

# NOAA Readiness Levels of Projects and Products

## Readiness Level of Climate-Weather Research Projects and Products

### Project/Product

### Readiness Level

#### **RAMA (Research Moored Array for African-Asian-Australian Monsoon Analysis and Prediction)**

Customers: Scientific community, National Centers for Environmental Information (NCEI), India Ministry of Earth Sciences (MoES), multiple international partners (China, India, Indonesia, others)

6

#### **PIRATA (Prediction and Research Moored Array in the Tropical Atlantic)**

Customers: Scientific community, National Centers for Environmental Information (NCEI), CLIVAR, National Weather Service, multiple international partners (Brazil, France, others)

7

#### **Ocean Climate Stations (OCS)**

Customers: Scientific community, National Weather Service/Climate Prediction Center (CPC), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), OceanSITES, Fisheries and Oceans Canada, multiple international partners

9

#### **Understanding coupled ocean-atmosphere processes at the eastern edge of the warm pool in support of TPOS**

Customers: Scientific community, National Weather Service/Climate Prediction Center (CPC) and Environmental Modeling Center (EMC)

8

#### **Multi-timescale near-surface salinity variability at the eastern edge of the warm pool: A Modeling and an OSSE study in support of TPOS 2020**

Customers: Scientific community, National Weather Service/Climate Prediction Center (CPC) and Environmental Modeling Center (EMC)

8

#### **Diurnal cycle metrics from moored buoys as a baseline for assessing model and satellite resolved air-sea**

Customers: Scientific community, National Weather Service/Climate Prediction Center (CPC) and Environmental Modeling Center (EMC)

8

#### **A pre-field modeling study of scales, variability and processes in the near surface eastern equatorial Pacific Ocean in support of TPOS 2020**

Customers: Scientific community

2

#### **Solomon Sea Glider Project**

Customers: Scientific community

7

#### **The Argo Project: Global observations for understanding and prediction of climate variability**

Customers: Scientific community, international Argo community, and Argo Float Consortium: Scripps Institution of Oceanography (SIO), University of Washington (UW), Woods Hole Oceanographic Institution (WHOI), NOAA Atlantic Oceanographic and Meteorological Laboratory (AOML), Navy's Fleet Numerical Meteorology and Oceanography Center (FNMOC), Global Ocean Observing System (GOOS)

9

#### **NOAA Deep Argo**

Customers: Scientific community, international Argo community, Argo Float Consortium

9

#### **PGAFF Deep Argo (Brazil Basin regional pilot array)**

Customers: Scientific community, Paul G. Allen Family Foundation (PGAFF)

9

## NOAA Readiness Levels of Projects and Products

### Global Heat-Salt Analysis

Customers: Scientific community, NOAA-led State of the Climate report (supplement to Bulletin of the American Meteorological Society [BAMS])

9

### Improving the Technology Readiness Level of the 6000-m capable Conductivity-Temperature-Depth (CTD) sensor mounted on Deep Argo floats

Customers: Scientific community, Global Ocean Observing System (GOOS), Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP), OceanSITES Program

7

### Modulation of MJO-diurnal cycle interaction over the Maritime Continent

Customers: Scientific community

3

### Year of the Maritime Continent (YMC) Banda Sea cruise

Customers: Scientific community, OAR Earth Systems Research Laboratory (ESRL) Physical Sciences Division (PSD), S2S forecast improvements for multiple end-users

8

### Developing extended sea surface latent and sensible flux datasets for the Arctic and high-latitude Pacific regions using in situ observations

Customers: Scientific community

8

### Characterizing MJO and multi-scale interactions over the Maritime Continent with CYGNSS: Validation, process study and model evaluation

Customers: Scientific community

4

### A new technique for improved MJO prediction

Customers: Scientific community, National Weather Service/National Centers for Environmental Prediction (NCEP)

8

### Observing Systems Research Studies

Customers: Scientific community, OAR Geophysical Fluid Dynamics Laboratory (GFDL)

6

### Ship-based Radar and Sounding Measurements in Support of PISTON

Customers: Scientific community, OAR Earth Systems Research Laboratory (ESRL) Physical Sciences Division (PSD)

1

### High-Resolution Precipitation Product and Analysis for Year of the Maritime Continent (YMC)

Customers: Scientific community, National Weather Service/National Centers for Environmental Prediction (NCEP)

6

### Sea Sweep: Measurements of Sea Spray Production

Customers: Scientific community, National Aeronautics and Space Administration (NASA) - North Atlantic Aerosols and Marine Ecosystems Study (NAAMES)

