

Ocean Vector Winds Science Team

Decadal Survey

OceanObs'19

Retirement

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Statement of Task

OVERARCHING TASKS

- Assess **progress from 2007**
- Develop a prioritized list of top-level **science and application objectives** for 2017-2027
- Identify gaps and opportunities in the **programs of record** at NASA, NOAA, and USGS
- Recommend approaches to facilitate the development of a robust, resilient, and appropriately balanced U.S. **program of Earth observations** from space

GENERAL & AGENCY-SPECIFIC TASKS

- **Cross-Agency**
 - Enabling activities
 - Partnerships & synergies
- **NASA**
 - Program balance and scope
 - Ventures flight element
 - Decision principles and measurement continuity
- **NOAA and USGS**
 - Non-traditional observation sources
 - On-ramp of scientific advances
 - Research-to-operations
 - Technology replacement/infusion



Integrating Themes in Decadal Survey

I. Global Hydrological Cycles and Water Resources

Water & Energy Cycle

II. Weather and Air Quality: Minutes to Subseasonal

Carbon Cycle

III. Marine and Terrestrial Ecosystems and Natural Resource Management

IV. Climate Variability and Change: Seasonal to Centennial

Extreme Events

Other

V. Earth Surface and Interior: Dynamics and Hazards

Summary of Top Science & Applications Priorities*

Science & Applications Topic	Science & Applications Questions addressed by MOST IMPORTANT Objectives
Coupling of the Water and Energy Cycles	<p>(H-1) How is the water cycle changing? Are changes in evapotranspiration and precipitation accelerating, with greater rates of evapotranspiration and thereby precipitation, and how are these changes expressed in the space-time distribution of rainfall, snowfall, evapotranspiration, and the frequency and magnitude of extremes such as droughts and floods?</p> <p>(H-2) How do anthropogenic changes in climate, land use, water use, and water storage interact and modify the water and energy cycles locally, regionally and globally and what are the short- and long-term consequences?</p>
Ecosystem Change	<p>(E-1) What are the structure, function, and biodiversity of Earth's ecosystems, and how and why are they changing in time and space?</p> <p>(E-2) What are the fluxes (of carbon, water, nutrients, and energy) <i>between</i> ecosystems and the atmosphere, the ocean and the solid Earth, and how and why are they changing?</p> <p>(E-3) What are the fluxes (of carbon, water, nutrients, and energy) <i>within</i> ecosystems, and how and why are they changing?</p>
Extending & Improving Weather and Air Quality Forecasts	<p>(W-1) What planetary boundary layer (PBL) processes are integral to the air-surface (land, ocean and sea ice) exchanges of energy, momentum and mass, and how do these impact weather forecasts and air quality simulations?</p> <p>(W-2) How can environmental predictions of weather and air quality be extended to seamlessly forecast Earth System conditions at lead times of 1 week to 2 months?</p> <p>(W-4) Why do convective storms, heavy precipitation, and clouds occur exactly when and where they do?</p> <p>(W-5) What processes determine the spatio-temporal structure of important air pollutants and their concomitant adverse impact on human health, agriculture, and ecosystems?</p>
Reducing Climate Uncertainty & Informing Societal Response	<p>(C-2) How can we reduce the uncertainty in the amount of future warming of the Earth as a function of fossil fuel emissions, improve our ability to predict local and regional climate response to natural and anthropogenic forcings, and reduce the uncertainty in global climate sensitivity that drives uncertainty in future economic impacts and mitigation/adaptation strategies?</p>
Sea Level Rise	<p>(C-1) How much will sea level rise, globally and regionally, over the next decade and beyond, and what will be the role of ice sheets and ocean heat storage?</p> <p>(S-3) How will local sea level change along coastlines around the world in the next decade to century?</p>
Surface Dynamics, Geological Hazards	<p>(S-1) How can large-scale geological hazards be accurately forecasted and eventually predicted in a socially relevant timeframe?</p>

