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The Collaborative Research Center TRR 181: Energy transfers in Atmosphere and Ocean

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The energy transfers between the three dynamical regimes – small-scale turbulence, internal gravity waves and geostrophically balanced motion – are fundamental to the energy cycle of both the atmosphere and the ocean. Nonetheless, they are poorly understood and quantified, and their representation in state-of-the-art Earth system models is unsatisfactory. Since the interactions of the dynamical regimes ultimately link the smallest scales to the largest scales by a variety of complex processes, understanding these interactions is mandatory to construct atmosphere and ocean models and to predict climate. The current lack of understanding is reflected by energetically inconsistent models with relatively large biases, but also paralleled by inconsistencies of a numerical and mathematical nature. We believe that it is now time to combine recent efforts to overcome these deficiencies, to foster new activities to understand the dynamical interactions, and to improve the consistency of ocean and atmosphere models.
In the collaborative project TRR 181 we aim to reduce the biases and to increase the skill of atmosphere and ocean models, and ultimately to improve climate models and climate predictions. The main aims of TRR 181 are
1. i) to develop the necessary understanding of the energy transfers between the different dynamical regimes of the atmosphere and the ocean,
2. ii) to develop, test and implement with this understanding new and consistent parameterisations in models, and
3. iii) to develop numerical methods featuring consistent energetics.

It is our vision to subsequently establish an energetically consistent framework of energy conversions in the climate system, and to develop physically, mathematically and numerically consistent models for both the atmosphere and the ocean.