also given with each example site.

Chapter nine, by P.K. Haff, refers to a numerical model titled "Waterbots". This describes abstract units of runoff that reflect the result of one or many storms. Waterbots are considered to be geological parameters used in a digital landscape to create changes in it. This model is one of many quantitative models used in sediment transport and landscape evolution. It consists of estimating the trajectory of a waterbot down a given slope. The initial waterbot replaces a waterbot occupying a slope-cell and causes a chain reaction down the next cell in the trajectory by carrying an amount of sediment proportional to the slope-cell. The article discusses hill slope diffusion of parameters other than fluvial sediment transport such as rain splash and soil creep. It also considers bedrock erosion and weathering. Several examples of applications are given.

Chapter ten, by F. Ogden and A. Heilig, refers to another numerical model based on two-dimensional watershed-scale erosion modeling. Similar to the previous chapter, the authors explain the development of the hydraulic erosion model CASC2D. This model calculates the x and y directions of a flow in a given DEM grid. Calculations of flow routing, erosion and sediment transport are included in the model. This model is applied to an experimental watershed where a series of gauging stations have recorded streamflow and rain, sediment and water runoff. Calibration and performance of the model are also given. The most important parameters in this erosion model are the characteristics of the watershed and the spatial variability of rainfall.

Chapter eleven, by E. Mitasova and L. Mitas, describes multiscale soil erosion simulations for land use management. This study implements a methodology and use of simulation methods for erosion prediction and conservation measures. The method is based on a process-based model (SIMWE), and examples given by other two process-base models (RUSLE3D and USPED). The method includes simulations for overland water and sediment flow and sampling, erosion and deposition, and water depth in different topographic settings. It also considers landscape-scale erosion planning and design, which includes risk assessment and conservation strategies as well as preservation and restoration of wetlands.

Chapter twelve, by G. Tucker, S. Lancaster, N. Gasparini, and R. Bras, presents a channel-hill slope integrated landscape development model called CHILD, which addresses the relations between measurable processes and the dynamics of long-term landscape evolution related to those processes. This is a complex model that analyzes spatial-temporal topographic variability in a given terrain by studying the effects of surface hydrology, sediment transport, erosion, and other parameters in a given geological setting.

Chapter thirteen, by J. Duan, simulates stream-bank erosion processes with a two-dimensional numerical model. A dynamic theoretical simulation model was developed to evaluate stream-bank erosion for the purpose of channel restoration. Several formulas for calculation of bank erosion are given and compared. This study explains formulas of bank erosion rate due to flow and failure as part of the theoretical model analysis. A numerical simulation is given for flow, sediment transport and bank erosion. The simulation is compared to laboratory experiments.

Chapter fourteen, by V.G. Jetten and A.P.J. de Roo, describes spatial analysis of erosion conservation measures with LISEM. LISEM is a physically based hydrological and soil-erosion model. The model simulates runoff and erosion from single rainstorms for a relatively small area (10 km^2). The framework of LISEM includes various parameters: rain intensity from rain-gauges, which is mapped according to rainfall input and surface covered by vegetation; infiltration depending on the substrate; potential of micro-depression storage for overflow; different types of surface morphology; erosion-deposition model; and flow. This model is integrated into a raster GIS.

Chapter fifteen, by G.A. Oliphant, A. Alhawas, and G.S. Fraser, is about numerical simulation of sediment yield, storage and channel bed adjustments. This numerical simulation uses drainage classification to relate different stream orders to inflow and sediment, and shows that low-order streams respond more readily to input of water and sediments than do higher order streams. This is a very interesting conclusion as it relates lower order drainages to exogenous factors rather than structural-geological factors.

As part of the overall conclusion for the book, chapters sixteen and seventeen discuss the limits of erosion modeling and the future for managing land and water resources.