9

### Measurements of Climate-Relevant Aerosol Species at Barrow, Alaska - A Data Recovery and Extension Effort

Customers: Scientific community, International Arctic Systems for Observing the Atmosphere (IASOA), OAR Earth Systems Research Laboratory (ESRL) Global Monitoring Division (GMD)

9

## NOAA Readiness Levels of Projects and Products

### Shipboard Launch and Recovery of Unmanned Aerial Systems UAS with 15 lb Payload Capabilities

Customers: Scientific community, L3 Technologies - Latitude Engineering, OAR Earth Systems Research Laboratory (ESRL) Physical Sciences Division (PSD)

8

### Improving CFS sea ice predictability through understanding the role of atmospheric forcing and ice thickness contributions

Customers: Scientific community, Pan-Arctic Ice-Ocean Modeling and Assimilation System (PIOMAS), improved CFSv2 forecasts for multiple end-users

5

### Arctic Change Detection

Customers: Scientific community, Arctic Monitoring and Assessment Programme (AMAP), NOAA Arctic Action Team, and NMFS Marine Mammal Laboratory (NMML), NOAA OMAO Marine and Aviation Operations Center (MAOC)

8

### Air-Sea CO2 and Dissolved Inorganic Carbon System for Autonomous Moored and Surface Vehicle Applications

Customers: Scientific community

6

### High-Resolution Ocean and Atmosphere pCO2 Time-Series Measurements

Customers: Scientific community, National Weather Service National Buoy Center, OAR Ocean Acidification Program, Carbon Dioxide Information Analysis Center (CDIAC) and NOAA Ocean Data Center (NODC), data synthesis groups developing air-sea CO2 flux maps (e.g. Takahashi climatology, Surface Ocean CO2 Atlas [SOCAT])

9

### TPOS Enhanced Monitoring

Customers: Scientific community

8

### Advancing understanding of Arctic sea ice variability and diagnostic predictability in ESMs with regional-to-global-scale process-oriented evaluation

Customers: Scientific community, OAR Geophysical Fluid Dynamics Laboratory (GFDL)

8

### Understanding the Freshwater Budget of the Atlantic Ocean: Controls, Responses, and the Role of the AMOC

Customers: Scientific community, Community Earth System Model (CESM) users

8

### Arctic freshwater pathways and their impact on North Atlantic deep water formation in a hierarchy of models

Customers: Scientific community

1

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# NOAA Readiness Levels of Projects and Products

## Readiness Level of Marine Ecosystems Research Projects and Products

Project/Product	Readiness Level
<b>Ecosystems and Fisheries-Oceanography Coordinated Investigations Program EcoFOCI: Chukchi and Arctic</b> Customers: Scientific community, NMFS Alaska Fisheries Science Center	9
<b>Ecosystems and Fisheries-Oceanography Coordinated Investigations Program EcoFOCI: Bering Sea project</b> Customers: NMFS Alaska Fisheries Science Center, North Pacific Fisheries Management Council	9
<b>Ecosystems and Fisheries-Oceanography Coordinated Investigations Program EcoFOCI: Gulf of Alaska project</b> Customers: NMFS Alaska Fisheries Science Center, North Pacific Fisheries Management Council	9
<b>Assessing regional sea-ice predictability in the US Arctic: A multi-model approach</b> Customers: Scientific community	1
<b>Ocean Noise Reference Network: Establishing baseline ambient sound levels across the US EEZ (hydrophone and mooring technology for ocean noise network)</b> Customers: 6 NMFS science centers, NOS sanctuaries, National Park Service.	9
<b>Antarctic acoustic environment monitoring (hydrophone and mooring technology for Antarctic research)</b> Customers: Korean Polar Research Institute (KOPRI)	9
<b>Full-ocean depth hydrophone (first long term record of ambient sound at Challenger Deep)</b> Customers: OAR Ocean Exploration and Research (OER)	9
<b>WISPR-2 400 kHz (High frequency, passive acoustic recording module)</b> Customers: PMEL Engineering & ITAE, Embedded Ocean Systems, LLC/Kongsberg	9
<b>Winch Mooring (Enables deep-ocean sound and CTD recording in areas of heavy surface sea-ice conditions)</b> Customers: US Navy-ONR-LMR, PMEL Innovative Technology for Arctic Exploration program (ITAE)	8
<b>Slocum gliders with passive acoustic modules (enables widespread spatial sampling of ocean acoustic)</b> Customers: NSF, OAR Ocean Acidification Program	9
<b>Spar buoy and drifting hydrophone</b> Customers: DOE Pac-wave energy program, US Navy, NMFS-Ocean Acoustics, OSU Sea Grant, OAR Omics Program	9
<b>Acoustic sea-ice sensor and recording module for Prowlers</b> Customers: PMEL Engineering & Innovative Technology for Arctic Exploration program (ITAE)	4
<b>Acoustic Monitoring of wave energy test facility</b> Customers: DOE Pac-wave energy program, NMFS-Ocean Acoustics, OSU Sea Grant, OAR Omics Program	3
<b>Seasonal forecasts of ocean acidification variability in WA and OR waters</b> Customers: WA and OR shellfish industry, local and tribal communities, WA State Dept of Ecology, EPA, OAR Ocean Acidification Program	8