* Complete set of Questions and Objectives in Table 3.3

NASA Observing System Priorities

TARGETED OBSERVABLE	SCIENCE/APPLICATIONS SUMMARY	CANDIDATE MEASUREMENT APPROACH	Designated	Explorer	Incubation
Aerosols	Aerosol properties, aerosol vertical profiles, and cloud properties to understand their direct and indirect effects on climate and air quality	Backscatter lidar and multi-channel/multi-angle/polarization imaging radiometer flown together on the same platform	X		
Clouds, Convection, & Precipitation	Coupled cloud-precipitation state and dynamics for monitoring global hydrological cycle and understanding contributing processes	Radar(s), with multi-frequency passive microwave and sub-mm radiometer	X		
Mass Change	Large-scale Earth dynamics measured by the changing mass distribution within and between the Earth's atmosphere, oceans, ground water, and ice sheets	Spacecraft ranging measurement of gravity anomaly	X		
Surface Biology & Geology	Earth surface geology and biology, ground/water temperature, snow reflectivity, active geologic processes, vegetation traits and algal biomass	Hyperspectral imagery in the visible and shortwave infrared, multi- or hyperspectral imagery in the thermal IR	X		
Surface Deformation & Change	Earth surface dynamics from earthquakes and landslides to ice sheets and permafrost	Interferometric Synthetic Aperture Radar (InSAR) with ionospheric correction	X		
Greenhouse Gases	CO ₂ and methane fluxes and trends, global and regional with quantification of point sources and identification of source types	Multispectral short wave IR and thermal IR sounders; or lidar**		X	
Ice Elevation	Global ice characterization including elevation change of land ice to assess sea level contributions and freeboard height of sea ice to assess sea ice/ocean/atmosphere interaction	Lidar**		X	
Ocean Surface Winds & Currents	Coincident high-accuracy currents and vector winds to assess air-sea momentum exchange and to infer upwelling, upper ocean mixing, and sea-ice drift.	Radar scatterometer		X	

Ozone & Trace Gases	Vertical profiles of ozone and trace gases (including water vapor, CO, NO ₂ , methane, and N ₂ O) globally and with high spatial resolution	UV/IR/microwave limb/nadir sounding and UV/IR solar/stellar occultation		X	
Snow Depth & Snow Water Equivalent	Snow depth and snow water equivalent including high spatial resolution in mountain areas	Radar (Ka/Ku band) altimeter; or lidar**		X	
Terrestrial Ecosystem Structure	3D structure of terrestrial ecosystem including forest canopy and above ground biomass and changes in above ground carbon stock from processes such as deforestation & forest degradation	Lidar**		X	
Atmospheric Winds	3D winds in troposphere/PBL for transport of pollutants/carbon/aerosol and water vapor, wind energy, cloud dynamics and convection, and large-scale circulation	Active sensing (lidar, radar, scatterometer); passive imagery or radiometry-based atmos. motion vectors (AMVs) tracking; or lidar**		X	X
Planetary Boundary Layer	Diurnal 3D PBL thermodynamic properties and 2D PBL structure to understand the impact of PBL processes on weather and AQ through high vertical and temporal profiling of PBL temperature, moisture and heights.	Microwave, hyperspectral IR sounder(s) (e.g., in geo or small sat constellation), GPS radio occultation for diurnal PBL temperature and humidity and heights; water vapor profiling DIAL lidar; and lidar** for PBL height			X
Surface Topography & Vegetation	High-resolution global topography including bare surface land topography ice topography, vegetation structure, and shallow water bathymetry	Radar; or lidar**			X
** Could potentially be addressed by a multi-function lidar designed to address two or more of the Targeted Observables					
Other ESAS 2017 Targeted Observables, not Allocated to a Flight Program Element					
Aquatic Biogeochemistry		Radiance Intercalibration			
Magnetic Field Changes		Sea Surface Salinity			
Ocean Ecosystem Structure		Soil Moisture			

OCEAN OBS'19



**An Ocean of
Opportunity**

September 16-20, 2019
Hawai'i Convention Center

History of OceanObs Series

Each conference of the OceanObs series focuses on a new area in need of enhanced guidance:

OceanObs'99 – St. Raphael, France (300 participants)

- Resulted in an internationally coordinated system for physical climate and ocean carbon observations (drifter, floats, xbt, tide gauge...)

OceanObs'09 – Venice, Italy (640 participants)

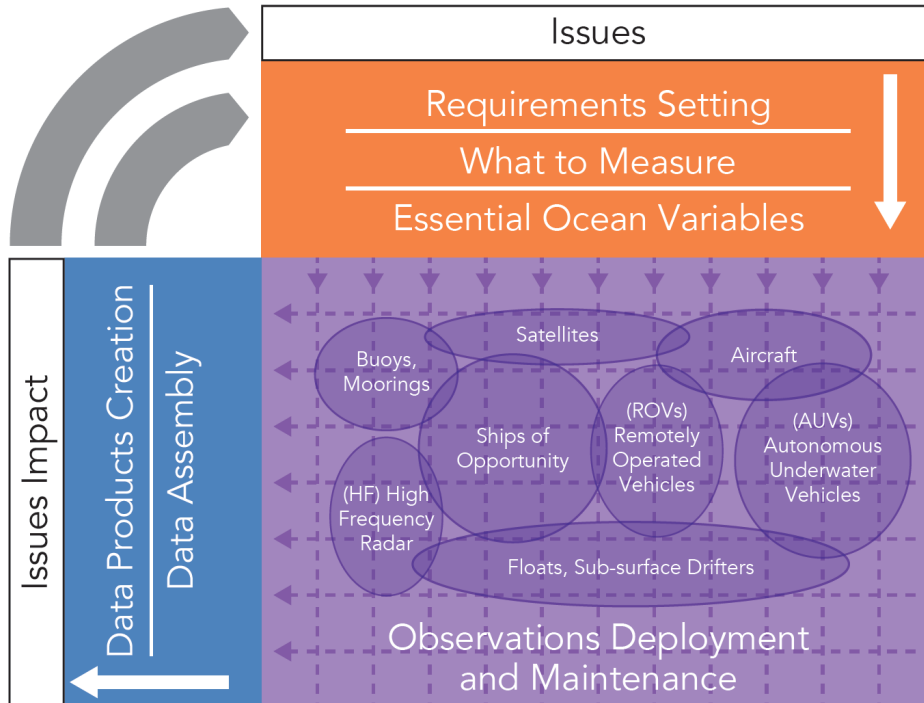
- Expanded the range of communities working together to undertake more comprehensive and sustained ocean observations and led to the Framework for Ocean Observing.