The quality of articles in this book is uneven, ranging from poor to excellent. The quality of the editing is also uneven: there are numerous typographical errors and many figures lack clear lettering. Also, some of the figures have handwritten comments on them. Nevertheless, the book will be of interest to those involved in the modeling of landscape evolution.

Coastal Environment: Environmental Problems in Coastal Regions IV

Edited by C.A. Brebbia
WIT Press, Southampton/Boston
c/o Computational Mechanics Inc.
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The coastal zone of the eastern Mediterranean has been subject to human modification and environmental impact for several millennia. It is therefore appropriate that the Fourth International Conference on Environmental Problems in Coastal Regions was convened in 2002 on the island of Rhodes. This was the birthplace of the earliest known maritime law, dating back to about 900

BC (Brewer, 1970). It was also the site of the famous Colossus, erected to commemorate a successful defence of this fortress harbour against terrible siege. The colossal statue stood for less than 60 years before falling in the earthquake of 224 BC. Thus, for 3000 years or more, the coast and nearshore waters of Rhodes have been littered with the debris of wars, shipwrecks, natural disasters, and the everyday life of a busy port, including memorably a marble 'Marine Venus' dragged from the harbour by fishermen (Durrell, 1953). As in other parts of the region, the cumulative impacts of this long history of human use are exacerbated today by more intrusive development pressures that often exert significant stress on the natural environment.

As editor C.A. Brebbia points out in the Preface, the First International Conference on Environmental Problems in Coastal Regions took place in Rio de Janeiro in 1996. Subsequent biennial meetings were convened in Cancun (1998) and Las Palmas de Gran Canaria (2000). Each was recorded in a volume of proceedings. The focus of the meetings, as seen in this latest volume, ranges from air and water pollution, groundwater contamination, and harbour water quality to issues of coastal erosion and sedimentation and the impacts of port structures and other coastal engineering activities. There is also a significant emphasis on coastal management issues, including environmental impact assessment, and growing attention to technological advances in remote sensing, survey technology, contaminant treatment, soft coastal protection, and other areas.

This collection contains 42 papers presented at the meeting in Rhodes. The book is divided into seven numbered sections, comprising from 2 to 11 papers each. While some, such as the sections on atmospheric processes and water quality, are thematically consistent, others such as those on environmental management and impact, erosion and drift, and sediment transport, are curiously mixed. A two-page author index appears at the end of the book.

Interesting contributions in Section 1 (***Environmental management and impact***) include papers on large-scale harbour clean-up in the Adriatic (Kaštela Bay, Croatia), coastal wetland hydrology (one contribution each from the USA and Greece), use of waste heat from ships' engines for decontamination of ballast water, contaminant impacts on endangered species at remote light-stations in British Columbia, treatment of chemical plant effluent, analysis of severe marine storms on Italian coasts, and numerical modelling of currents and water exchange in Japanese inter-island waters. In the very first paper, S. Kostopoulou (Economics, Aristotle University of Thessaloniki) examines environmental issues and sustainable planning strategies in an urban coastal setting. This paper considers the impacts of population expansion and poorly integrated urban development; it proposes an economic model framework for integrated coastal zone management incorporating analysis of key economic activities and their impacts on ecosystems, social conditions, and cultural heritage. Another paper by M. Tzatzanis and T. Wrbka (Institute of Ecology and Conservation Biology, University of Vienna) considers conservation-tourism conflicts ("Sun beds vs. sand dunes") in western Crete. They highlight the degradation of coastal landscapes by poorly planned tourism development over the past 40 years and the low level of environmental awareness among local residents as well as some tourists. The attraction of an important segment of the tourist population (those with higher environmental awareness, coming predominantly from parts of southern Europe and Germany) to undeveloped parts of the coast points to the value of environmental protection for a more sustainable tourism economy in the future.