## NOAA Readiness Levels of Projects and Products

<b>Ocean Acidification (OA) Mooring Test-beds: Evaluating and Expanding New Carbon Technologies to Subsurface Habitats</b> Customers: Scientific community, OAR Ocean Acidification Program, U.S. Interagency Working Group on Ocean Acidification (IWG-OA), NOAA OA Observing Network (NOA-ON)	6
<b>Sustained Ocean Acidification Mooring Observations</b> Customers: Scientific community, OAR Ocean Acidification Program	9
<b>Sustained Ocean Acidification Data Management Quality Control, Access, and Products</b> Customers: Scientific community, OAR Ocean Acidification Program	9
<b>Filling the Gaps in Full Water Column Autonomous Ocean Acidification Observing: Deployment of High-Quality Surface Carbon System and Carbon Prowler</b> Customers: Scientific community, OAR Ocean Acidification Program, U.S. Interagency Working Group on Ocean Acidification (IWG-OA), NOAA OA Observing Network (NOA-ON)	8
<b>Ocean Acidification (OA) Monitoring in Coral Reef Ecosystem: Chuuk and Beyond</b> Customers: Korean Institute of Science and Technology (KIOST), scientific community	9
<b>Metagenomic responses of commercially important fisheries and their food chains across coastal Pacific and Alaskan waters: Enhancing the Blue Economy</b> Customers: Scientific community, NMFS, Commercial fishing and shellfish industry	5
<b>Enhancing the Blue Economy through Metagenomic Characterization of Hydrothermal Vent and Methane Seep Communities</b> Customers: Scientific community	5
<b>Metagenomic Fluctuations of Zooplankton and Ichthyoplankton Communities in the Salish Sea: Association with Water Chemistry</b> Customers: Scientific community	5
<b>Marine Community Metagenomics: Species, Population, and Genetic Diversity in Response to Ocean Parameters</b> Customers: Scientific community, NOAA National Centers for Environmental Information (NCEI)	5

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# NOAA Readiness Levels of Projects and Products

## Readiness Level of Ocean and Coastal Processes Research Projects and Products

### Project/Product

### Readiness Level

#### Use of High Performance Computing for Real-Time Tsunami Data Inversion

Customers: National Weather Service Tsunami Warning Centers (TWCs)

7

#### Implementation of GNSS-based Tsunami Forecast in Operational Forecast Systems

Customers: National Weather Service Tsunami Warning Centers (TWCs)

6

#### Tsunami Recurring Forecast Applications and Models

Customers: National Weather Service/Tsunami Warning Centers (TWCs), National Weather Service/Analyze, Forecast, and Support Office (AFSO)

9

#### Ocean Tracers

Customers: Scientific community, CLIVAR/GO-SHIP Repeat Hydrography Program

9

#### Global hydrothermal exploration and discovery of new deep-sea resources and ecosystems

Customers: Scientific community, OAR Ocean Exploration and Research Program (OER), NOAA Coral Reef Ecosystem Division (CRED), CAPSTONE Project for exploring National Marine Monuments

7

#### Long-term Ocean Observations at Axial Seamount

Customers: Scientific community, OAR Ocean Exploration and Research Program (OER)

9

#### Cascadia Margin Methane Seeps

Customers: Scientific community, OAR Ocean Exploration and Research Program (OER)

7

#### Hydrothermal Fluid and Particle Sampler (HFPS). Collects hydrothermal vent fluids up to 400°C and preserves DNA in-situ for laboratory analysis.

