Geoscientific Model Development Discussions

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Comment on gmd-2022-130

Anonymous Referee #3

Referee comment on "Impact of increased resolution on the representation of the Canary upwelling system in climate models" by Adama Sylla et al., Geosci. Model Dev. Discuss., https://doi.org/10.5194/gmd-2022-130-RC3, 2022

Authors investigate the Canary upwelling system with the use of six global climate models at high and standard resolution from the HighResMIP project covering quite a long period of time from 1950-2014. The analysis done by the authors is based not only on the SST, wind stress, sea surface height, but also in the layer depth fields. In that sense, I would like to arise my minor comment or just a curiosity.

Minor comment:

1.- Bonino et al. (2019) pointed out that both the wind stress and the stratification should be considered in order to evaluate future changes in coastal upwelling. Bakun (1990) did not consider the stratification and other processes that might change the thermocline depth such as coastal trapped waves. Warming in coastal areas increases the stratification and inhibits the vertical nutrient exchange limiting the productivity (Brady et al., 2019; Di Lorenzo et al., 2005; Garcia-Reyes et al., 2015). Coastal trapped waves can also change the water column stratification and cause anomalies affecting the productivity (Bachèlery et al., 2016; Echevin et al., 2014; Pietri et al., 2014; Rykaczewski & Dunne, 2010). In fact, both the wind stress and the stratification are able to amplify or mitigate the upwelling intensity.

Consequently, changes in wind stress and stratification might be complementary or competitive for the upwelling intensity in a global warming scenario (Siemer et al., 2021; Bachèlery et al., 2016; Pietri et al., 2014). Moreover, Bonino et al. (2019) and recently showed by Siemer at al., 2021, found that in the Canary upwelling system the stratification and coastal trapped waves seem to have stronger effects on the upwelling intensity than in other EBUS such as the Benguela system where a positive linear relationship exists between the upwelling intensity and the wind stress.

Do you think that the improve in the global model performance is exclusively based on the increased in resolution or other physical parameters could be responsible of this improvements that are include in the HR models instead of the LR??

Have you investigate this complementary or competitive factor for the upwelling intensity due to the wind stress and stratification in the CUS?

References

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