Section 2 (***Oil slicks and spills***) contains only two papers, with some common authors. The first, by K. Lee (Fisheries and Oceans Canada) and co-authors with a variety of US and Canadian affiliations, is on monitoring the recovery of a salt marsh in Nova Scotia following an intentional crude-oil spill and five experimental remediation treatments (with an unoiled control case). Nutrient addition was found to be ineffective on an operational scale and the study concludes that natural attenuation is the preferred clean-up strategy in this setting. The second paper, by A.D. Venosa (US Environmental Protection Agency) and others, is on bioremediation of coastal freshwater wetlands and salt marshes, based on experimental spills at the same salt marsh site in Nova Scotia and a freshwater wetland along the St. Lawrence River near Québec.

Section 3 (***Erosion and drift***) and Section 4 (***Sediment transport***) are difficult to distinguish and might better have been combined in a single group. Section 3 has three papers, one on coastal erosion, another describing a laboratory study of bottom boundary roughness, and the third on the phenomenology of debris flows in coastal regions. The coastal erosion paper, by G.S. Xeidakis and P. Delimani (Civil Engineering, Democritus University of Thrace), provides an interesting review of factors affecting rates of cliff erosion along the northern Aegean coast (highlighting lithology and structure of cliff materials and anthropogenic effects such as diminished fluvial sediment supply resulting from stream regulation, and changes in nearshore wave conditions caused by coastal engineering structures). The paper on debris flows, by G. Lorenzini and N. Mazza (Agricultural Economics and Engineering, University of Bologna) provides an interesting and potentially useful review of the physics involved in triggering these hazardous flows, but is unfortunately handicapped by poor English and an obvious lack of editing. Lorenzini's name is misspelled at the head of the paper (acknowledged on an Erratum slip) and in the Table of Contents (not acknowledged) and various parts of the text are bordering on incomprehensible. The seven papers in Section 4 begin with an interesting contribution by A.P. Barros (Harvard University) and S.J. Jordan (Penn State University) on linkages between climate variability, changing land use, and sedimentation in Upper Chesapeake Bay, showing that anthropogenic land-use change in the drainage basin has increased rates of sediment accumulation by up to an order of magnitude. The authors argue that this,

together with dam construction, causing a significant decrease in the coarse fraction of sediment inputs, obscures the signature of major flood events in the sedimentary record. Other useful papers in this section include a full-scale laboratory investigation of sediment resuspension by waves (by J.J. Williams and co-authors from the Proudman Oceanographic Laboratory), and an analysis of the correlation between flow kinematics, bottom sediment type, and macrobenthos in the vicinity of a harbour and river mouth in Ishikari Bay, Japan (by T. Yamashita of Hokkaido University and two co-authors).

Section 5 (***Hydrodynamics and transport modelling***) also contains seven papers. The first, by T. Hibino (Engineering, Hiroshima University) and colleagues, considers the impact of variability in sea level and the path of the Kuroshio current on water quality in the Seto Inland Sea. This is based on an impressive 20-year monitoring program by a Japanese government agency. A contribution by T. Ohsawa and others (Engineering, Gifu University) demonstrates successful simulation of surface winds over Ise Bay, Japan, as part of an ocean monitoring system for this heavily populated area, where a 1959 typhoon caused the worst storm-surge disaster in Japanese history. H. Karahan (Civil Engineering, Pamukkale University, Denizli) presents a model demonstrating the impact of changing bathymetry on circulation and water quality in Izmir Bay, in a heavily populated region of Turkey. G.W. Hein (Geodesy and Navigation, University FAF Munich) and colleagues describe the development of a precise shallow-water bathymetric system using real-time kinematic GPS. An otherwise interesting paper on groundwater dynamics and management of an alluvial aquifer in the vicinity of Nice airport, southern France, by M. Hochart (Geosciences, Université de Franche-Comté) and others, suffers from many of the same linguistic and editorial problems mentioned earlier ("Nice airport was fitted out on the holocene Var delta, upright a coastal alluvial sheet which feeds the low Var valley and Nice city" [sic]). This paper does usefully demonstrate how inherited geological complexity in a Holocene deltaic sediment body, if properly understood, can significantly improve water management, in this case limiting saltwater intrusion to a coastal aquifer despite high pumping rates. The last paper in Section 5 is possibly the most valuable in the book. Based on an invited conference presentation by G. Rodríguez (Physics, Universidad de Las Palmas de Gran Canaria), this presents the Hartley transform as an efficient tool for estimating the spectral density function of time series data for surface waves, coastal currents, or other environmental phenomena. In contrast to the complex-valued Fourier transform, the transform introduced by Hartley (1942) is real-valued and otherwise effectively equivalent, therefore easier to program and computationally more efficient for use with real-valued time series.

