Submission No:	26
Date Received:	29-5-08
Secretary:	

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Janet Holmes
Secretary
Standing Committee on Climate Change, Water,
Environment and the Arts
House of Representatives
Parliament House
PO Box 6021
CANBERRA ACT 2601
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Dear Ms Holmes

Re: Inquiry into climate change and environmental impacts on coastal communities

Thank you for your letter of 2 April asking for our views on issues related to the above inquiry.

Geoscience Australia's response is attached. We would be happy to provide further details as may be required.

Yours sincerely

Dr Neil Williams PSM
Chief Executive Officer
Geoscience Australia
29th May 2008

Australian Government
Geoscience Australia

Submission by Geoscience Australia to the

House of Representatives Standing Committee on Climate Change, Water, Environment and the Arts

Inquiry into climate change and environmental impacts on coastal communities

May 2008

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Introduction

Geoscience Australia (GA) is Australia's national geoscience research and information agency. Our mission is to use geoscientific research and information for the economic, social and environmental benefit of Australia. GA has for many years played an important role in assisting State and Commonwealth environmental and disaster managers by providing geoscientific information and advice related to coastal issues. GA works closely with State and Commonwealth agencies to achieve shared outcomes. In many cases, data and information are available through on-line systems including the OzCoast and OzEstuaries web information delivery system, AMSIS (Australian Maritime Spatial Information System), MARS (marine sediments) and Map-Connect (topographic data). Housing and maintaining these systems requires significant resources, including specialist staff with the disciplinary expertise to act as effective database custodians. Moreover, GA provides technical advice to government on a variety of issues in environmental management of the coast and natural hazard/risk management that bear directly on the subject of this inquiry.

Inter-agency relationships around coastal issues include:

- Australian Hydrographic Office (Royal Australian Navy): Agreements on the sharing of hydrographic data to allow accurate mapping of bathymetry
- Bureau of Meteorology: Joint Australian Tsunami Warning Centre
- Australia and New Zealand Land Information Council: National Elevation Data Framework
- Department of the Environment, Heritage, Water and the Arts: Commonwealth Environment Research Facility (CERF)
- CRC for Spatial Information (CRC-SI)
- Attorney General's Department: Critical Infrastructure Protection Modelling; Maritime Boundaries; Disaster Mitigation Australia Package
- AusAID
- EMA: protocols for access to satellite images for emergency response
- Department of Climate Change (DCC): Coastal vulnerability.

These relationships are often managed through Collaborative Head Agreements under the National Service Improvement Framework (www.agimo.gov.au).

GA's activities of relevance to the Committee fall into four groups: 1) fundamental geographic data; 2) vulnerability of the coastal environment; 3) coastal vulnerability and natural hazards; and 4) natural disaster management. Activities and issues in each of these areas are summarised below.

Fundamental Geographic Data

GA is custodian of several key national data sets that underpin coastal zone management, including:

- coastal and estuarine geomorphology
- coastal bathymetry
- elevation data

- satellite imagery data capable of showing long-term change
- satellite imagery data collected in response to floods and cyclones
- topographic mapping data
- marine boundaries
- NEXIS, national exposure information system of buildings, infrastructure and demographic data needed for impact assessments (under development)
- development of methods to measure depth (bathymetry) from satellite imagery to provide accurate data required for modelling of tsunami run-up in pacific islands (AusAID Pacific Governance Support Program)
- through the CRC-SI, improvement in the national tide tables to allow accurate representation of the land-sea interface required to accurately model processes such as tsunami run-up and storm surge inundation.

Coastal geomorphology, bathymetry and elevation data in particular are fundamental to our ability to model coastal processes and to predict impacts in the coastal zone from increased population and climate change. Gaps that exist in these types of coastal environmental data continue to limit our ability to reliably model impacts and provide the scientific outcomes necessary to support sustainable management of natural resources. Similarly, incomplete databases on exposure – the social and environmental assets that will be exposed to climate change in the coastal zone and how they will respond – limit our ability to model impacts.