Customers: Collaborating scientists (chemists, biologists) from multiple universities and institutions

9

#### In-situ Incubator module for HFPS. Incubate hydrothermal fluids at controlled temperatures up to 100°C in-situ, with addition of reagents and collection of DNA.

Customers: Collaborating microbiologists

5

#### Miniature Autonomous Plume Recorder (MAPR), versatile multi-platform instrument for detecting chemical plumes in the ocean.

Customers: Global scientific research community, oceanographers from multiple institutions worldwide, OAR Ocean Exploration and Research Program (OER), Ocean Exploration Trust, and others

9

#### Helium Isotope Lab, providing analysis of rare gas concentrations and helium isotopic ratios.

Customers: Universities, research institutions, and oceanographers worldwide

6

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# NOAA Readiness Levels of Projects and Products

## Readiness Level of Research Innovation and Development Projects and Products

Project/Product	Readiness Level
<b>Extending the Reach of the Global Navigation Satellite System (GNSS) Network to the World's Oceans: Buoy System Development for Monitoring Sea-Surface Height, Precipitable Water Vapor, Waves, and Space Weather</b> Customers: Scientific community, broad range of NOAA users and PMEL research programs, NASA SWOT (Surface Water Ocean Topography) Mission	6
<b>DART-4G Deep-ocean Assessment and Reporting of Tsunamis): Chile Evaluation, Support, and Training</b> Customers: Servicio Hidrográfico y Oceanográfico de la Armada de Chile/Hydrographic and Oceanographic Service of the Chilean Navy (SHOA), National Weather Service/National Buoy Center	9
<b>Arctic Heat Open Science Experiment autonomous ocean profiler development: Air-Launched Autonomous Micro-Observer (ALAMO) Float (MOD for under-ice observations)</b> Customers: Scientific community, MRV Systems LLC, Office of Oceanic and Atmospheric Research (OAR), National Weather Service (NWS)	9
<b>Arctic Heat Open Science Experiment autonomous ocean profiler development: Air-Launched Autonomous Micro-Observer (ALAMO) Float (Natural Parachute)</b> Customers: MRV Systems LLC, Office of Oceanic and Atmospheric Research (OAR), National Weather Service (NWS)	6
<b>Saildrone US Arctic Field Program: Basic sensor suite</b> Customers: Scientific community, NOAA Marine Fisheries Service (NMFS), NMFS Alaska Fisheries Science Center, other NMFS Fisheries Science Centers, OAR Ocean Acidification Program, NOAA Marine & Aviation Operations (OMAO), National Ocean Service (NOS), Office of Oceanic and Atmospheric Research (OAR), National Weather Service (NWS), National Environmental Satellite, Data, and Information Service (NESDIS)	8
<b>Saildrone US Arctic Field Program: CO2, Autonomous Surface Vehicle (ASV) CO2 (2nd generation)</b> Customers: Scientific community, OAR Ocean Acidification Program	6
<b>Saildrone US Arctic Field Program: WBAT &amp; WBT-mini (Fisheries Echosounder)</b> Customers: NOAA Marine Fisheries Service (NMFS), NMFS Alaska Fisheries Science Center (AFSC), NOAA Marine & Aviation Operations (OMAO)	9
<b>Saildrone US Arctic Field Program: Radiometers</b> Customers: National Ocean Service (NOS), Office of Oceanic and Atmospheric Research (OAR), National Weather Service (NWS)	6
<b>Saildrone US Arctic Field Program: Wildlife Computer SPLASH Tags</b> Customers: NOAA Marine Fisheries Service (NMFS)	6
<b>Saildrone US Arctic Field Program: CATS Tags</b> Customers: NOAA Marine Fisheries Service (NMFS)	8



## NOAA Readiness Levels of Projects and Products

### Saildrone US Arctic Field Program: Acousonde

Customers: NOAA Marine Fisheries Service (NMFS)

6

### Saildrone US Arctic Field Program: Data Stream

Customers: NOAA Marine & Aviation Operations (OMAO), NOAA Marine Fisheries Service (NMFS), National Ocean Service (NOS), Office of Oceanic and Atmospheric Research (OAR), National Weather Service (NWS), National Environmental Satellite, Data, and Information Service (NESDIS)

8

### Oculus Coastal Glider: platform

Customers: Kongsberg, Office of Oceanic and Atmospheric Research (OAR)

9

### Oculus Coastal Glider: LISST

Customers: Office of Oceanic and Atmospheric Research (OAR)

6

### Prawler System: Lab-on-a-Chip (bridle mount)

Customers: Office of Oceanic and Atmospheric Research (OAR)

