

**Understanding Sea-Level Rise and Variability.** John A. Church *et al.* (eds). Wiley-Blackwell, A John Wiley & Sons Ltd Publication, The Atrium, Southern Gate, Chichester, West Sussex, PO19 85Q, UK. 2010. xxvi + 428 pp. Price not mentioned.

It is well known that a consequence of the climate change due to addition of greenhouse gases into the atmosphere due to human activity is sea-level rise. What is not known as well is that a large number of processes are involved in linking the change in climate to the change in sea level. Each of these processes must be understood and carefully observed to quantify its contribution to the sea-level change. The book under review, with 13 chapters written by 98 contributors and spread over 428 pages, does a commendable job of putting in perspective the processes that link climate change to sea-level change. The book also reveals how human beings in the last hundred years have changed the Earth, once considered far too big for humans to change it.

The book is a result of the work undertaken by the Intergovernmental Panel on Climate Change (IPCC) to prepare its Fourth Assessment Report completed in 2007. The same year the IPCC was awarded the Nobel Peace Prize for its efforts to gather and disseminate knowledge about man-made climate change. The World Climate Research Programme, which led the effort towards the scientific basis for the IPCC Assessments, organized a workshop in Paris during 6–9 June 2006, that brought together the world’s specialists on sea-level change to assess present understanding of the link between climate change and sea-level change. The deliberations at the workshop have been subsequently updated,

consolidated and summarized into the present book. Its primary concern is the uncertainties in determining how global sea level has changed in the past and will change in the future.

A significant fraction of the Earth’s inhabitants is crowded near the coastline, often attracted by its fertile coastal plain, easy access to sea-lanes for transportation, recreational opportunities, gainful employment from traditional activities such as fishing and from modern industrial complexes that find the coasts attractive for a number of reasons, including access to the sea for discharging waste. The introductory chapter sets the stage for the rest of chapters with a grim message that while history shows that society’s progress occurred during times of stable climate and sea level, the world is now moving into a period of accelerated change in both. The second chapter looks at what the impacts of sea-level rise have been and what the options before the society are to cope with the impacts. While the sea-level rise has its own adverse impacts, a point not usually appreciated enough is that a major factor causing damage to a coastal area is occurrence of extreme sea levels, such as that due to a surge of sea level arising from a storm in the coastal area. Expected with the present climate change is an increase in occurrence of such extreme events. Chapter 3 assesses impacts of such events on offshore structures and costal industrial complexes.

The next two chapters are dedicated to description of recorded sea-level change. Chapter 4 examines records before the modern sea-level recording systems were in place, and Chapter 5 is dedicated to estimates based on modern systems. Like the introductory chapter, Chapter 5 too has a grim message. A consensus amongst the specialists examining tide-gauge records around the globe is that the sea-level rise during the 20th century was ‘closer to 2 than 1 mm/year’. It was about 1.7 mm/yr during the last half a century. The disturbing part is that satellite data during the last decade and a half suggest a rise of 3.2 mm/yr. What are the processes that have led to the observed increase? This question is addressed in the next three chapters. Chapter 6 looks at contribution of change in ocean temperature and salinity, Chapter 7 at the cryosphere (polar ice caps and glaciers), and Chapter 8 at the consequences of changes in terrestrial water storage (due

to building of dams, for example). Keeping track of the complex array of processes that lead to sea-level rise requires a robust frame of reference that can take into account the fact that shape of the Earth itself changes with time. Complexities associated with this issue are discussed in Chapters 9 and 10.

As noted earlier, major damage to coastal areas occurs due to extreme sea levels. The coastline surrounding the Bay of Bengal, for example, has been a major sufferer due to storm surges generated by the cyclones that either originate or intensify over the bay. Extreme sea levels can also occur due to waves generated by winds over the open ocean. Most vulnerable to extremes of surges and wind waves are low-lying coastal areas and coral islands such as the Lakshadweep Islands. Chapter 11 discusses past and future changes in extreme sea levels and waves. A conclusion drawn in this chapter is that there is an urgent need for sustained observations of sea level to get a handle on addressing issues related to extreme water levels.

Sustained high-quality observations are in fact required to study other aspects of sea-level change too. This theme is the focus of Chapter 12, where existing capabilities of sea-level observing systems are described and new capabilities envisioned. Chapter 13, the concluding chapter, provides a synthesis of the important issues related to sea-level rise and its implications to society.

