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Foreword by Dr. Rick Spinrad, Ph.D., CMarSci

Introduction: A snapshot of NOAA's Research and Engagement

Portfolio Logic Why NOAA Invests in Research What Kind of Research NOAA Supports Where NOAA Invests in Research What Principles Guide NOAA Research How NOAA Research Transitions into Operations, Applications, Commercialization, and Utilization What is the Budget for NOAA Research

Theme Chapters

Integrated Earth System Processes and Predictions

El Nino Rapid Response Campaign Yields New Discoveries on Weather Phenomena Unmanned Aircraft Systems Utilized to Improve Hurricane Forecasts Model Enhancements Improve Timeliness and Resolution of Weather Forecasts Wind Forecast Research Optimizes Renewable Energy Efforts Hurricane Surge Forecasting to Better Predict Flooding in Coastal Communities Last Place on Earth Where CO2 Exceeds More Than 400 ppm Better Prediction of Harmful Algal Blooms Advancing Research on Blue Carbon Global Climate Model Revealing Changing Ocean Conditions Fish Species Response to Climate Change Off the Atlantic Coast Warm Blood Makes Opah an Agile Predator

Environmental Observations and Data

Next Generation Satellite Provides Enhanced Observational Capabilities New Frontier of Using DNA to Study Marine Life Coral Reef Outlook to Predict Future Bleaching Events Ocean Exploration Activities Reveals New Discoveries Assessment of Whale Health Using Unmanned Aerial Vehicles Utilizing Electronic Monitoring and Reporting to Improve Commercial Fisheries Utilizing Ocean Sensors on Marine Mammal Satellite Tags Evaluation of Sea Lion and Seal Response to Unoccupied Aircraft Systems Autonomous and Piloted Aircraft Support Search and Rescue Advancement of Shoreline Mapping Techniques Gravity Data from Unmanned Aircraft to Improve Floodplain Management Expansion of Oblique Aerial Imagery Collections to Provide Insight Before and After Extreme Weather Events Engaging Citizen Science to Improve Weather Forecasts Worldwide Increased Satellite Capability to Monitor Global Sea Levels Key for Revolutionizing Space Weather Forecasts Future Satellite for Global Weather Forecasts Accessibility of All NOAA Data through Partners

Decision Science, Risk Assessment, and Risk Communication

Sustainable Management and Resilience of U.S. fisheries in a Changing Climate Assessing the Vulnerability of the California Current Ecosystem to Ocean Acidification Tools and Expertise Help U.S. Aquaculture Industry Expand Tools to Meet Challenges of a Changing Climate Weather-Ready Nation Helps to Build Ready, Responsive, and Resilient Communities Forecasting a Continuum of Environmental Threats Tracking Previous Events and Forecasting Potential Floods Mapping Living Marine Resources Supports Development of Offshore Renewable Energy Promoting Nature-based Shorelines to Protect the Coast Climate Vulnerability Assessment of Northeast Fish and Shellfish Impact of Ocean Noise on Marine Life Technical Guidance on Anthropogenic Sound in the Ocean

Water Prediction

Increased Capability in Water Prediction Nationwide Tracking Precipitation to Provide Flash Flooding Forecasts at the Neighborhood Level Better Toxin Detection for Harmful Algal Blooms In-situ Water Collection Instrument Sequence Samples in Real-time

Arctic

Innovative Technology for Arctic Exploration Forecasting Sea Ice Distributed Biological Oceanography Using Infrared and Color Instruments to Monitor Marine Mammals in the Chukchi Sea Monitoring of Northern Fur Seal Foraging Behavior Insights into the Prince William Sound Fisheries Following the Exxon Valdez Oil Spill Role of Springtime Arctic Clouds in Determining Autumn Sea Ice Extent Climate Prediction Center Experimental Seasonal Sea Ice Prediction

Bibliometrics

Methodology Main NOAA Research Areas Meteorology and Atmospheric Sciences Marine and Freshwater Biology Oceanography Environmental Sciences Fisheries Ecology Geo-Sciences

NOAA's Scientific Workforce

Scientific Awards and Achievements Department of Commerce and National Oceanic and Atmospheric Administration Awards External Awards Scientific Integrity Laboratory and Program Science Reviews National Marine Fisheries Service Oceanic and Atmospheric Research National Environmental Satellite, Data, and Information Service National Ocean Service National Weather Service

Concluding Thoughts

Contributors and Acknowledgements