Vulnerability of the coastal environment

GA is involved with several programs that are delivering information to better understand the vulnerability of our coastal environment:

- Commonwealth Environment Research Facility (CERF) program in marine biodiversity
- Commonwealth Environment Research Facility (CERF) program in tropical river/coastal ecosystems
- Participation in the Integrated Marine Observing System (IMOS) element of the National Collaborative Research Infrastructure (NCRIS), to provide remote sensing of the marine and coastal zone.

Coastal environmental problems are inherently complex and typically involve trade-offs between the social, economic and environmental spheres. For this reason a collaborative approach between major research providers is needed, and initiatives similar to that of the Cooperative Research Centre for Coastal Zone, Estuary & Waterway Management are essential in order to make significant headway on many coastal issues. Impacts of population growth include loss of habitat to housing and supporting infrastructure; modification of habitat due to modified shoreline and catchment processes; pollution of coastal groundwater; etc. GA has entered into agreements with the WA State government and as a partner in the CERF Tropical Rivers and Coastal Knowledge Hub to conduct surveys to assess sediment and water quality issues in impacted estuaries such as Darwin Harbour and the Swan River estuary. Mechanisms that promote the sustainable use of coastal resources are also being addressed by the CERF Marine Biodiversity Hub, which is conducting research that will enable marine biodiversity to be mapped and modelled to support the design

of marine protected areas. The outputs of this collaborative research are enabling the twin goals of biodiversity conservation and sustainable use of natural resources.

GA has carried out modelling studies to quantify the exposure of the seafloor and coast to storm wave processes, including the implications for sea level rise. Of course, impacts of climate change are far from being restricted to sea level rise. Additional processes leading to impact include (but are not restricted to) increased water temperature; changes in water/sediment chemistry; changes in storm magnitude and frequency; changes in storm direction; changes in catchment runoff and river discharge with attendant changes in estuarine circulation; increased exposure of previously protected open-ocean and estuarine shorelines; etc. Many of these impacts are expected to modify natural habitats/ecosystems, place a strain on natural resources, and increase the hazard to infrastructure in the coastal zone. In order to prioritise potential adaptations to climate change, risk models for ecosystems and other natural resources (eg potable groundwater) as well as infrastructure are necessary. The economic viability of many coastal regions depends on tourism, which ultimately relies on both the natural amenity of the region, as provided by coastal habitats and landscapes, as well as the built environment.

Coastal vulnerability and natural hazards

There is a growing recognition by Commonwealth and State agencies that a systematic, consistent map of Australia's coastal depositional environments is essential for the modelling of coastal processes and vulnerability to natural hazards. Under a recent initiative of the Department of Climate Change (DCC), the Department of Environment, Water and Heritage (DEWHA), and the Intergovernmental Coastal Advisory Group to assess Australia's coastal vulnerability to climate change, GA will provide fundamental information that will support decision-makers in identifying areas in Australia's coastal zone where potential impacts may be rated as high, medium and low. As part of the assessment GA contracted the University of Tasmania to produce a classification of the geomorphology and stability of Australia's shoreline that will be completed in June 2008 ('Smartline' maps). The second part of the project will estimate climate change related coastal inundation and the impacts of severe (storm) winds. Interactive information products from the project will be delivered online through OzCoast and OzEstuaries http://www.ozcoasts.org.au/.

GA's work in coastal vulnerability assessment includes the physical and economic consequences of changes to tropical cyclone characteristics (intensity, spatial distribution, and occurrence) as well as severe synoptic winds (non-tropical regions). In a second project supported by the DCC, a coastal vulnerability assessment will be conducted by integrating the 'Smartline' with a national digital elevation model (DEM), projected sea level rise and 1 in 100 year storm height data in order to determine possible areas of inundation associated with shorelines for future climate scenarios. In a first-cut attempt to assess the economic risk to coastal communities, the Smartline maps will be linked with GA's National Exposure Information System (NEXIS), which contains detailed information about buildings and other infrastructure. The result will be indicative but quantitative estimates of climate change impacts on human settlements and nationally-significant infrastructure across

different timescales. This work will highlight areas where more detailed data and vulnerability/risk modelling will be needed for input to adaptation programs and planning.

