Project: **1239**

Project title: **Collaborative Research Centre (CRC) "TRR 181" sub-project S2: Improved Parameterizations and Numerics in Climate Models**

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During the last year, we finalized our work regarding the IDEMIX 2020 ICON and FESOM inter-comparison. To this end, we improved our diagnostics of the diapycnal streamfunction and rerun several experiments with the improved diagnostics. Ultimately, we submitted our work to JAMES (Brüggemann et al., submitted to JAMES) and we are waiting currently for the review.

Another important aspect of our last years work was the quantification of the Lorenz Energy Cycle (LEC). Here, we performed 15 years of simulations with ICON-o and a 5km horizontal resolution (R2B9). Diagnostics of the energy conversion terms of the LEC (Fig. 1) indicate a stronger eddy activity of this configuration compared to previous estimates from coarser simulations (Ssebandeke et al. 2023).

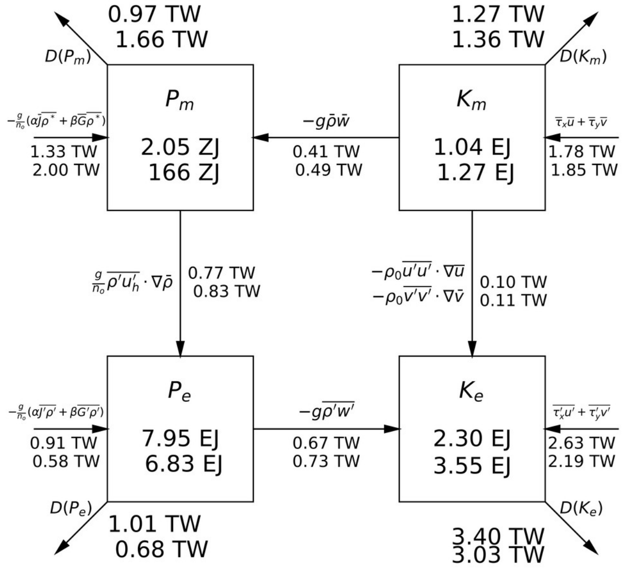


*Figure 1: Schematic of the LEC with upper numbers inferred from the R2B9 ICON-o configuration and lower numbers from von*

One major uncertainty of the Lorenz Energy Cycle is the dissipation of mesoscale eddy energy. Since processes which are hypothesized to be responsible for mesoscale energy dissipation occur on spatial scales even smaller than the mesoscale eddies themselves, eddy dissipation is typically purely represented in global ocean models. Therefore, we lack an understanding and quantification of these processes.

During the last year, we started to evaluate several processes related to eddy dissipation. First, we were assessing eddy kinetic energy dissipation by bottom friction (Fig. 2). We find that typical hot spots of eddy activity like the Southern Ocean and western boundary currents are also regions of enhanced bottom friction. Other dissipation mechanism like vertical harmonic friction and biharmonic horizontal friction will be evaluated in a next step. Currently, we are investigating how eddy kinetic energy is distributed vertically and how this energy which originates from the upper and mid ocean is able to reach the bottom. To this end, we investigate the energy transfer from higher vertical Stourm-Liouville modes up to the first baroclinic and barotropic mode that ultimately allow the energy to be dissipated at the bottom. An answer to this question is also relevant for another important eddy energy dissipation by lee waves generated when eddies encounter topographic obstacles.

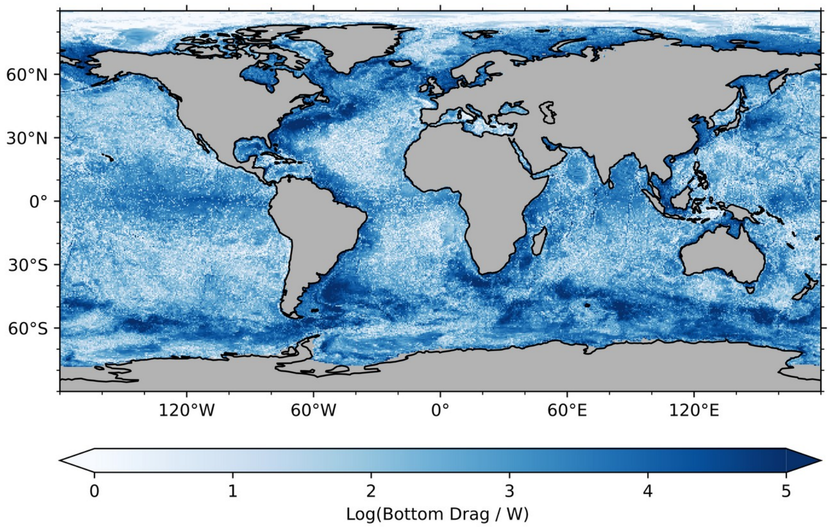


*Figure 2: Logarithm of bottom friction in an ICON-o simulation with 5km horizontal resolution.*

Finally, we also participated in the development of ICON-o's new sea ice dynamics. Here, we performed several sensitivity simulations with various parameter tests of the mEVP rheology in ocean-only configurations of 5km horizontal resolution. We established several diagnostics to more accurately check the convergence of the mEVP algorithm.


References:

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