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Seasonal occurence of toxic hydrogen sulfide in the surface waters of the Benguela upwelling area off Namibia

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The ecosystem off Namibia experiences seasonal events of hydrogen sulphide occurence in coastal surface waters. The origin of this toxic gas is still under discussion. A numerical ecosystem model is used to test one special hypotheses, which explains the hypoxia as a consequence of reduced ventilation of the shelf waters. The ecosystem model is based on the ERGOM code and is fully coupled with a 3D circulation model. It simulates the nitrogen cycle and considers nutrients, primary producers and a bulk zooplankton. Oxygen is consumed by bacteria recycling organic matter in the water column and in the sediment. Usually, the shelf is ventilated by a southward coastal undercurrent and an Ekman compensation current, which both supply dissolved oxygen and nitrate. In response to relaxed trade winds these currents may weaken or disappear. When dissolved oxygen and nitrate are exhausted, sulphate is reduced and hydrogen sulphide is formed in the near bottom water. If the trades intensify again, a considerable amount of hypoxic water may reach the surface by upwelling.

The model is driven with QUIKscat winds and integrated over 5 model years. The results are discussed in comparison with field data and remote sensing investigations. The simulations demonstrate a direct link between atmospheric forcing and ecosystem dynamics.