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Spatial and temporal variability of the Agulhas frontal system in the South West Indian Ocean through a comparative study between model and *in situ* observations from OISO (Océan Indien Service d'Observation)

J. Llido (1), E. Machu (2), J. R. E. Lutjeharms (3), N. Metzl (4) and **V. Garçon** (1)

(1) Laboratoire d'Etudes en Géophysique et Océanographie Spatiales, Toulouse, France, (2) Centre de Recherches Halieutiques Méditerranéenne et Tropicale, Sète, France, (3) Department of Oceanography, University of Cape Town, South Africa, (4) Laboratoire de Biogéochimie et Chimie Marines, Paris, France

(garcon@notos.cst.cnes.fr / Phone : 33.5.61.33.29.57, llido@notos.cst.cnes.fr / Phone : 33.5.61.33.27.85)

A three dimensional regional physical model AGAPE (AGulhas As Primitive Equation) coupled with a biological model (Nutrient, Phytoplankton, Zooplankton, Detritus) with an eddy-permitting (1/3˚ x 1/3˚) horizontal resolution is used to study the seasonal and interannual variability of the Agulhas frontal system formed by the closed juxtaposition of the Agulhas Front (AF) and the Subtropical Front (STF) associated to the Agulhas Return Current and the Subtropical Convergence respectively, and further south to the Subantartic Front (SAF). A comparative study is carried out between modelled fields and *in situ* observations collected along repetitive oceanic transects Réunion-Crozet-Kerguelen-Amsterdam-Réunion during the OISO (Océan Indien Service d'Observation) cruises in 1998 and 2000.

The seasonal variability of the Agulhas system observed during the OISO cruises east of 50˚E is quite well reproduced by the model. In the South Western Indian Subtropical Gyre (SWSIG) region, the modelled chlorophyll field exhibits a maximum concentration in subsurface near 100 m during austral spring-summer, in agreement with observations. In winter, the distribution of nutrients extends until 34˚S, further north than

the rest of the year explaining the highest chlorophyll concentrations in the SWSIG both in the model and observations. At the Subtropical Convergence (STC), maximum gradients of temperature, salinity and nutrients are measured in austral winter-spring. These gradients are slightly underestimated by the model and some differences appear also in their seasonal variability. The biological front simulated by the model is diffused and the spatial heterogeneity of the modelled chlorophyll field is weaker than that observed during the OISO cruises. This lack of spatial variability may be attributed first to the coarse model resolution that cannot reproduce submesoscale vertical motions and secondly to the monthly interannual atmospheric forcing used which does not include high frequency information.

The interannual variability of the Agulhas Current system is mainly marked by a southward shift of the frontal system between the years 1998 and 2000. Both *in situ* observations and model show that the maximum temperature and salinity horizontal gradients take place 2˚-3˚ further south in 1998 than in 2000, whatever the season. This southward shift of the dynamical fronts influences also the horizontal distribution of nutrients and chlorophyll a as observed during the OISO cruises. The austral summer 2000 presents higher chlorophyll concentrations than in summer 1998, in agreement with the *in situ* observations.