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Limited predictability properties of modelled sand ridges on the inner shelf

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A nonlinear morphodynamic model is discussed that simulates feedbacks between a storm-driven current, waves and the sandy bottom of the inner shelf (depths between 10 and 20 m). The currents are governed by shallow water equations, the wave properties are described by phase-averaged equations, the bed level follows from sediment mass conservation and a Bailard-type of formulation for sediment transport is employed. The model describes the time evolution of amplitudes of known eigenmodes of the system, which resemble observed shoreface-connected sand ridges. Here, the sensitivity of the characteristics of finite-amplitude ridges to changes in the number N of modelled subharmonics (of the initially fastest growing mode) is investigated. It turns out that for any choice of N the model shows the growth and subsequent saturation of the height of the ridges. The migration speed of the ridges and the average spacings between successive ridges in the saturated state differ from those in the initial state. The saturation time, final height, average spacing and migration speed of the sand ridges hardly vary with N and they appear to agree fairly well with field data. However, individual time series of modal amplitudes and of bottom patterns strongly depend on the choice for N. As the latter parameter is not well known the model results suggest that the detailed dynamics of finite-amplitude ridges can only be predicted for a finite amount of time.