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BOOK REVIEWS

Sea Level Rise: History and Consequences. C. Douglas, S. Kearney, and S. P. Leatherman, 2000, San Diego: Academic Press, advance copy.

This is a timely volume, marking the new millennium, by a team originally at the Department of Geography in the University of Maryland (College Park, MD), though two have since migrated to the International Hurricane Center (F.I.U.) In Miami (B.C.D. and S.P.L.). Thanks to their courtesy I have been provided with an advance copy.

Their prevailing theme is that even with a minimal mean rise of sea level during the 21st century, if maintained, a catastrophic situation would arise. This is the result of a "collision course" between opposing trends: the social migrations towards settlement in the coastal zone and the rise of mean sea level anticipated in global warming scenarios.

The first problem, the coastward migration of populations, is recognized from the start as a sort-of self-evident axiom. Why this lemming-like rush to the coast? No doubt it would fill another volume, so for the moment we must accept as a "given" that a mysterious centrifugal social force is driving human populations towards the sea, not only in the United States, but almost worldwide.

Most of the book is devoted to the second problem, the observed rise of sea level during much of the 20th century. After an introduction (by Douglas), there is an historical review of the late Holocene by Kearney. This is particularly important because it illustrates the fluctuating nature of NORMAL sea level, that is to say, prior to the atmospheric pollution of the last century. A residual question is always: how much of the 20th century change is natural, how much is anthropogenic? Chapter 3 (by Douglas) considers the tide gauge results and what they mean. The long-term records, in excess of 200 years, are unfortunately very few in number, and the global departures (both positive and negative) clearly support the "neotectonic" argument, i.e. the influence of local crustal movements.

W. R. Peltier compares the global isostatic model with modern tide gauge data. The argument calls for the progressive adjustment of the Earth's crust, in a vertical sense, to the retreat and final melting of the last glacial stage ice sheets. Those of the North Hemisphere greatly exceeded all the rest, so that the isostatic adjustments are highly skewed. Inasmuch as the last vestiges of non-polar continental ice had melted by 6000 years ago, the slow isostatic adjustment of both the Earth's crust and the ocean surface (geoid) involve complex calculations that need to be taken into regional evaluations.

Some of those regional and local matters are examined by Vivien Gornitz, especially those concerning impoundment, groundwater "mining" and other hydrologic matters. The writer (R.W.F.) Organized a NATO Advanced Study of the subject (ed. by Paepe et al., 1990) on Fuerteventura in the Canary Is. Since then there has been much progress.

Utilizing modern satellite observations for monitoring purposes is only just now becoming feasible, as discussed by R. S. Nerem and G. T. Mitchum. Some patterns of regional and global change are beginning to show up. The statistics of tide-gauge measurements on a decadal level are examined by W. Sturges and B. G. Hong.

Finally, in chapter 8, the social and economic costs of the anticipated sea-level rise are appraised by Stephen Leatherman, the lead inspiration. All-in-all, the volume shows the benefits of careful planning and coordination. In contrast to the poor (or non-existent) editing of many conference volumes, this approach provides a highly readable study of the subject which is likely to be quoted and referred to for quite some years. There is enough background information to provide working material for serious researchers and policy makers. Much use has been made of graphical material, to quote the author's own words, "believing that graphics and data are the best teachers".

As the authors clearly recognize, there is far more to sea-level change than simply beach erosion. To begin with, there are extensive coastal belts in the high latitudes that are still isostatically rising, some at rates in excess of the world average sea-level rise. Tectonic and volcanic regions are crustally active, and their dynamics also eclipse world sea-level patterns. Rightly, the authors comment that the subject is complicated. The local dynamics always need to be sifted out from the historical patterns that appear to be largely dictated by climatic fluctuation. Evidence for the latter is derived from independent sources: evidence such as glacier advances and retreats, tree-ring variations, lake levels, and other long-term time series. During the next century we are talking of sea-level changes in terms of mm/yr or cm/yr, but during the Holocene natural fluctuations of sea level have sometimes exceeded several meters in a century, which calls for remarkably sustained rates of change. This prompts the reviewer to push his own interpretation of the major (i.e. sustained) sea-level fluctuations over the last eight millennia, viz. their prime dependency on long-term atmospheric pressure systems that may result in major shifts or even complete reversals of wind systems and intensities (as suggested in a recent Stockholm University thesis "Wind Controlled Climate" by Hans Jelbring, 1998).

A simple relationship between sea-level rise on the east coast of North America and net beach erosion is often masked by coastal engineering projects and inlet dynamics, as pointed out in a recent review by Leatherman, Zhang and Douglas (EOS, v.81(6), 55–56; Feb. 8, 2000). That relationship is dictated on theoretical grounds by the "Bruun Rule", because

nearshore water depth is increased, bringing more wave energy to the beach face. However, the Bruun Rule is two-dimensional and has been controversial because of longshore dynamics. Several observers believe that angle of incidence of principal wave action is the key. But, of course, much more research is needed.

The Douglas-Kearney-Leatherman volume is enormously enriched by the addition of a CD-ROM on tide-gauge data with glacial isostatic adjustments suggested by Peltier, together with an EL Niño treatment (also accessible on the Web).

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