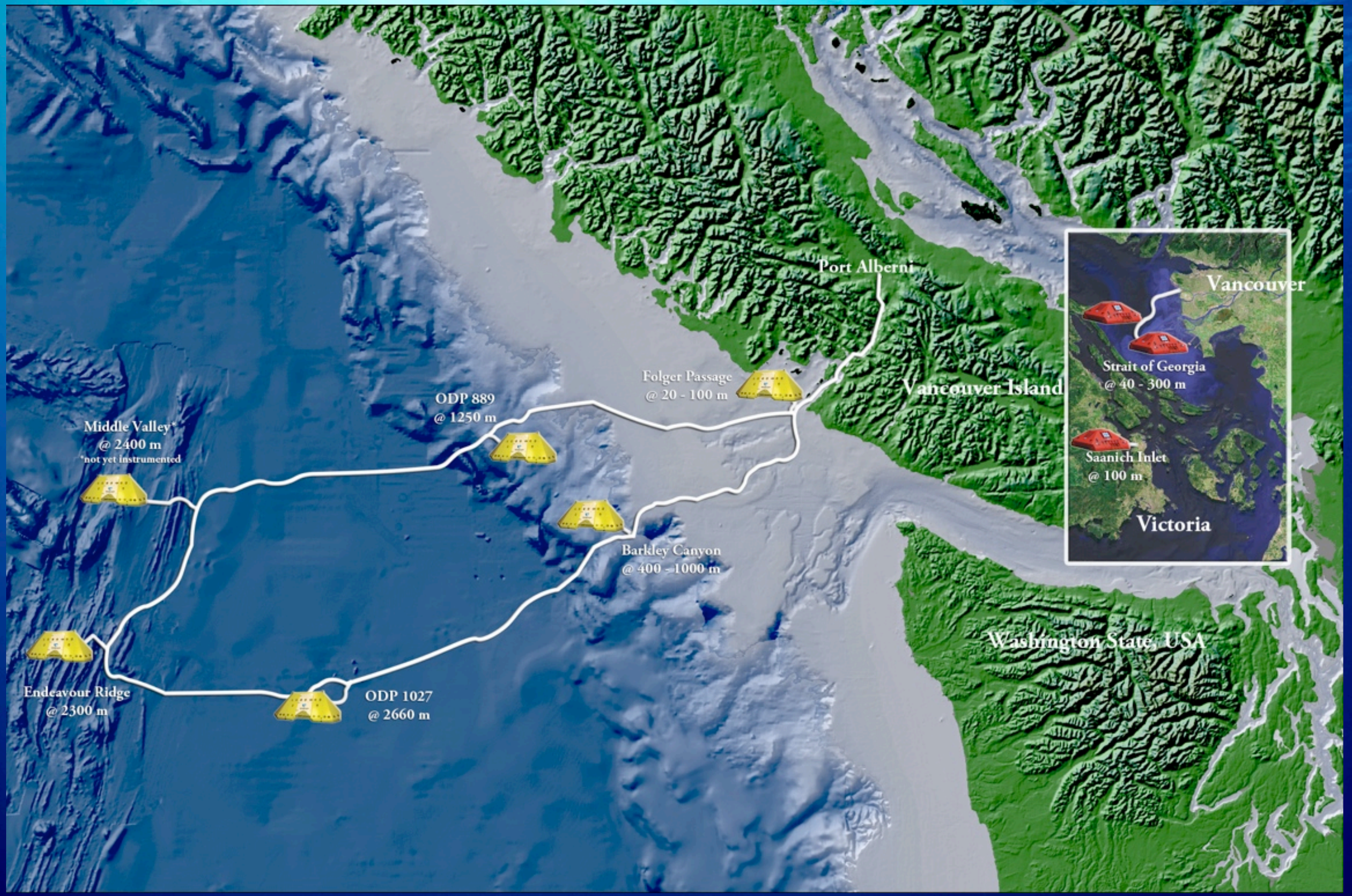
Future Steps

- Ocean observations – better integrated with climate science community
- More marine & earth scientists working in policy where ocean & earth knowledge is critically needed
- Educate & communicate



