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Instability-Driven Benthic Storms Below the Separated Gulf Stream in a High Resolution Ocean Model

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Mixed barotropic-baroclinic instability accompanied by deep cyclogenesis is a major driver for benthic storms below the separated Gulf Stream. To show this the output of the 1/20°-horizontal resolution ocean general circulation model VIKING20 was examined to investigate the relation between the gain in eddy kinetic energy due to energy transfer and benthic storm probability in the western North Atlantic. Between Cape Hatteras and the New England Seamounts the Gulf Stream predominantly releases its energy to the eddy field. Regions of eddy kinetic energy source due to energy transfer were found to be located upstream of the center of the structure of highest benthic storm probabilities and near-bottom eddy kinetic energy maxima. The upstream shift is characteristic for baroclinic instability. The relevant physical process is identified to be cyclogenesis: each year about three developing meander troughs of the Gulf Stream are accompanied by cyclones that extend over the whole water column and are associated with large bottom velocities of more than 0.4 m/s.