
TRR181

Energy Inflow #21 December 2020

Towards the next phase!

Best work news for this crazy Corona year: The DFG decided to support the second phase of our Transregio Project! After all the work on the proposal and 6 months interim phase, we are now very much looking forward to the next 3,5 years.

On the last Thursday in November, late in the afternoon, the whole project with 60 people waited together in a Zoom meeting for the call from the DFG for one and a half hours - it was nerve-racking. Finally we got the GO for the second phase and hopefully we can celebrate this very good news next year in person!

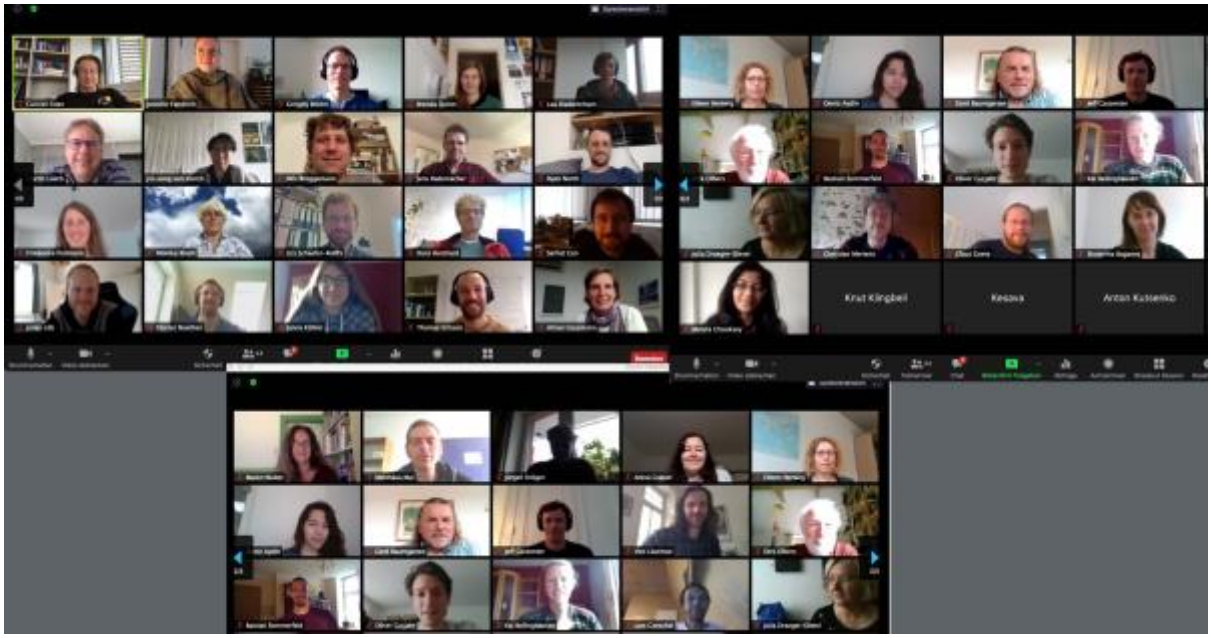
We now welcome Technische Universität Hamburg and Goethe-Universität Frankfurt on board of the TRR 181.

Thanks so much to everyone who helped in the process!

We are now curious who will join next year the TRR 181 team. Enjoy the holidays, all the best for the upcoming break and stay healthy.

What´s in this issue:

Digital Retreat - days full of science!



This year as you all know we weren´t able to meet in person for our Retreat. Nevertheless, we had a great meeting via Zoom with up to 70 participants - thanks to good organization and our wonderful TRR audience.

The first day started with an introductory talk by Carsten Eden and afterwards science talks from Jeff Carpenter, Jaques Vanneste and Hans Burchard. The afternoon was reserverd for Breakout Groups about IDEMIX and FESOM and ICON news as well as SONETT cruise and diagnostics meeting.

On the second day Almut Gassmann and Kesava Ramachandran from IAP started with science talks, followed by Stephan Juricke and in the afternoon there was a guest talk by Kevin Lamb and more scientifc breakout group meetings as well as a PhD defense training, Outreach and Research Training Group meeting.