This commendable compilation of knowledge on sea level by well-known experts around the world would be of interest to the Indian community for four reasons. First, India owns possibly the best collection of sea-level records in the Indian Ocean. The Mumbai tide-gauge record is well over a century long. The



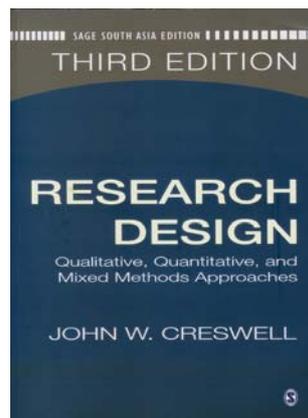
Telegraph poles south of Bangkok, Thailand: built on subsiding land, they are now up to 1 km out to sea.

country needs to ensure that the record is examined from a number of angles that this book discusses. Second, every chapter of the book concludes with recommendations on issues that need to be addressed to make progress in understanding the sea-level rise. These recommendations would help researchers formulate new problems with focus on the Indian coastline and islands. The researchers would also benefit from the exhaustive list of references at the end of each chapter. Third, the country is in the process of putting together a policy to manage its coastline. The book provides an overview of the issues that the policymaker should be aware of with respect of sea level, including its rise and its tendency for attaining extreme values. The policymaker will find the first three chapters and the last chapter useful to get an overview of the concerns that have been raised so far around the world. Fourth, the book brings home convincingly the fact that the expertise in earth sciences required to face modern-day problems requires going across borders of classical disciplines of earth sciences – oceanography, meteorology, geology, geophysics, glaciology, hydrology, etc. If one were to teach a course to stress the need to look at the earth as an integrated system, an eminent choice of a topic for the course would be sea-level change due to climate change. This book would be a wonderful textbook for the course.

In summary, I strongly recommend this book because of its thorough and exhaustive discussion on all aspects of sea-level rise due to climate change. Virtually every researcher and student of earth system can find something in it that links his/her field of interest to the broad canvas of research on sea-level rise. There is useful material in it too for the policymaker concerned with management of coastlines and islands to confront the sea-level rise.

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**Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.**

John W. Creswell. SAGE Publications India Pvt Ltd, B1/I-1 Mohan Cooperative Industrial Area, Mathura Road, New Delhi 110 044. 2011. 3rd edn. xxix + 260 pp. Price: Rs 395.

Human and social science researchers typically ask two fundamental types of question: (i) *What* is going on? (ii) *Why* is it going on? For a new researcher it is rare to find a book on research design which comprehensively covers both these questions. The book under review is one such rare edition. It takes a strategic perspective and details, often step-by-step, various approaches to investigating research questions. Through limited in providing designs for complex research questions, it is an excellent reference for anyone planning to start serious, well-formed social science research.

The book is divided into two parts and ten chapters. The first part, comprising five chapters, discusses the preliminary considerations before designing a research. It examines the various philosophical worldviews, the use of literature in research and in the design techniques, integration of theory in research, and developing the theoretical perspective of research. Each of these sub-themes is also discussed from the research design perspective. The first part also includes a chapter on writing strategies and ethical considerations in a research process. The second part, comprising five chapters, discusses the main theme of the book. It puts forth the ways to frame research questions under the qualitative, quantitative and mixed method approaches, and illustrates the various research designs possible to answer some basic research questions.

Chapter 1 commences with putting forth the four main worldviews, namely the post positivist, the social constructivist, the advocacy/participatory, and the pragmatic and listing the various types of research methodologies. It then discusses research design as different worldviews and research strategies. Chapter 2 highlights the use of literature in various types of research designs, including the design techniques. This chapter also comprises several examples illustrating the link between literature review and research methodology. Chapter 3 begins by reviewing the definition of theory and focuses on the placement of theory in a quantitative study. Chapter 4 assesses how proposal structures differ according to the nature of design, and discusses writing consistency considerations, principles of writing a good prose and ethical issues involved in a research process. Chapter 5 serves as an introduction to the second part of the book. It illustrates the different approaches to writing a proposal, namely introduction, research problem, integrating literature and identifying the target audience for a research study.

Chapter 6 is the beginning of the second part of the book. It discusses research statements and research purpose from the nature of enquiry perspective, namely qualitative, quantitative or mix method. Chapter 7 expands the discussion by including research questions and hypotheses, and gives a model for presenting descriptive and inferential quantitative questions and hypotheses. Chapters 8–10 examine the main focus on the book, namely the research designs. Chapter 8 illustrates the quantitative procedures. It gives a checklist to develop topics for a survey research, steps for survey procedures, checklist for experimental research, identifies types of experimental procedures for best fit, and discusses the potential internal and external validity threats to a study. Chapter 9 illustrates the qualitative procedures, the basic characteristics of qualitative research, the difference between types of data collection, distinguishes between forms of data analysis and analysis within strategies of enquiry, and strategies to establish validity of qualitative studies. Chapter 10 illustrates the mixed method procedures. It discusses the timing, weight and theory related to mixed method design, puts forth six models of enquiry, and deliberates on their basic differences.