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Effects of coupling strength and stochastic parameterizations on data assimilation

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The large scale dynamics of the atmospheric and oceanic circulation while being described by governing equations that are very similar, can be quite different in character. This is mainly due to the difference in the first internal Rossby radius of deformation: a natural scale of the system at which the effects of (stable) stratification and rotation are comparable. In the atmosphere this scale is of the order of a thousand kilometers, where as in the ocean it ranges from 10 to 100 km. This leads to oceanic circulation being more strongly coupled across scales. For example, while atmospheric convection may occur on scales two to three orders of magnitude smaller than the deformation scale, oceanic convection occurs on scales just about one order of magnitude smaller. It is for this reason that a stochastic representation of unresolved processes is likely to be more involved in the oceanic context as well. In this work, we investigate the effects of the strength of coupling across scales on the effectiveness of data assimilation and the behavior of data assimilation when stochastic parameterizations are used to represent the faster processes.