Sea Level Information for Coastal Adaptation Decision Making

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Coastal risk management and climate adaptation require sea level (SL) information aligned to the specific decision context coastal decision makers are facing, and this will vary with aspects such as risk appetite and the time-scales involved. This alignment is not a straight forward exercise and often a gap between available information and what is required for a specific decision context remains. For example, the IPCC sea-level rise scenarios, which are arguably the most authoritative source of information on future global mean sea-level rise, do not provide adequate guidance on aspects such as the possibility or magnitude of rapid melting of the ice sheets, which will be especially important to the most risk-averse actors.

This paper stresses that any effort to use SL information in coastal risk management and adaptation decision making needs to start with characterising the decision context confronted with, and then proceed to selecting an appropriate decision making framework and in turn suitable SL information. The decision context refers to the specific decision faced by the coastal actor and the biophysical, social and institutional environment in which it is embedded. Coastal decision contexts are diverse and may be distinguished through a variety of dimension such as decision horizon (lead and life time of adaptation options), risk preferences (whether an actor is, e.g., risk neutral or risk averse) and existing policy prescriptions. Each dimension has indications on which decision framework may be suitable. For example, if actors are risk averse, standard decision making frameworks that rely on computing the mathematical expectation of the benefits of adaptation (e.g. cost-benefit analysis) are not suitable. Alternative decision-making frameworks such as Minimax or robust decision making are required instead.

The applicable decision making framework has, in turn, indications on the kind of SL information required. For example, cost-benefit analysis requires probabilistic information on SL rise, while Minimax requires information on its upper tail-end. Finally, not all of the SL information required by a chosen decision making framework may be attainable given the current state-of-the-art of SL science. Hence, coastal decision making needs to establish an interactive exercise between coastal managers, decisions scientist and SL scientists, iteratively aligning decision making frameworks and the latest SL information to the specific decision context faced. This alignment needs to take account of both the latest estimates of uncertainty in SL and the confidence in the approaches applied for deriving these estimates, the latter of which typically comes from expert judgement.

This paper addresses gaps and opportunities in better aligning SL information to coastal decision making. We discuss different types of SL rise related adaptation decision contexts and map these to appropriate decision making frameworks. Next, we review some of the SL rise information available for coastal decision making, discuss uncertainty metrics and methods behind, and contrast these with the requirements of adaptation risk management. Finally, we outline research opportunities at the interface between SL science and decision science for improving the utilization of SL information in coastal adaptation decision making.

Keywords: adaptation, decision making, sea-level rise, coastal