



BOOK REVIEWS

TIDAL DYNAMICS: COASTAL FLOODING AND CYCLES OF GRAVITATIONAL FORCE, by Fergus J. Wood, 1985, D. Reidel Publ. Co., Dordrecht/Boston, etc. 558p \$149.00, ISBN 90-277-1910-1.

This is a very remarkable volume, a unique source of information. It is regrettably expensive but nevertheless copies of it should be in every coastal library. It treats with the long-term behavior of tides from the point of view of people living on the coast, and of engineers and environmentalists who need to plan for extremely hazardous situations that occur from time to time. Disregarding all the other factors such as tsunamis, hurricane surges, wave set-up, low-atmospheric pressure and so on, just consider the 40% augmentation of mean spring tidal range at full moon during a perigee-syzygy alignment! Synchronous incidence of both the latter and the passage of a low pressure frontal cannot be predicted with any long-term precision, but it has an actuarial probability. The chances are greatly increased, however, because the tsunami, or the weather condition itself may be triggered by the same lunar stress peak.

The author is a scientist formerly with the National Ocean Survey of NOAA (the National Oceanic and Atmospheric Administration, Washington), for whom a first edition of this book was written in 1978. Excellent at the time, it was very little publicized or reviewed. The new edition contains all the useful information of the first version but has now been expanded by about one third. The author assumes no prior knowledge of astronomy, so that any literate person can pick up the book and start reading.

According to the analyses of Fergus Wood, only two fundamental tidal cycles explain all of the great historical coastal flooding events. His "series A" is the 1.13 tropical-year lunar evectional period (14 lunar months) which generates a perigee-syzygy approximation. Secondly, his "series B", an 18.03...yr. cycle, leads to

enhancement of that combined luni-solar tide-raising effect, which the author calls a "proxigee" situation. At a proxigee-syzygy alignment the moon comes on average 27,923 km closer to the earth than at ordinary syzygy, and 3,366 km closer than at average perigee-syzygy.

The lunar nodical cycle of 18.6134 yr. corresponds to the Moon's changing declination and the Earth's precessional nutation, but is not itself a tide-generating periodicity, only the angle of its orbit with respect to the equator. It does however affect the alignment. At times it is almost coincident (in phase) with the "B cycle", e.g. Jan. 4, 1912, so the extreme proxigee-syzygy peaks occurred on, and for several decades before and after that date. A comparable crest was 186.04 (2×93.02) yrs. before, on Dec. 19, 1725. Nevertheless convergences of the various cycles result in much more frequent peak tidal events, e.g. December 31, 1986. Coincidences of extreme proxigee-syzygy with high lunar declination (nodical cycle) took place in 1632, 1725, 1818, 1912, 2005.

From the humanistic point of view, one should refer to the supplement section (p. 431.15-431.26). Here the incredibly destructive North Sea coastal disasters of the last millennium are documented. Each major disaster corresponds to some combination of the series A and B cycles, $+/- 2$ or 3 days. Of course, this does not imply that prediction is possible, because storm fronts must coincide with the tide peaks, but probabilities are greatly enhanced.

I would strongly recommend starting at the beginning and not just browsing. There is so much interesting and important material for coastal people that one cannot afford to ignore either the fundamental principles or the fascinating historical data. For example, did you know that the most destructive (non-tropical) coastal storm ever recorded in northeastern North America was at the new moon (18.03 yr perigee-syzygy and 31.008 yr perihelion alignment) on March 6-7, 1962? And incidentally, in Europe three weeks earlier there was a similar

storm in the North Sea area on February 16, 1962? We might add that Robert Currie has identified the 18.6 yr. lunar nodical cycle in long-term tree-ring records and several geophysical parameters, so that we are evidently not dealing with a simple oceanographic effect, but with one that modulates geomagnetic signals and atmospheric dynamics.

Fergus Wood's major contribution to this increasingly important field comes at a most appropriate time when the eyes of scientists around the world are being directed to the rising dangers and threats of large-scale coastal disasters.

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COASTAL AND ESTUARINE SEDIMENT DYNAMICS, by Keith R. Dyer, 1986, John Wiley & Sons, Chichester, 342 p, £36.50stg, ISBN 0-471-90876-2.

The author, Professor Dyer, was Head of the Sedimentation Group at the Institute of Oceanographic Sciences until savage financial cuts broke up the team which he had assembled and led to the forefront of rigorous research. The field of marine sediment dynamics will sadly miss the collective works of Heathershaw, Langhorne, Carr, Davies, Soulsby and of Dyer himself and will echo the hope, which is expressed in the preface, that the group will reform with the same zeal elsewhere, possibly in Plymouth where the author has now taken up again as Dean of the new Institute of Marine Studies. The work of Dyer's group reflected the decades of change in Marine Geoscience from the geologists broad description of the seafloor, through the demands of engineering and piloting for an improved understanding of bathymetric evolution and into our ongoing technical and mathematical assault on the fine scale physics of wave and tidal boundary layers and the resulting seabed sand transport. *Coastal and Estuarine Sediment Dynamics* is not a history book, but it is the story of those developments written by, and one suspects for,

informed reflection on the state of the subject with a view of planning the next steps forward.

The book, with eleven Chapters and some 340 pages, is well illustrated throughout, with some two hundred line drawings and two half tones. The short, introductory Chapter 1 outlines the descriptive, empirical and deterministic approaches and argues for the last based upon the first but resorting reluctantly to the second when inadequate theory is available. The book remains true to these objectives. The Chapter also sets a temporal context through sea-level change and concludes with a patchy discussion of fluvial sediment inputs to the world ocean.

Chapter Two is a well written, concise but comprehensive description of the mineralogical and physical properties of sediments, the bulk of which deals with the acquisition and analysis of grain size distributions and with their potential for palaeoenvironmental interpretation. Dyer presents all of the old arguments but makes no choices. The sixty pages of Chapter 3, on Fluid Flow, begin at the beginning with mass continuity, drag and open channel flow. Dyer then finds his pace with a very detailed description of boundary layers exemplified by flow over bedforms. The reader is brought right up to date with Dyer's Group's last work on some of the subject's theoretical shortcomings through detailed discussions of the reference height for roughness lengths and turbulent bursting phenomena. Tides are covered descriptively in six pages and Airy wave theory receives similarly short shrift, and then Dyer again changes pace for a brief but comprehensible section on wave-induced boundary layers.

There are two possible solutions to the problem of summarising and explaining the vast body of theory and literature which lies behind Chapters 4 to 8, the Sediment Dynamics of the book's title. This is because the initiation and subsequent transport of sediment must be dealt with in both steady and reversing flows. Dyer chooses the route which presents the initiation of bedload transport in first steady and then reversing flow (Chapter 4: Sediment Movement and Chapter 5: Sediment Movement Under Waves) before combining both initiation and flux of suspended sediment under both steady and reversing currents in Chapter 6 (Sediment Suspension). Dyer then returns to bedload rates in Chapter 7 (Sediment Transport Rate) and finally deals with Cohesive Sediments in