TRR 181 NEWSLETTER

ENERGY INFLOW

NEW YEAR, NEW DESIGN

It has been quite some time since the last newsletter. So much happened in the last months, that there wasn't enough time to write it all down. :)

Now we are back in action! This newsletter includes reports from the winter school in Goslar and the workshop in April. Furthermore you find a long list of new publications (27!) and new reports from the scientific front.

As you may also noticed: we have a new design! Please enjoy!

Jennifer and Meike

Group picture from the Winter School in Goslar

WINTER SCHOOL IN GOSLAR

Our second TRR 181 Winter School took place at the Hotel Hessenkopf in Goslar starting February 26 to March 3. More than 50 PhDs, Postdocs and PIs faced the cold winds and snow of the German low mountain range Harz to collaborate and learn about the different TRR 181 disciplines and subprojects.

The whole week was dedicated to science and networking. Nearly all young researchers of our project could attend the Winter School, helping to foster the communication between the TRR locations.

The week was mainly dedicated to the internal work done in the project so far. We had overview talks by the PIs from the different subprojects as well as PI Expert talks and short subproject talks prepared by the PhDs and Postdoc. Furthermore, the Early Career Scientists presented their work during a poster session.

As we were very lucky to have a lot of snow during the winter (!) school, there was also time for winter sport, as you can see in the picture gallery on our website. Our PhD Serhat Can from IAP Kühlungsborn took some analog shots of the Winter School. Just like the Harz in general, they do have a nostalgic touch, so enjoy ;)

COLLABORATIVE WORKSHOP ON "SCALES AND SCALING CASCADES IN GEOPHYSICAL SYSTEMS" A FULL SUCCESS

Our fourth annual workshop on "Scales and scaling cascades in geophysical systems" was held from April 4-6, 2018 at "Haus des Sports" in Hamburg, Germany.

Over 100 scientists from all over the world gathered in Hamburg for our annual workshop.The topic of the workshop was "Scales and scaling cascades in geophysical systems".

Complex processes involving cascades of scales pose ubiquitous challenges in natural science research. Often the smallest and largest scales are widely eparated in such processes, as .g. for the different dynamical regimes in atmosphere and ocean: gravity waves, small-scale turbulence and geostrophically balanced flow. Interactions between the smallest, largest, and intermediate scales connecting different dynamical regimes challenge our established theoretical or computational tools and the formulation of consistent models.

On our website you find some of the presentations (with permission given to upload) as well as some impressions from the workshop in a picture gallery.

Impressions from the workshop

PUBLICATIONS

Have you also published your work, but cannot find it here? Please get in touch with the project coordination.

Badin, G. and Barry, A., (2018) **Collapse of generalized Euler and surface quasi-geostrophic point-vortices,** Physical Review E, 98, 023110, doi.org/10.1103/PhysRevE.98.023110

Becker, E., and Vadas, S. L. (2018). **Secondary Gravity Waves in the Winter Mesosphere: Results From a High-Resolution Global Circulation Model.** Journal of Geophysical Research: Atmospheres, 123(5), 2605-2627.

Burchard, H., Bolding, K., Feistel, R., Gräwe, U., MacCready, P., **Klingbeil, K.**, Mohrholz, V., Umlauf, L., and van der Lee, E. M. , (2018). **The Knudsen theorem and the Total Exchange Flow analysis framework applied to the Baltic Sea**, Progress in Oceanography, 165, 268-286 , https://doi.org/10.1016/j.pocean.2018.04.004 .

Cabos, W., Sein, D. V., Durán-Quesada, A., Liguori, G., **Koldunov, N. V.**, Martínez-López, B., ... and Pinto, J. G. (2018). **Dynamical downscaling of historical climate over CORDEX Central America domain with a regionally coupled atmosphere–ocean model.** Climate Dynamics, 1-24.