Section 6 (***Water quality issues***) has five papers on topics ranging from water quality and trophic status at sites in Mexico, to an integrated autonomous system for coastal water-quality-monitoring developed in Italy, to a field study of suspended sediment and nutrient dispersal off a river in Japan during the snowmelt season. The last paper in this section, by J.H. Kim and others (Chemical Engineering and Materials Science, University of California, Irvine), presents field data and a conceptual steady-state model for the dispersal and fate of fecal indicator bacteria in the surf zone of a California beach. The model follows earlier work in computing a dilution ratio but also accounts for the non-conservative behaviour of bacterial pollutants with a new dimensionless number to estimate the relative importance of dispersal versus bacterial die-off.

Section 7 (***Atmospheric pollution and control***) includes five papers covering topics from application of new-generation air-quality dispersion models over complex coastal topography, to changes in the carbon cycle of a coastal region induced by industrial emissions to the atmosphere. Another paper describes the verification of models used for dispersion and air quality prediction in Australia. Two papers explore approaches to modelling surface ozone. The most interesting is a contribution by G. Latini and colleagues (Energetics, Ancona University) in which a neural network approach is applied to simulation of non-linear ozone formation in a complex coastal area where land-sea breezes play an important role.

Rounding out the book is a final pair of 'orphan' papers, grouped under the heading "Special Session" in the Table of Contents. The first, by R.M. Hassan (Water Engineering, IHE Delft), presents a case study on erosion problems and recommended solutions in the Egyptian resort city of Alexandria. Driven by very large capital investments in hotel and other tourism infrastructure and the diminished width of the beaches, a protection strategy was adopted using submerged breakwaters and some beach nourishment. An artificial berm armoured with concrete cubes was built along 16 km of coast in connection with widening of the coastal highway to six lanes. It is interesting to speculate on the potential resilience of this coast, thus hardened, to future changes in sea level, wave climate, and shoreface profile adjustment. The final paper, by C. O'Donnell and others (Civil Engineering, University of Liverpool), on a laboratory study to investigate the effect of seepage flows on bedload sediment transport in sand, showed a very small effect at rates up to 70 to 80% of those required for bed failure, after which bedload transport increased by two to three times. Each of these papers would fit in an earlier section and their appearance at the end of the book is curious.

Poor copy editing is evident throughout this volume and many papers require some effort to decipher. Despite the inclusion of some valuable papers, this collection covers such a disparate range of disciplines with little in the way of an integrating thread, that I was greatly disappointed after the promise of such an apt conference venue. More careful editing, objective paper reviews, sensible organization, short linking or introductory paragraphs between sections, and a brief wrap-up piece might have salvaged some coherence and conceptual value to produce more than a mixed bag of highly variable content and quality. With all its shortcomings, at the list

price of US$247, this volume is unlikely to appeal to individual researchers, who are more likely to seek out papers of interest in a library copy. However, in these days of shrinking library budgets and rising journal subscription prices, it also questionable how many libraries will be willing to expand their collection of proceedings from this otherwise potentially valuable conference series.