On Friday, the last day of the meeting, Gergely Böloni from GU Frankfurt and Thomas Eriksen and Jin-Sing von Storch finished the Retreat with Science talks.

It was a full(filling) program and we are glad it was possible to organize on short notice a digital event with so much science input and breakout group meetings.

We hope for a meeting in person at a nice venue next year. Until then: Stay healthy and enjoy the holidays!

Ad Maiora! - Report by former TRR 181 Postdoc Valerio Lembo

In August 2020, my postdoctoral position at TRR181 project, subproject S1 "Diagnosis and Metrics in Climate Models" has come to an end. These 3 years and 10 months have been a very exciting and fruitful experience, not only being my first employment as a Postdoc, but also because of the inspiring environment I found in Hamburg and in the project. Coming from a PhD in Italy, it was certainly challenging to deal with a new country, a new research group, and learning to interact with colleagues (including my supervisor, who soon moved to UK for a new employment) remotely, autonomously organizing the work and expressing my thoughts and concerns directly to the PIs of the subproject I was part.

My research focus was mainly on to the development of tools to diagnose the first principles of thermodynamics in the outputs of state-of-the-art climate models. This is particularly relevant in the context of the TRR181, because energy imbalances are often found in the model outputs, that are not attributed to the impact of any natural or anthropogenic source, and the aim of the project as a whole is studying the processes underlying them and developing new methodologies to address them in order to achieve better energy conservation in the models. Ultimately, this would allow to detect the effect of anthropogenic forcings, isolate that from natural variability, and provide more reliable climate projections. Being at the interface between climate model developers and theoreticians, I soon came to learn about the ESMValTool community. This huge inter-institutional effort is aimed at standardizing tools for model diagnostics, including them in a comprehensive, though user-friendly architecture, in which model outputs are ingested and processed in a common way. Leading this project, under the auspices of the Climate Model Intercomparison Project (CMIP) of the World Climate Research Programme (WCRP), is Prof. Veronika Eyring, from University of Bremen, who will hopefully join the TRR181 project in its second phase. Thanks to the help of Dr. Nikolay Koldunov, teammate in the S1 subproject, I was introduced to the ESMValTool language and made our diagnostic collection, the Thermodynamic Diagnostic Tool (TheDiaTo), part of the ESMValTool architecture.

Consistently with my aim to diagnose and discuss model performances in terms of energy exchanges, I also continued working with previous colleagues at the ETH Zürich, Dr. Doris Folini and Prof. Martin

Wild. With them, I discussed the strange behavior of cross-equatorial energy transports in the atmosphere and the oceans, noting that different forcings trigger very different anomalies, and that in general several timescales of the response can be recognized. With Prof. Rune Graversen in Tromsø and Prof. Gabriele Messori in Uppsala, we also looked into the details of the extremes in meridional heat transports in the mid-latitudinal atmosphere, finding that the different seasons and hemispheres have peculiar behaviors, and that eddy-decomposed transports disclose surprises in the roles of different (especially planetary) waves! Thanks to the support of the TRR181, the last two years have been devoted to an increasing interest on full-scale multi-millennial ensemble model simulations with MPI-ESM model at DKRZ. In a paper recently published on Scientific Reports, we have shown that the Ruelle's Response Theory can be used to predict the linear response of the climate system to whatever "smooth" forcing, provided that the Green's function is known. This promises to be a significant achievement in the path to skillfully select the model simulations that are actually needed to understand the impact of the anthropogenic forcing on climate.

