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Coupling the atmospheric to the coastal ocean components of the Earth-System (II): Estimating transfer velocities of greenhouse gases and aerosols

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The Global Ocean is an expected climate change mitigator by acting as sink for greenhouse gases and as source of aerosols that increase the albedo in the upper atmosphere. Given the calculus constrains of Earth-System Models (ESM), are used simpler formulations relying on wind speed as sole driver of the turbulence at the sea-surface that mediates the transfer velocities of gases. This is sufficient for the coarse resolution of ESM with cells roughly 1000 km wide dominated by the Open Ocean. Meanwhile, the Coastal Ocean was considered fundamental for the atmosphere-ocean gas exchanges and atmospheric budget of its constituents. Although its precise role is yet poorly understood due to its heterogenic environmental conditions and multitude of ecosystems, it has been proposed as responsible for half the atmosphere-ocean greenhouse gas exchanges worldwide. At the Coastal Oceans, other factors become important mediators of turbulence and gas transfer velocities, namely sea-surface roughness, atmospheric stability, currents, surfactants and rain. We propose a numerical framework to couple the atmospheric WRF to the oceanographic WW3-NEMO models, customizable to integrate the desired factors and respective formulations. We compared the application of alternative formulations with data from the European Coastal Ocean at 11 km and 1h resolutions during 6 days in May 2014. More comprehensive formulations estimated 50% less transfers of greenhouse gases than the generalization currently in use by ESM. Therefore, increasing the accuracy of ESM requires finer resolutions for space and time, but also for the better description of the processes involved.

Biography

Vasco M N C S Vieira has terminated his PhD in Marine, Land and Environmental Sciences in the University of Algarve in 2011. Until 2011, he worked at the ALGAE – Marine Plant Ecology Research Group of University of Algarve, and since then in Maretec – Marine Technology Group of Instituto Superior Técnico. He has 17 published articles on the subject of marine ecology, environment and technology.

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