Climate-change impacts and adaptation: a coastal geoscience perspective

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Projected global surface temperature changes over the coming century range from 1.1–2.9 °C to 2.4–6.4 °C depending on the emissions scenario, a function of the development pathway (Fourth Assessment Report, 2007 [AR4]). At constant year 2000 GHG concentrations (i.e. irrespective of future emission reduction accomplishments and not accounting for 2000–2008 emissions growth), the existing commitment to warming is 0.6 ± 0.3°C (all projections for global mean at 2090–2099 relative to 1980–1999). Changes are projected in a range of other climate variables, including precipitation and water balance, storm intensity, ocean circulation, and sea levels. For the same time frame and scenarios, the projected rise in global mean sea level ranges from 0.18–0.38 m to 0.26–0.59 m, compared to the observed sea-level rise over the past 50 years equivalent to 0.18 m/century (AR4). In other words, sea level will rise at least as fast as in the past and likely faster. In Atlantic Canada, the apparent rise in mean water level against the coast is amplified by widespread crustal subsidence. Sea-level rise over the past century has already increased the frequency of coastal flooding in this region, with implications for coastal erosion and shoreline change. Coastal erosion rates are spatially and temporally highly variable, but rising sea levels, increased storm intensity (with associated storm surges and waves), and reduced extent and duration of sea ice are likely to produce accelerated erosion. Rates of coastal wetland loss may increase, in part due to structures preventing landward migration, and salt-marsh biodiversity may be diminished (AR4). Population growth in coastal areas, combined with rising property values, leads to increased vulnerability in some regions including Atlantic Canada, where the current level of adaptation is predominantly poor and uneven. Thus we are already challenged by the existing climate and ill-prepared for faster change. Our conventional development practices are often maladaptive. Vulnerability depends on the timing and effectiveness of adaptation and on coping capacity (AR4). The latter can vary widely and often depends on individual champions as well as economic and technical resources and institutional arrangements. In this context, as for geohazard mitigation, geoscience expertise can play a key role limiting vulnerability. Examples include measurement and modelling of vertical motion, estimates of past and future sea-level rise, detailed topographic data and flood projections, and understanding of coastal response processes, enabling informed projections of future environmental change. Sound geoscience and geomatics information is a critical foundation for robust adaptation. Through establishment of collaborative partnerships between scientists and planners, geoscience can inform policy development and the planning process in coastal communities, thereby enhancing resilience in the face of a changing climate.

Atlantic Geology, 2008, Volume 44, Number 1