As I am now ready for a new start, I am aware that I owe to the TRR181 the merit of allowing me to express my potential, exploring new ways, sometimes successfully, sometimes less. The soft skill events organized in coincidence of retreats, winter schools etc., were also important steps in building up my career as a researcher. I am also thankful to the PIs and Prof. Carsten Eden, in particular, for letting me part of the organization of important project events, such as the workshop in Potsdam or the EGU sessions. Of course, I want to acknowledge Prof. Valerio Lucarini, PI of the S1 subproject and careful supervisor, for putting a lot of trust in me, Dr. Nikolay Koldunov, together with the ESMValTool team, the project management team, Meike Ruhnau and Jennifer Fandrich, for being collaborators, relentless supporters and good friends. In general, I will miss the TRR181 community, that was the best possible working environment and family during my Hanseatic times. Ad Maiora!

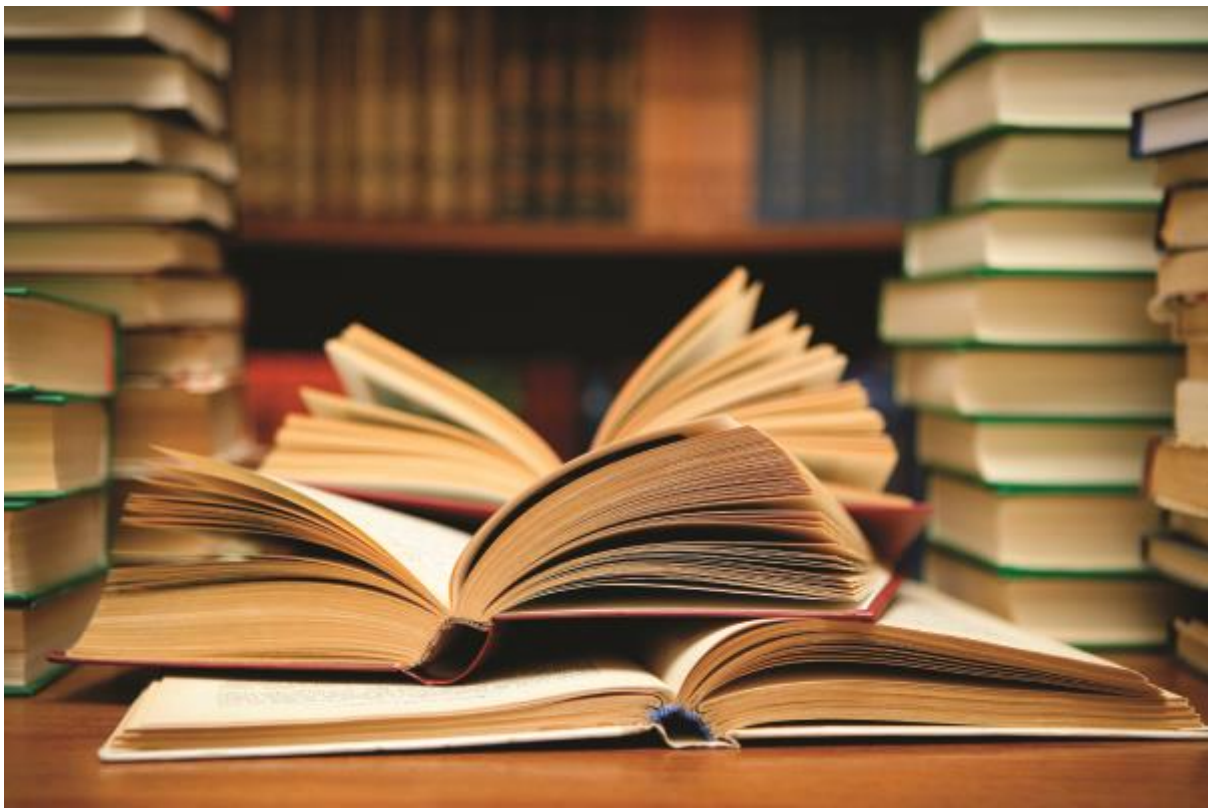
High-resolution data for a better understanding of energy budgets

My name is Larissa Schultze and I am a Postdoc at the Helmholtz-Zentrum Geesthacht. I am passionate about data and I am eager learn about and implement methods that support the analysis of collected measurements and of simulation results. I am driven by the translation of large amounts of data into palpable results that improve the understanding of a system while also allowing the identification of further knowledge gaps.

