of projected trends). However, human activities may have a far greater impact on both corals and mangroves than any anticipated climate change.

Socio-economic impacts of climate change are summarized in a matrix (Alm *et al.*, chapter 15), which, however, does not emphasize the most significant parameters. The last chapter (Engelen *et al.*, chapter 16) introduces a two-level mathematical model integrating natural and socio-economic variables.

Climatic Change in the Intra-Americas Seas is an important addition to the growing literature of climate change and consequent impacts. The book presents a comprehensive overview of the status of climatological and oceanographic research, limitations of models, extant and additional data requirements for this region. The quantitative assessment of climate impacts lags somewhat behind, although research needs and new methodologic approaches are discussed. A few things could have been improved, however. It would have been useful to summarize the sea-level and shoreline data on separate maps, for the Holocene and recent changes (chapter 7). Also, labels and outlined areas on some of the summary marine ecological charts (chapter 10) could have been made clearer. A few errors have crept in (*e.g.*, a page header reads "echo systems" instead of "ecosystems" [chapter 1]; "moluscs" instead of "molluscs", Fig. 10.16). On the whole the book is clearly written and well-illustrated. As such it provides a useful reference for climatologists, oceanographers, coastal ecologists, planners and economists.

Vivien Gornitz
Columbia University
New York, NY

Glacial Isostasy, Sea Level and Mantle Rheology, edited by R. Sabadini, K. Lambert, and E. Boschi, 1991. Kluwer Academic Publishers, Dordrecht, The Netherlands, 708p. ISBN 0-7923-1167-1 (Hardcover).

In this book, geophysicists and coastal geologists use varied approaches to resolve the problem of modeling the earth's viscosity structure, and particularly, the response of the earth's lithosphere to loading and unloading of ice sheets. Readers of the *Journal of Coastal Research* will be mainly interested in the papers dealing with the applications of sea-level and shoreline changes; these will be briefly reviewed here.

Relative sea-level data are essential for validating geophysical models of the earth's rheology, particularly on time scales of 10^3–10^4 years. Tide-gauge data contain contaminating residual glacial isostatic signals which must be removed in order to determine contemporary global sea-level trends more accurately, as a possible indicator of climate change.

This book presents the Proceedings of the NATO Advanced Research Workshop on Glacial Isostasy, Sea Level, and Mantel Rheology, held in Erice, Italy, in 1990. Following a brief introduction, the remainder of the book is organized into five sections: post-glacial rebound, glaciology, and climatology, sea-level fluctuations, mantle rheology, and mantle and lithospheric dynamics. The book concludes with a discussion section and recommendations for more studies. G. Visconti briefly reviews the connection between climate change and sea-level rise. K. Lambeck uses sea-level observations to constrain glacial models for Scotland. The symmetrical, concentric pattern of uplift around northern Scotland, deduced from paleo-shorelines, rules out those ice models showing a thick, continuous ice sheet covering the entire North Sea, at least ~18,000 years BP. M. Nakada and K. Lambeck further utilize the Holocene sea-level record from various regions to infer lateral variations in mantle viscosity.

W.R. Peltier has refined his earlier glacial rebound model to examine recent sea-level behavior, as well as gravitational and rotational anomalies. Tide-gauge data, from which glacial isostatic effects have been filtered, show a residual trend of 2.4 mm/yr. A.S. Trupin and J.M. Wahr, employing an older version of Peltier's glacial rebound model, and selecting longer-term tide-gauge stations, away from tectonically active regions, find a globally-averaged sea-level rise ranging between 1.45 and 2.6 mm/yr, with a preferred value of 1.75 mm/yr. On the other hand, S.M. Nakiboglu and K. Lambeck obtain a globally-averaged secular sea-level trend of only 1.15 + 0.38 mm/yr, from spherical harmonic analysis. These divergent results span the range of values listed in the 1990 IPCC report.