In a parallel effort, GA is contributing to the Garnaut Climate Change Review, which is an independent study by Professor Ross Garnaut (commissioned by Australia's State and Territory Governments). The Review is examining the impacts of, and possible policy responses to, climate change on the Australian economy. GA is determining the potential economic impacts of tropical cyclones on three states; Queensland, the Northern Territory and Western Australia (severe wind and storm surge impacts only). Eight climate change greenhouse gas emission scenarios are being considered that are based on model projections of large-scale environmental factors from the Intergovernmental Panel for Climate Change (IPCC) Fourth Assessment Report simulations (21st century). Again, this analysis will assist in identifying the most significant risks which will require further research and analysis for consideration in climate change adaptation.

Natural Disaster Management

Many of the issues facing policy makers and practitioners in climate change adaptation for coastal communities are common with the issues facing emergency and disaster managers in government and industry. As discussed above, climate and demographic change could bring potential changes to the frequency, intensity and location of natural hazard events and their impacts. However, the means of understanding and managing these impacts will need to leverage off our current understanding of natural hazard risks. By combining our current understanding of natural hazard risks with climate change projections, we will be able to quantify risk in a manner necessary for effective risk management, including new policies on disaster mitigation and climate adaptation.

A significant national capability exists in estimating the impacts of natural hazard events, and this capability can readily be directed towards estimating climate change impacts on coastal communities. For example, GA has developed models, tools and databases under the Disaster Mitigation Australia Package in the four years to June 2008. These include the National Exposure Information System (NEXIS), which is a fundamental tool for assessing the physical and economic impact of natural hazards across Australia. Another example is the development by GA and the Australian National University of ANUGA, an Open-Source hydrodynamic modelling software. ANUGA has been applied to several studies of tsunami inundation of coastal communities and is adaptable to estimate coastal inundation from storms and flooding.

Similarly, established emergency management governance arrangements can directly contribute to national climate change adaptation arrangements and the implementation of adaptation policy. The emergency management arrangements are not fully exploited in this way at present. For example, there are significant commonalities between community and infrastructure risk assessment and risk management in the National Risk Assessment Framework for sudden onset natural hazards, and the National Climate Change Adaptation Framework.

'All hazards' risk management is an element of the strategic work plan of the Australian Emergency Management Committee (AEMC). GA provides leadership and executive support for several national committees that support AEMC's initiatives in this area. These are the National Risk Assessment Advisory Group, the Technical Risk Assessment Advisory Committee and the National Flood Risk Advisory Group. GA also exercises emergency management arrangements through the Joint Australian Tsunami Warning Centre and hosts the Sentinel geospatial hazard monitoring capability, which is currently used to identify bushfire hot spots but will in future also display floods.

GA and the Bureau of Meteorology together operate the Joint Australian Tsunami Warning Centre, which was funded in 2005 following the 2004 Indian Ocean tsunami. GA operates seismic systems that detect and locate earthquakes, notifies the Bureau of any significant earthquakes and assists in determining the likelihood of a tsunami. As part of this program, GA assists States and Territories with the assessment of tsunami hazards and risks, which provides an important input to tsunami evacuation plans.

Summary of knowledge and data gaps

Through these programs it is clear that a wide range of data sets, models, tools and expertise are fundamental to our ability to model coastal processes and to predict impacts in the coastal zone from increased population and climate change. Data sets include coastal geomorphology, bathymetry and elevation data which underpin any assessment of environmental and coastal vulnerability assessment. Further, to determine the physical, social, and economic impacts of natural hazards, including climate change, requires fundamental data on community assets such as buildings and critical infrastructure, and the attributes that make them susceptible to damage and economic loss. Computational models are then needed to combine this information in ways that allow us to see how climate change and associated hazards combined with environmental factors and community assets contribute to undesirable environmental, social, physical and, ultimately, economic impacts. The work that has been done by GA and others to date provides a basis for future investment in data, models and tools that will be needed to improve our ability to assess risks and make appropriate mitigation and adaptation decisions for sustainable management of natural resources and coastal communities.