Within the TRR 181, I work with principal investigator Jeff Carpenter in the subproject T2, in which we tackle the energy transfers of the surface mixed layer. I make use of observational methods and numerical modelling to study stratification, turbulence and mixing in shallow seas. The observational approach focuses on the processing and analysis of high-resolution data collected by autonomous underwater gliders equipped with an instrument package for small-scale turbulence

measurements. Generally, the gliders are controlled via satellite and are able to uninterruptedly collect data for several weeks even under adverse weather conditions. The gliders are able to measure physical properties ranging from the surface of the water column until approximately a thousand meters depth. This, for example, advances knowledge of turbulence levels, mixing rates and heat transfers across the water column during storms. As for the numerical modelling, I conduct Large Eddy Simulations using PALM (Parallelized Large Eddy Simulation Model for atmospheric and oceanic flows) to improve the understanding of wind-wave dynamics.

Just published



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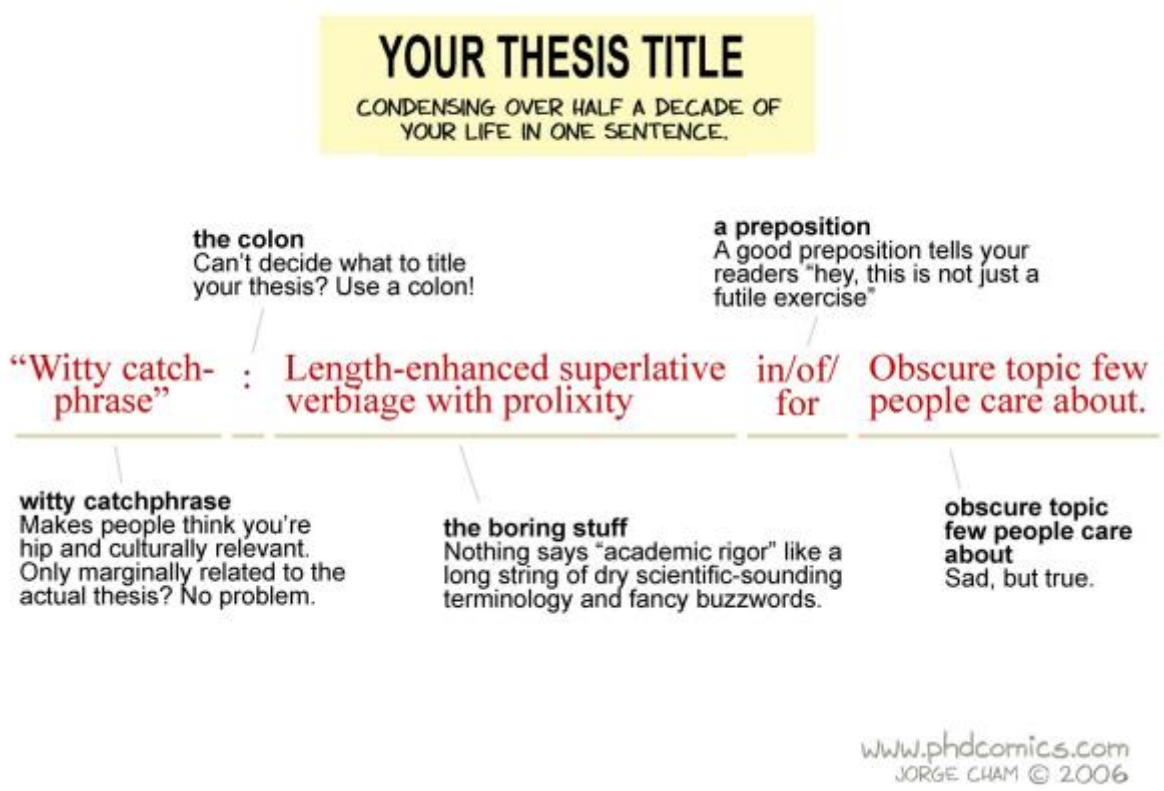
As usual: Something funny for the end



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