6

### Prawler System: Radiation Sensor

Customers: Office of Oceanic and Atmospheric Research (OAR)

7

### Prawler System: Housing/ratchet system

Customers: Office of Oceanic and Atmospheric Research (OAR)

9

### Prawler System: PRAWLER mooring

Customers: Office of Oceanic and Atmospheric Research (OAR)

9

### Prawler System: ICE PRAWLER mooring (PRAWLER Release)

Customers: Office of Oceanic and Atmospheric Research (OAR)

4

### Pop-up Float/Buoy: Basic and Applied Research of Platform for Observation of the Water-Ice Boundary

Customers: NOAA Marine Fisheries Service (NMFS), Office of Oceanic and Atmospheric Research (OAR)

7

### Nitrification RAS (moored incubation system for time series measurements of in situ nitrification rates in the US Arctic)

Customers: Office of Oceanic and Atmospheric Research (OAR)

4

### Contros-Alk TA Sensor (alkalinity sensor) (to understand the vulnerability and response of marine ecosystems to acidification)

Customers: Office of Oceanic and Atmospheric Research (OAR)

7

### SAMI- TA Sensor (alkalinity sensor) (mooring system to quantify the variability of calcium carbonate saturation states and ocean acidification in the world's oceans)

Customers: Office of Oceanic and Atmospheric Research (OAR)

6

### Plankton Imaging Artificial Intelligence (AI) - (for plankton identification and ecosystem research)

Customers: NOAA Marine Fisheries Service (NMFS), National Oceans Service (NOS), Office of Oceanic and Atmospheric Research (OAR)

3

## NOAA Readiness Levels of Projects and Products

**Ice Dart - IoTAS (low-cost telemetered spatial position beacon to monitor ice drift to provide needed data to improve the modeling and prediction of ice forecasts.**

Customers: Office of Oceanic and Atmospheric Research (OAR)

2

**Primary Production: A primary productivity index for the Bering Sea and continued development of new methods for determining primary productivity in the world's oceans.**

Customers: NOAA Marine Fisheries Service (NMFS), National Oceans Service (NOS)

6

**NSOAR— New Sustained Observations for Arctic Research**

Customers: Office of Oceanic and Atmospheric Research (OAR), U.S. Arctic Observing Network (AON)

8

**Acidification in the Distributed Biological Observatory (DBO)**

Customers: Office of Oceanic and Atmospheric Research (OAR), OAR Ocean Acidification Program, U.S. Interagency Arctic Research Policy Committee (IARPC)

8

**DART-4G (Deep-ocean Assessment and Reporting of Tsunamis)**

Customers: SAIC (industry)

9

**DART-4G (Deep-ocean Assessment and Reporting of Tsunamis)**

Customers: National Weather Service/National Buoy Center

9

**DART (Deep-ocean Assessment and Reporting of Tsunamis): Single Housing**

Customers: National Weather Service/National Buoy Center

9

**ASVCO2 (™) Systems on Waveglider**

Customers: Jupiter Research Foundation

9

**Air-Deployable Micro Buoy (ADMB) Development**

Customers: Scientific community

4

**Advanced Glider Sensing Technologies for Innovative Studies at Coral Reef Ecosystems**

Customers: Coral reef and water quality monitoring programs in the southeast U.S. and Caribbean region

8

**Advancement of Mobile, In-situ HAB Toxin Warning and Genomic Observation for Great Lakes Decision Support Tools (MBARI Long Range AUV)**

Customers: OAR Great Lakes Environmental Research Laboratory (GLERL)

9

**Advancement of Mobile, In-situ HAB Toxin Warning and Genomic Observation for Great Lakes Decision Support Tools (Toxin sensor)**

Customers: OAR Great Lakes Environmental Research Laboratory (GLERL)

6

**Advancement of Mobile, In-situ HAB Toxin Warning and Genomic Observation for Great Lakes Decision Support Tools (DNA Collection and Storage)**

Customers: OAR Great Lakes Environmental Research Laboratory (GLERL)

6

## NOAA Readiness Levels of Projects and Products

### Admin System

Customers: NESDIS STAR-Cooperative Research Programs Division, OAR Atlantic Oceanographic and Meteorological Laboratory (AOML)

5

### Science Data Integration and Data Management

Customers: PMEL research programs, Office of Oceanic and Atmospheric Research (OAR)

5

### Observing System Monitoring Center (SDIG)

Customers: National Weather Service/National Buoy Center

5

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