


## Book Review

### Wilco Graf von Hardenberg, *Sea Level: A History*

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In *Sea Level: A History*, historian of science and the environment Wilco Graf von Hardenberg explores the history of sea level as a scientific concept and a datum for measurement from the eighteenth century to the present. Sea level, Hardenberg convincingly demonstrates, is not and never has been a natural or physical plane or index; instead, it is a construct, ‘a product of technically and culturally determined assumptions’, frequently involving political and imperial motivations (p. 1). Over the course of six chapters, he traces how those assumptions formed and changed during the period in question; how they were affected by scientific, national and imperial politics; and how the resulting idea of sea level as a datum both grew from ongoing scientific discussions and was then enlisted into new ones, including its current role as a leading indicator of climate change.

Hardenberg traces three phases of scientific conception of the sea’s level: a falling sea, a stable sea and now a rising sea, as well as three stages of sea level’s use as a metric: its definition, its adoption as a reference point and its redefinition as an index of the Anthropocene. ‘Sea level as a concept is a product of Western ontologies’, he tells us, though the rest of the world makes appearances in colonial contexts and as they come under threat of sea level rise, and other possibilities exist, such as the Māori conception of the continuity of sea and land (p. 135).

For much of the eighteenth century, Hardenberg shows, sea levels were understood as falling, partly in continuity with the biblical flood story, but also supported by research such the use of historical legal documents to trace changes in the height of proprietary seal-hunting locations in the Baltic Sea. By about the 1830s, though, the near simultaneous development, on the one hand, of theories of a stable sea with local land uplift deployed to explain apparent relative change, and, on the other, of self-registering tidal gauges, allowed a ‘mean’ sea level be calculated more accurately. Beyond scientific interest, this also suggested a useful surveying benchmark that would allow heights to be consistently delineated in positive numbers.

But, of course, it was not that simple to find and agree on this mean. Hardenberg demonstrates that as national efforts to map and build infrastructure expanded to imperial efforts to possess and control, the benchmarks adopted by different governments depended on their national goals. International efforts to agree upon a datum existed, but over time they ‘dwindled into oblivion’, because of ongoing uncertainty in the accuracy and precision of measurement, and even more because the symbolism of using a benchmark within one’s own boundaries was too strong to overcome without good reason, which none of the

proposed international reference points was able to provide (p. 73). Even within an empire, comparing mean-sea-level calculations between far-flung places was impossible, and in fact served little purpose.

Towards the end of the nineteenth century, Hardenberg shows, scientific consensus on sea level shifted again, as theories of ice ages and large-scale glaciation provided a mechanism for sea level to vary or even rise. The new debate, by the twentieth century, was not whether sea levels could change, but whether they did so only on geological timescales, or also historical ones. After mid-century, ongoing change had become the consensus, and satellite technology provided a new means of measuring those levels, even as the international scientific community increasingly understood ongoing climate change to be associated with rising – even accelerating – sea levels.

Hardenberg deftly interweaves multiple forms of evidence and expertise through his story, from legal documents, to the received wisdom of mariners, to pronouncements of the United Nations. He also provides useful – and very readable – explanations of the resulting tapestry, such as his unpacking of satellite technology: although it appears to offer precision and objectivity – the observer is literally outside the observed system – the previous long-term series of *in situ* observations proved necessary to calibrate orbiting instruments. At the same time, the apparent disjuncture between data obtained with old waterline gauges and new orbiting radars is invoked by climate sceptics to undermine conclusions drawn from the combined data.

Even as satellites have allowed precise measurement, Hardenberg tells us they have also led to the final abandonment of efforts to identify a global mean sea level as a reference plane. This is ironic, as a rising global sea level is now a symbol for the Anthropocene. Focusing on a general, mean rise in level globally, though, makes it ‘much blurrier’ in terms of specific geography and chronology (p. 126). Models are not good at showing how and when sea level rise might play out at a given locality, and ‘conceptualizing the sea as a mean smooths out the perception of dangers’ and ‘hides some of the risks’ that threaten specific coastal populations (p. 130).

We have, Hardenberg asserts, absorbed the idea of the world as a stable place, and of the constantly shifting sea as having a mean level, so even if we accept sea level rise in theory, it makes it hard to comprehend on the local level. While this might seem a warning in the specific, it also demonstrates the broader applicability of his argument: sea level might be a construct, but that does not make it less real.

As the engagement with climate change in the final chapters suggests, *Sea Level* will be of interest to scholars of the environment and of disaster studies, but its tracing of changing scientific ideas definitely deserves attention from historians of science, especially historians of geology and ocean sciences, and of metrology and related technologies, particularly in imperial contexts. The general reader (or student) may want to keep a notebook handy to track the cast of characters, but the book’s readable prose and enlightening connections will make it worth their while to do so.