Reports

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VIMS response to climate change 2009, United Nations Environmental Programme : responding to climate change in the coastal zone

Virginia Institute of Marine Science. Initiative for Coastal Climate Change Research

VIMS Response to Climate Change 2009
United Nations Environmental Program

Responding to climate change in the coastal zone

Virginia Institute of Marine Science

The world's coastal zones are expected to experience major impacts as a result of climate change. Coastal regions are home to roughly half the world's population and comprise some of the most productive yet threatened ecosystems on earth. Risks include sea level rise, higher water temperatures, increasing frequency and intensity of severe storms, coastal habitat deterioration, and displacement of human populations - all with significant associated environmental and economic costs. Responding adaptively to these challenges requires both a thorough knowledge of how climate forcing affects coastal environments and societies, and effective implementation frameworks for integrating state-of-the-art research with responsive planning and management.

The Virginia Institute of Marine Science (VIMS) is the largest institution in the USA focusing on research, education, and advisory service related to the coastal ocean. VIMS and its new Initiative for Coastal Climate Change Research (http://www.vims.edu/climatechange/) promote both basic and applied research extending from watersheds to the open ocean and spanning the globe from the poles to the tropics, with primary emphasis on coastal and estuarine environments.

A diverse portfolio of VIMS research is improving our understanding of the complex relationships between climate forcing and various coastal processes, and impacts on living resources and the human communities that they support. VIMS also provides graduate education and basic and applied research training relevant to effective management and conservation of coastal and estuarine resources for present and future generations.

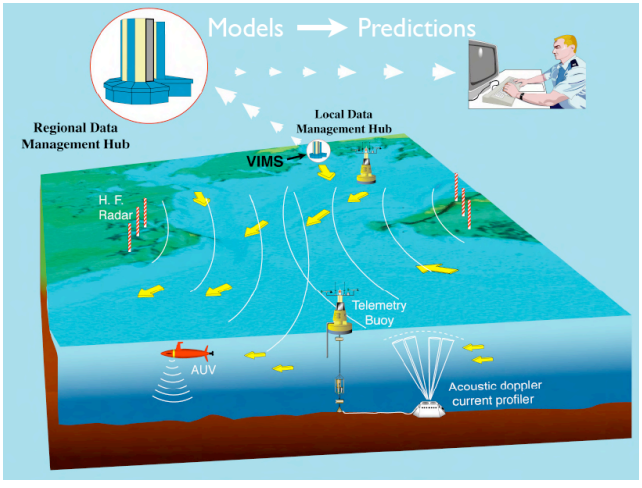

Figure 1. Example of a coastal monitoring and prediction system that provides tangible products to the public, and to local and regional governments and planners. As disruptions from climate change increase, such systems will become increasingly important for effective response planning and resource management.

Observing and modeling global warming impacts in coastal zones. The low-lying Mid-Atlantic coastal plain is representative of many coastal zones globally, and may be used as a model to assess key environmental and societal disruptions expected from changes such as sea level rise. It and regions of similar vulnerability require sustained

coastal observing systems, with observational data feeding into models that predict the local weather, storm inundation, precipitation and runoff, inputs of organic materials and nutrients from land, potential releases from sewage and pollutant storage facilities, living resource distributions and abundances, and the presence and spread of aquatic diseases and their potential vectors. In conjunction with governments, industry, and research institutions under the auspices of the Chesapeake Bay Observing System (CBOS: www.cbos.org), VIMS has helped develop modern visualization tools such as the prototype Chesapeake Inundation Prediction System (CIPS; http://cbos.org/Home/chesapeake-bay-inundation-prediction-system-cips) as a potential forecasting tool for NOAA's National Weather Service (NWS; http://www.nws.noaa.gov/), in partnership with local and regional emergency managers. Systems such as CBOS, CIPS, and the Virginia Estuarine and Coastal Observing System (http://www2.vims.edu/vecos/) will play increasingly critical roles in helping to protect lives, property and natural resources in coastal regions with predicted increases in sea level and storm intensity, facilitate environmental and resource management, and enhance security for local and national interests including the military and emergency relief agencies.

Coastal protection by living shorelines. Climate impacts on coastal environments and economies are aggravated by the continuing sequestration of sediments by damming, loss of coastal plant communities, and impediments to the shoreward migration of wetlands under different sea level rise scenarios. VIMS maintains the world's longest-running research and monitoring program on submerged and emergent aquatic vegetation, documenting previously unrecognized worldwide loss of this important coastal buffer and seafood nursery habitat. VIMS' Center for Coastal Resources Management (http://ccrm.vims.edu/index.html) provides effective wetlands research and management for developing computer models and GIS tools that allow resource managers and stakeholders to assess wetland conditions, and ecological and economic value. Such assessments will become increasingly important to managing the consequences of rising sea levels as wetlands and submerged aquatic vegetation respond dynamically to climate forcing.

Figure 2. Living shoreline in different parts of the coastal zone. Preserving, creating or enhancing natural vegetation is always the preferred approach for shoreline protection and restoration.

Climate change and aquatic diseases in the coastal zone. Changing environmental conditions portend a growing need to actively monitor viral, bacterial, protozoan, fungal and other diseases relevant to living resources and human health in coastal regions.

Keystone species of the Chesapeake Bay and Mid-Atlantic coast such as the Virginia oyster (*Crassostrea virginica*) have already suffered catastrophic declines from parasitic diseases such as MSX and Dermo. As the environmental baseline conditions of coastal zones shift, certain diseases are expected to proliferate, while others diminish in importance. The need for accurate predictions of the epidemiology and spread of aquatic pathogens such as those being conducted by VIMS researchers has therefore never been greater.

Changing linkages between land and the coastal ocean. Shifting precipitation patterns, runoff and related inputs of nutrients, particulates and organic matter from land via rivers to the coastal ocean, are all predicted to impact coastal features and processes such as circulation, salinity, sediment supplies, hypoxia, and ecosystem function. VIMS scientists conduct research around the globe on Earth's water, carbon and nutrient cycles in an effort to anticipate how future climate change will further influence these cycles and their effects on coastal environments.

Virginia Institute of Marine Science
The College of William and Mary
Gloucester Point, Virginia 23062-1346, USA
Tel: 804-684-7000
Web: http://www.vims.edu/climatechange/
Email: climatechange@vims.edu