Domeisen, D.I.V. , **Badin, G**. and Koszalka, I., (2018) **How predictable are the Arctic and North Atlantic Oscillations? Exploring the variability and predictability of the Northern Hemisphere**, Journal of Climate, 31, 997-1014, https://doi.org/10.1175/JCLI-D-17-0226.1

Faranda, D., **Lembo, V.**, Iyer, M., Kuzzay, D., Chibbaro, S., Daviaud, F., Dubrulle, B. (2018). **Computation and Characterization of Local Subfilter-Scale Energy Transfers in Atmospheric Flows.** Journal of the Atmospheric Sciences, Vol 75, 2175-2186, https://doi.org/10.1175/JAS-D-17-0114.1

Gonchenko, M. , Gonchenko, S., **Ovsyannikov, I.** and Vieiro, A. (2018). **On local and global aspects of the 1:4 resonance in the conservative cubic Hénon maps**. Chaos , 28, 043123, 2018. https://doi.org/10.1063/1.5022764

Ivanov, V., Smirnov, A., Alexeev, V., **Koldunov, N. V.**, Repina, I., & Semenov, V. (2018). **Contribution of convection-induced heat flux to winter ice decay in the Western Nansen Basin.** Journal of Geophysical Research: Oceans.

Juricke, S., MacLeod, D., Weisheimer, A., Zanna, L., and Palmer, T. (2018). **Seasonal to annual ocean forecasting skill and the role of model and observational uncertainty.** Quarterly Journal of the Royal Meteorological Society.

Klingbeil, K., Debreu, L., Lemarié, F., and **Burchard, H.** (2018). **The numerics of hydrostatic structured-grid coastal ocean models: state of the art and future perspectives.** Ocean Modelling, Vol. 125, 80-105.

Köhler, J., Völker, G.S., and **Walter, M.**, (2018). **Response of the Internal Wave Field to Remote Wind Forcing by Tropical Cyclones**, Journal of Physical Oceanography, 48, 317-328, https://doi.org/10.1175/JPO-D-17-0112.1

Koldunov, N. V., Köhl, A., Serra, N., and Stammer, D. (2017). **Sea ice assimilation into a coupled ocean–sea ice model using its adjoint**, The Cryosphere, 11, 2265-2281, https://doi.org/10.5194/tc-11-2265-2017

Kutsenko, A. A., Shuvalov, A. L., and Poncelet, O. (2018). **Dispersion spectrum of acoustoelectric waves in 1D piezoelectric crystal coupled with 2D infinite network of capacitors** , Journal of Applied Physics, 123, 044902, https://doi.org/10.1063/1.5005165 .

Lemmen, C., R. Hofmeister, **K. Klingbeil,** Nasermoaddeli, M. H., O. Kerimoglu, **H. Burchard**, F. Kösters, K. W. Wirtz (2018). **Modular System for Shelves and Coasts (MOSSCO v1.0) – a flexible and multi-component framework for coupled coastal ocean ecosystem modelling**, Geoscientific Model Development, https://doi.org/10.5194/gmd-2017-138

MacCready, P., Geyer, W.R. , and **Burchard, H.**, (2018). **Estuarine exchange flow is related to mixing through the salinity variance budget**, Journal of Physical Oceanography, 48, 1375-1384, https://doi.org/10.1175/JPO-D-17-0266.1.

Mohamad, H., **Oliver, M.** (2018). **H s-class construction of an almost invariant slow subspace for the Klein-Gordon equation in the non-relativistic limit,** Journal of Mathematical Physics, 59, 051509, https://doi.org/10.1063/1.5027040

Nasermoaddeli, M. H., Lemmen, C., Stigge, G., Kerimoglu, O., **Burchard, H., Klingbeil, K.**, Hofmeister, R., Kreus, M., Wirtz, K. W. & Kösters, F. A (2018). **A model study on the large-scale effect of macrofauna on the suspended sediment concentration in a shallow shelf sea Estuarine**, Coastal and Shelf Science, Geoscientific Model Development, https://doi.org/10.1016/j.ecss.2017.11.002

North, R. P., Jochumsen, K., and Moritz, M. (2018). **Entrainment and Energy Transfer Variability Along the Descending Path of the Denmark Strait Overflow Plume**. Journal of Geophysical Research: Oceans, 123(4), 2795-2807.

