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The nature and dynamics of oceanic forcing of seasonal and interannual variability of coastal hypoxia in the Benguela upwelling system

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Natural hypoxia in the global ocean is receiving increasing attention because of the uncertainties its variability, particularly in the context of global change, raises in respect of coastal habitats, biodiversity and ecosystem services. Recent understanding of hypoxia indicates that its incidence and strength are governed by complex coupled physical and biogeochemical processes.

In the Benguela system, recent work has shown how the linkages between the Eastern Tropical South Atlantic (ETSA) and the upwelling system are central to understanding the seasonal – interannual variability of hypoxia. Recent work has established a mechanistic basis for the important incidence of warm water events and their relationship to the relaxation of western equatorial winds (1). Shelf hypoxia events in the Benguela upwelling system appear to be closely correlated with such events on seasonal, interannual and decadal scales. Furthermore, recent reviews (2) of the historical biogeochemical data archive have shown that the boundary conditions of the central Benguela upwelling system are of equatorial origin.

However, it is not the warm water that transports the hypoxia but the sub-thermocline waters in response to changes in stratification. We present the basis for this coupled physical response. Hypoxia in the central Benguela is then a response to the boundary conditions provided by the oceanic signal rather than shelf based biogeochemical oxygen demand fluxes. Shelf hypoxia is suggested to be strongly modulated by the dynamics of the coupled atmospheric – oceanic responses in the Equatorial system. We use a combination of observational and modelling (Clipper) data to explain the

dynamical responses that govern this coupling, provide an overall conceptual model and discuss some possible climate change scenarios.

1 Florenchie, P., Lutjeharms, R. E., & Reason, C. J. C. (2003). The source of Benguela Niños in the South Atlantic Ocean. *Geophysical Research Letters*, 30(10), 12

2 Monteiro P.M.S. and van der Plas, A.K. (2005) Forecasting Low Oxygen Water (LOW) variability in the Benguela System. THE BENGUELA: PREDICTING A LARGE MARINE ECOSYSTEM. Elsevier Series, Large Marine Ecosystems Part II: Chapter 5.