OceanObs'19 – Honolulu, USA (1200 participants)

- Connecting with a wide range of user communities and improve data flows and governance arrangements.

Framework for Ocean Observing (FOO)

Framework for Ocean Observing Process Diagram



- OceanObs'19 will build on the success generated by the Framework developed at OceanObs'09.
- Experts will work during the lead up to the conference to identify opportunities and drawbacks, which will be articulated prior to, and during OceanObs'19.
- We expect to develop a number of follow-up activities including update of existing processes.

Conference Overview

MISSION

The OceanObs'19 conference is a community-driven conference that brings people from all over the planet together to communicate the decadal progress of ocean observing networks and to chart innovative solutions to society's growing needs for ocean information in the coming decade.

VISION

In recognition of the central role the ocean plays in supporting all life on Earth, we see a resilient world whose societies prosper through sustainable interactions with our ocean, guided by timely, reliable, and accessible information.

Financial and Intellectual Sponsors



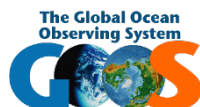
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Financial

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Community Engagement Updates:

COMMUNITY WHITE PAPERS:

- 126 Papers submitted Frontiers in Marine Science, peer review in progress, many published
- Recommendations/Outcomes from CWP under analysis (~April 2019)
- Draft Conference Statement with key outcomes (~July 2019)

RECENT DEADLINES:

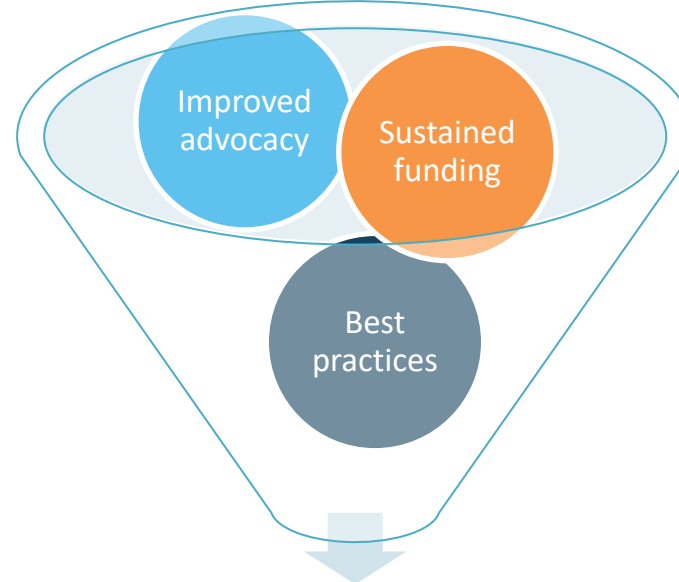
- EXHIBITORS: 50 Public, Private, Non-Profit Organizations
- TRAVEL SUPPORT REQUESTS: 53 Students, Early Career, Dev. Country
- EARLY REGISTRATIONS: ~600+ Registered
- BREAKOUT SESSIONS: 75 Session Proposals

Conference Outcomes

Conference Themes

- Observing System Governance
- Data & Information Systems
- Observing Technologies & Networks
- Discovery
- Ecosystem Health & Biodiversity
- Climate Change & Variability
- Water, Food, & Energy Securities
- Pollution & Human Health
- Hazards & Maritime Safety
- Blue Economy

(Overarching) IMPROVE GOVERNANCE and INTEROPERABILITY



Outcomes / Actions

Information: Meeting future user needs

Innovation: Spurring innovation in observing technologies, products, and user services

Integration: Balancing user and operator needs, capabilities, and knowledge worldwide




<http://www.oceanobs19.net/>

Questions?



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