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Climate Change: A Multidisciplinary Approach

by William James Burroughs
Cambridge University Press
40 West 20th Street, New York, NY 10011-4211
2001, 298 p. Paperback US$29.95, Hardback US$85.00

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This small, readable, and useful volume on climatology and climatic change is aimed at the educated non-specialist. This is fortunate, for it is a comprehensive overview and we are all non-specialists for many of the topics discussed. The chapter headings are as follows:

1. **Introduction**
2. **Radiation and the Earth's Energy Balance**
3. **The Elements of Climate** (atmospheric and oceanic circulation)
4. **Evidence of Climate Change** (geological and historic climatic change)
5. **Consequences of Climate Change** (from sea levels to the spread of disease)
6. **The Measurement of Climatic Change** (a review of data sources from pollen analysis to satellites)
7. **Statistics, Significance and Cycles** (mathematical techniques for understanding the climatic evidence)
8. **Causes of Climatic Change** (from autovariance to human activities)
9. **Modelling the Climate** (The essential features of computer climate models and their ability to replicate climate)
10. **Predicting Climate Change** (natural fluctuations and human induced change)

Burroughs appears to have designed the Introduction as a filter to exclude the uncertain, rather than to attract the reader to topics in climatology and climatic change. An anecdotal and historical introduction to climate change could have provided a more enticing entrance to a fascinating subject. Instead, a battery of graphs establishes concepts in climatic variability and climatic change. However, this chapter serves as a warning; if you want a superficial treatment of the subject, or are allergic to analysis, do not read on.

The strength of the book is in Chapters 2 to 10, where the subject is developed from the essentials of the earth's radiation balance to a discussion of possible future climatic change. Burroughs is clearly most comfortable in the physics of climate and the volume maintains a rigorous, numeric approach to the topic. The diversity of topics considered is commendable.

Only a small portion of the volume, Chapter 4, dealing with the evidence of past climatic change, is of particular interest to geologists. His treatment touches on plate tectonics and "Snowball Earth" to "The Little Ice Age", including a figure illustrating sequence stratigraphy. Most of the discussion focuses on the Pleistocene and Holocene, with a critical dissection of the evidence. Anyone who has experienced the vast gulf in thinking between a modern climatologist, who considers a 30-year series a climatic average, and a paleoclimatologist, for whom decadal resolution would be very high resolution, will appreciate how well Burroughs writes in both areas.

Heartening to a geologist is his firm statement of the value of the geological record. He writes, " In terms of current concerns about future changes in the climate, these [geological] changes seem immeasurably slow and hence of little relevance to contemporary issues. This view is short sighted. An understanding of longer term changes not only sets current events in context, but also identifies the importance of different components of the global climate....So the more we know about what has happened in the past...the easier it may be to appreciate the questions that need to be answered today" (p. 74).

Burroughs shows good scientific balance in the presentation of controversial topics, emphasizes uncertainties, and is commendably restrained in conclusions. For example, he does not press the (enticing) case for a climatic influence in human evolution, noting that the topic is "....an intellectual snakepit." (p. 121).

Considering the current Kyoto Accord controversy, Chapter 10, "Predicting Climate Change" is especially relevant. Burroughs comments: "The cozy notion that warming will simply produce a gradual displacement of climatic zones to higher latitudes, so England will eventually have a climate like southern France, is probably a gross oversimplification". What will matter, but is not known, is whether there will be a significant shift in the incidence of weather regimes. Regarding the much maligned general circulation models, he points out that, in spite of their limitations, there is no alternative to these tools to try to understand the climate and possible human impact.

Many figures are attributed to Intergovernmental Panel on Climate Change (IPCC) reports, which have brought together and synthesized work from diverse fields. Capable as he is, Burroughs would not likely have been able to bring this volume together without the use of IPCC reports. We have now had the 3rd IPCC report. Perhaps this volume will be updated to IPCC, 2001.

Several of the half-tone figures are of poor quality or are outright muddy (Fig 8.1, p. 209 showing the dust cloud distribution after the Pinatubo eruption). In spite of this flaw, this is a commendable book, and in soft cover, at a price that students deserve.