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Field observations and morphodynamic modeling of spontaneous tidal network formation within a constructed salt marsh

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We have monitored and analyzed, through remote sensing and ancillary field surveys, the rapid (O(1) year) development of a tidal network within a newly restored artificial salt marsh in the Venice Lagoon. After the construction of the salt marsh, a network of volunteer creeks established themselves away from an artificial main channel, with mean and maximum annual headward-growth rates of 11 m/yr and 18 m/yr, respectively. The rapid formation of this system of tidal creeks provides a unique opportunity to test the reliability of a model of tidal network initiation and development, previously proposed by the authors. The restored marsh presents the characteristics of a controlled environment analogous to a large-scale field laboratory, as it allows comparison of the morphologic features of real and simulated network structures under the reasonable assumption of neglecting accretion and deposition processes over the timescales of observation. Our results compare favorably with observational evidence: the synthetic creeks tend to originate at locations which match those of the actual ones, showing that the model proves reasonably capable of reproducing the main features of the actual channel-network patterns. The model reproduces statistical network characteristics of eco-morphodynamic and hydrodynamic relevance and captures the dominant modes of the network-incision process.