Several of the papers examine the Holocene sea-level record. P.A. Pirazzoli, for example, compares a number of sea-level curves with model predictions. J.T. Andrews uses the Holocene data to reconstruct the deglaciation history of Baffin

Island, at the northeastern margin of the Laurentide Ice Sheet. R.J.N. Devoy has synthesized paleo-sea-level data for northwestern Europe to deduce regional patterns of glacial isostatic uplift and subsidence. O. van de Plasche has produced more reliable and accurate relative sea-level curves based on new field studies at several localities on both sides of the Atlantic.

The collection of papers in this book represents a fairly thorough, up-to-date summary of the relation between the response of the earth's lithosphere to the deglaciation history, and Holocene sea-level changes, as seen from the perspectives of several disciplines. However, there are a few shortcomings. Some of the papers (*e.g.* those by Peltier, Pirazzoli, Trupin and Wahr) have basically been published elsewhere. Also, many of the figures have been reduced to such an extent that a magnifying glass is needed to read the numbers and labels on some of the graphs. Some of the papers could have undergone more careful proofreading (*e.g.* Visconti's paper on global warming). In spite of these limitations, the book, as a whole, is recommended as a good review of the latest developments in the glacial rebound problem that has challenged geophysicists, glaciologists, and coastal geomorphologists for over a century.

Vivien Gornitz
Columbia University and
Goddard Institute for Space Studies
New York, U.S.A.

Submerging Coasts: The Effects of a Rising Sea Level on Coastal Environments, by Eric C.F. Bird, 1993. John Wiley & Sons, Ltd., Chichester, U.K., 184p. ISBN 0-471-93807-6.

A number of recent books have been written on the subject of sea-level rise due to the expected global climate warming. This book, a sequel of E.C.F. Bird's 1985 book *Coastline Changes: A Global Review,* documents the nature of shoreline changes presently occurring on the world's subsiding coasts, as a preview of changes that can be expected elsewhere in the future, as global sea-level rise accelerates. It also examines three likely human response strategies.

The Introduction outlines regions where the world's coastlines are presently subsiding, and points out that these sectors will become more extensive, while emergent coasts will become rarer, as sea-level rises. Chapter Two presents an overview of the many processes that affect sea-level, of which global warming is only one. Other important factors include tectonic movements, glacial-isostatic adjustments in formerly glaciated regions and along their margins, hydro-isostatic loading of continental shelves, sediment loading at major deltas, and artificially-induced subsidence due to groundwater and/or hydrocarbon extraction. Shifts also occur in ocean surface topography due to tides, the earth's rotation, and changing patterns of ocean circulation. Given the wide variety of contributing causes, and divergence in sea-level trends deduced from tide-gauges, a certain degree of caution is recommended in interpreting the apparent rise in global sea-level of around 1.2 mm/yr.

Chapter Three examines the effects of rising sea-level in different geomorphological settings, such as steep coasts, beaches and barrier coasts, estuaries and lagoons, deltas, intertidal zones, also heavily developed coasts. Coastline responses are difficult to predict quantitatively and will depend on the interaction of many local variables. In general, however, low-lying and intertidal areas will become progressively submerged, and cliff and beach erosion will increase. The actual recession will depend on the relative rates of sea-level rise vs. offsetting trends such as rates of sediment supply, organic accretion, and in the case of coral reefs, growth rates. Critical coastal ecosystems, such as saltmarshes, mangroves, and coral reefs will be under increasing stress, not only from sea-level rise, but even more so because of pollution and over-development. Mangroves, in particular, have been cleared extensively in recent decades for agriculture and urban or industrial development. Coral reefs have been decimated by pollution, increased siltation due to inland deforestation, use of explosives for fishing, quarrying, and collecting, and also a mysterious "bleaching" believed to be caused by higher sea surface temperatures, possibly associated with El Niño events. These practices are especially unfortunate, because mangroves and coral reefs act as buffer zones to protect the inner coast and islands from flooding and erosion by cyclones or typhoons, and ultimately, to mitigate the effects of sea-level rise.

Sea-level rise is only one of 20 listed causes of beach erosion; most of the rest are attributed to various sources of reduced sediment supply. On sandy beaches, the widely-used Bruun Rule pre-