Networked Science: Exploration in a Changing Ocean from Anywhere on Earth

Amateur overview of the USA's, mainly NSF funded, Ocean Observatories Initiative & Cloud(s)

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The good source materials & ideas are from: John Delaney ,John Orcutt, Matt Arrott, Tony Haymet, Bob Weller, Pete Barletto, Tim Cowles, Mark Stoermer and others

#### Ocean Sciences: Theory. Experiment. Observation.



#### The old way

#### A history of community involvement and design,



This community involvement resulted in a successful Final Design Review in November 2008 and ~\$300 million in funding commitment

Slide derived from Tony Haymet

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Ocean Observatories Initiative (OOI): Summary

## THE VISION

To catalyze an era of scientific discovery... across and within the oceans, utilizing widely accessible, interactive, scalable, and mostly real-time networked sensors, instruments & robots; linked to others at a global level.

### **Ocean Observatories Initiative:**

An interactive ocean laboratory integrated by a leading-edge, multi-scalar cyberinfrastructure.



- Open data
  Near-real-time
  Interactive
- Scalable
  Data provenance
  Social Networking

Understanding



## **Ocean Observatories Initiative (OOI)**

### PHILOSOPHY

## Select Critical Locations, Deploy Cutting-edge Infrastructure, to Enable High Payoff Interactive Studies and to Launch Crucial Long-term Measurements.

Slide from Tony Haymet

Ocean Observatories Initiative (OOI) Profusion of Science Drivers

**Profusion of Disciplines Across Ocean Sciences** 

Profusion of Sensors, Robots, Instruments etc. for geophysicists, genomicists, marine biologists, atmospheric scientists, chemists, engineers, fisheries policy studies etc.

'Global', 'Coastal' & 'Regional' Scale Nodes

Requiring open (and closed) unified cyberinfrastructure

# 'Global' Deep Sea Moorings: Exploring Extreme Deep Ocean Ecosystems

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# OOI 'Global' Sites



e.g. OOI Global sites will sample the high latitudes- strongly forced, but poorly observed

Wind Power Density

#### **December-February**

2000

 $W m^{-2}$ 

 $\left( \right)$ 

**June-August** 

### ormation of deep ocean water "Conveyor Belt"

46°N

127°W

Warm Surface Current Cold Deep Current

#### 'Coastal' Scale Nodes

'Continental shelf systems.Wind-driven upwelling & river forcing.etcLinks to climate forcing, fisheries etc





#### Spreading Mid-Ocean Ridges

Microbes & Deep Biosphere

CO

Crustal Magma Chamber

Magma Generation Asthenosphere



OOI will allow cruse scientists to sample Company of the sector of the s ramifications for Solid Inner Core humans

## RSN INFRASTRUCTURE Interactive Real-time

Extensible Scalable design – 20+year

N5

UW

Pacific City Pacific Wave

PNWGP

- Primary Node
- Secondary Nodes

N3

- Sensor Packages
- Vertical Mooring



## SECONDARY INFRASTRUCTURE NODES



### Shallow Water Primary Node



### Deep Water Primary Node





## **RSN 5 year SCHEDULE**

- PROGRAM START ......FY2010
- SHORE STATION......FY2011
- PRIMARY INFRASTRUCTURE......FY2012-2013
- SECONDARY INFRASTRUCTURE......FY2013-2014
- SYSTEM COMMISSIONING......FY2014

Turn it on



#### Initial Instrument Packages

# So, we have a mix of nodes across a very large geography with:

- Global' (satellites, buoys, swimmers/drifters)
- 'Coastal' (cabled and other sensor & instrument arrays & swimmers, robots etc),
- 'Regional' (cabled and other sensor & instrument arrays & swimmers, robots etc),
- capabilities all coming. And all part of an overall integrated 'observatory'

#### To be accessed, used & unified via a CyberInfrastructure



## Ocean Sciences – the old way



- Segregation of Disciplines (and lots of them)
- Isolation/Segregation within Disciplines

 But we need coherent, comprehensive, curated environmental data at a global scale



<u>OOI</u> CI – Cartoon Sketch of the Model (which has no singular long term project provided repository! :)



OCEAN OBSERVATORIES INITL

## How will 'we' integrate with other Observatory CI's ? And E-Infrastructure Ecosystem

# Thank you

# **Questions?** Comments?