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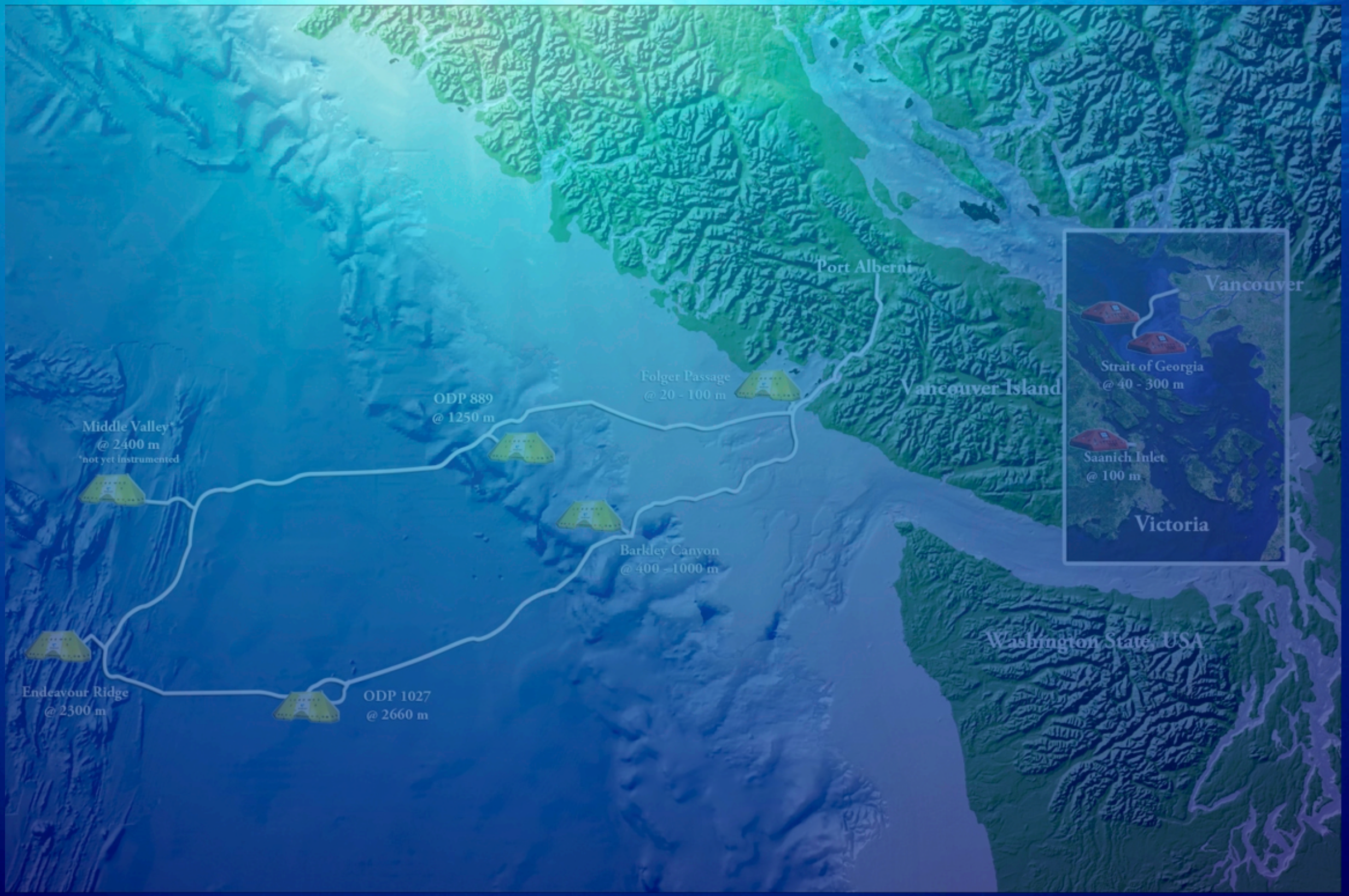

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- long-term physical, chemical & biological observations
- advancing tsunami & storm surge science & detection
- understanding fisheries & habitats
- earthquake studies
- methane hydrate dynamics & carbon cycle
- hot vent dynamics & ecosystems

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Ocean Networks Canada

- NEPTUNE & VENUS – UNOLS fleet
- Operations & maintenance experience
- Science Community Growth & Awareness
- A 24/7 internet-connected ocean enables citizen engagement – Digital Fishers

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Thank-you

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