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Regional oceanic and biogeochemical modeling strategy :forced or coupled model ?

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Regional high resolution biogeochemical modeling studies generaly use an oceanic model forced by prescribed atmospheric conditions. The computational cost of such approach is far lower than using an high resolution ocean-atmosphere coupled model. However, forced oceanic models cannot represent adequately the atmospheric reponse to the oceanic mesoscale (~10-100km) structures and the impact on the oceanic dynamics.

To assess the bias introduce by the use of a forced model, we compare here a regional high resolution (1/12°) ocean-atmosphere coupled model with oceanic simulations forced by the outputs of the coupled simulation. Several classical forcing strategies are compared : bulk formulae, prescribed stress, prescribed heat fluxes with or without Sea Surface Temperature (SST) restoring term, ... We study the Chile Eastern Boundary Upwelling System, and the oceanic model includes a biogeochemical component,

The coupled model oceanic mesoscale impacts the atmosphere through surface current and SST anomalies. Surface currents mainly affect the wind stress while SST impacts both the wind stress and the heat fluxes. In the forced simulations, mesoscale structures generated by the model internal variability does not correspond to those of the coupled simulation. According to the forcing strategy, the atmospheric conditions are not modified by the forced model mesoscale, or the modifications are not realistic. The regional dynamics (coastal upwelling, mesoscale activity, ...) is affected, with impact on the biogeochemical activity.

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