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Resilience of coastal wetlands to sea level rise: A global-scale assessment

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Globally, coastal wetlands are increasingly considered as valuable landscape features. They deliver a wide range of globally relevant ecosystem services, including carbon sequestration, natural coastal protection, support of fisheries and water quality improvement. Widespread uncertainty exists as to how coastal wetlands will respond to 21st century global sea level rise (SLR). Regional to global-scale projections suggest a reduction in present-day coastal wetland area by 20% to 90%, while field data and local-scale models often suggest much higher resilience.
Through a new global model, we show that the primary reason for these scale differences comes from the need to consider essential eco-geomorphological and socio-economic system feedbacks, represented in small-scale studies but not yet considered in large-scale assessments. Now taking these feedbacks into account, we project that until 2100 less than 20% of the present-day global coastal wetland area will be lost, even under the highest SLR scenario. The resilience of coastal wetlands globally is primarily driven by coastal accommodation space, allowing coastal wetlands to migrate inland in response to SLR. It is strongly affected by human coastal infrastructure and how it will develop over the 21st century. Globally, we expect gains of up to 96% of the current area if more than 38% of all coastal wetlands are given sufficient accommodation space to migrate inland. At present, little is known about what percentage of coastal wetlands globally are actually able to migrate inland, but our estimate is that this potential is available to only 38% of the global wetlands. Hence, if no additional accommodation space is created, global losses are inevitable.
However, conversely, large-scale loss of coastal wetlands is avoidable if new accommodation space is created through innovative “nature-based adaptation” schemes, currently implemented as local-scale projects only. Such approaches will need to be strategically up-scaled to allow coastal wetlands to adapt to SLR globally and, at the same time, help protect the rapidly increasing global coastal population.