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Shoreline change in 48 river deltas: towards indexing erosion as a criterion of delta vulnerability

Manon Besset, Edward Anthony, Philippe Dussouillez, and François Sabatier
Aix-Marseille University, CEREGE - OSU PYTHEAS, Aix en Provence cedex 4, France (besset@cerege.fr)

River deltas are considered as increasingly vulnerable to environmental modifications resulting from climate change and human activities. Delta vulnerability is associated with a number of drivers, chief among which are depleted sediment supply, changes in water discharge, and pumping of underground fluids. These activities lead to accelerated subsidence and erosion, the twin mechanisms of delta destruction. A lot of attention has been focused on vulnerability resulting from accelerated subsidence. Here, we address the problem of delta erosion based on the analysis of 48 deltas, including 30 of the world's largest deltas. Using satellite images (Landsat, Spot 5, Spot 6) and aerial photographs, we determined for each delta, the change in delta protruberance area over a 30-year period, this being defined as the area of delta protrusion relative to a straight shoreline running across the delta plain and linking the delta to the adjacent non-protruding non-deltaic shoreline. We classified the deltas in terms of net area loss, gain, or stability, the last corresponding to an uncertainty threshold of _0.3% of the delta's protruberance over the 30-year period. The results show that 25 (52%) of the studied set of deltas show area loss, 11 (23%) stability, and 12 (25%) gain. Area loss is more important in deltas with a protruberance area <500 km2 (67% of small deltas) than in the largest deltas (23%), with a protruberance area >500 km2. Besides sediment supply conditions, which are a primary factor in delta erosion, eroding deltas tend to be more commonly subjected to relatively significant levels of wave energy.