Global morphodynamic response of deltas to sea-level rise in the 21st century

Jaap Nienhuis\(^1\) and Roderik van de Wal\(^{1,2}\)
\(^1\)Utrecht University, Physical Geography, Netherlands (j.h.nienhuis@uu.nl)
\(^2\)Utrecht University, IMAU, Netherlands (r.s.w.vandewal@uu.nl)

River deltas are low lying areas that will likely experience significant land loss because of relative sea-level rise. Most future projections of delta land loss, however, assume passive coastal inundation (using so-called “bath-tub” models) and as such they tend to be unvalidated and exclude morphodynamic processes such as sedimentation. To improve future projections of delta land area change, here we apply a morphodynamic model of delta response to RSLR to all 10,000 deltas globally. We use historic RSLR, sediment supply, and observed delta land area change from 1985-2015 to calibrate and validate this model for all these deltas. Applying our model using future RSLR scenarios, we find that by the end of this century deltas globally will have lost land under all RCP scenarios. Land loss is aggravated by river dams that have diminished sediment supply to many deltas. RSLR expected under RCP8.5 will force delta land loss at at rates exceeding 900 km\(^2\)/yr by 2100. We predict cumulative land loss under RCP8.5 up to 2100 of ~35,000 km\(^2\), or about 4\% of total global delta area.