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Coupling the atmospheric to the coastal ocean components of the Earth-System (I): Estimating the solubility of greenhouse gases and aerosols

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The Global Ocean is perceived as climate change mitigator by acting as sink for greenhouse gases and as source of aerosols that increase the albedo in the upper atmosphere. More recently, the coastal ocean was determined as fundamental for the atmosphere-ocean interactions and atmospheric budget of its constituents, although its precise role is yet poorly understood due to its heterogenic environmental conditions and multitude of ecosystems. Solubility is one of the two fundamental factors setting the atmosphere-ocean balance and flux of gases. It basically changes with water temperature and salinity, which are highly variable at the coastal ocean. We tested the two most used approaches to model solubility with data from the European coastal ocean. The traditional method used by Earth-System modellers corrects the ideal gas law for the effects of moisture and fugacity of non-ideal gases, while the solubility coefficients are provided by the virial equations. Its alternative estimates solubility from the molecular structures, thermodynamic properties and concentrations of pure water, its dissolved salts and of the gases. Both formulations generally agreed remarkably well and only diverged by up to 4.5% in extreme situations of temperature and salinity. However, these situations occur in critical components of the Earth-System, namely the warmer and less saline coastal oceans and the cooler polar oceans. These mismatches led to a bias of 3.86×10^6 ton of CO_2 , 880.7 ton of CH_4 and 401 ton of N_2O dissolved in the first meter depth of the European coastal ocean.

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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