Schaefer-Rolffs, U. and Becker, E., (2018). **Scale-invariant Formulation of Momentum Diffusion for High-Resolution Atmospheric Circulation Models** , Monthly Weather Review, 146, 1045-1062, https://doi.org/10.1175/MWR-D-17-0216.1

Sein, D. V., **Koldunov, N. V.**, Danilov, S., Sidorenko, D., Wekerle, C., Cabos, W., ... and **Jung, T.** (2018). **The relative influence of atmospheric and oceanic model resolution on the circulation of the North Atlantic Ocean in a coupled climate model.** Journal of Advances in Modeling Earth Systems.

Sidorenko, D., **Koldunov, N.**, Wang, Q., Danilov, S., Goessling, H. F., Gurses, O., ... and **Jung, T.** (2018). **Influence of a salt plume parameterization in a coupled climate model.** Journal of Advances in Modeling Earth Systems.

Slavik, K., Lemmen, C., Zhang, W., Kerimoglu, O., **Klingbeil, K.**, and Wirtz, K. W. (2018). **The large-scale impact of offshore wind farm structures on pelagic primary productivity in the southern North Sea**. Hydrobiologia, 1-19.

Vissio, G., **Lucarini, V.,** (2018). **A proof of concept for scale-adaptive parametrizations: the case of the Lorenz '96 model**, Quarterly Journal of the Royal Meteorological Society, 144, 710, 63-75, https://doi.org/10.1002/qj.3184

Wang, Q., Wekerle, C., **Danilov, S., Koldunov, N.**, Sidorenko, D., Sein, D., Rabe, B., **Jung, T.** (2018). **Arctic Sea Ice Decline Significantly Contributed to the Unprecedented Liquid Freshwater Accumulation in the Beaufort Gyre of the Arctic Ocean**, Geophysical Research Letters, 45, 4956-4964, https://doi.org/10.1029.2018GL077901

Xu, J., **Koldunov, N. V**., Remedio, A.R.C., Sein, D.V., Zhi, X., Jiang, X., Xu, M., Zhu, X., Fraedrich, K., Jacob, D. (2018). **On the role of horizontal resolution over the Tibetan Plateau in the REMO regional climate model**, Climate Dynamics, February 8, 2018, 1–18, https://doi.org/10.1007/s00382-018-4085-7

Hu, G., **Franzke, C**. L. E., (2017). **Data Assimilation in a Multi-Scale Model**, Mathematics of Climate and Weather Forecasting, 3, 1, 118-139, https://doi.org/10.1515/mcwf-2017-0006

Sein, D. V., **Koldunov, N. V.**, Danilov, S., Wang, Q., Sidorenko, D., Fast, I., Rackow, T., Cabos, W. and **Jung, T.** (2017) **Ocean Modeling on A Mesh with Resolution Following the Local Rossby Radius**. Journal of Advances in Modeling Earth Systems. Accepted Author Manuscript. https://doi:10.1002/2017MS001099

ATMOSPHERIC GRAVITY WAVES FROM LIDAR OBSERVATIONS

by Marwa Almowafy, PhD T1

My name is Marwa Almowafy, I am a PhD student in the subproject "T1: Mesoscale energy cascades in the lower and middle atmosphere". I am working on temperature perturbations in the upper stratosphere and mesosphere, between 30 and 80 km, caused by atmospheric gravity waves. These waves are mainly generated in the troposphere due to several processes, for example convection and flow of air over mountains. The waves are propagating upward carrying momentum and energy. Eventually this momentum and energy is deposited at higher altitudes. With the help of observations, we address the cycle of gravity propagation and dissipation which is important for understanding their role of modifying the background atmosphere.

"My mission is to develop data analysis from our observations and apply it to the output from the Kühlungsborn Mechanistic Circulation Model (KMCM)"

At the Leibniz Institute for atmospheric Physics (IAP) we have a variety of observation techniques and facilities such as balloons, sounding rockets, radars and Lidars. In the frame work of my PhD, I am focusing on data from Lidar observations. Our Rayleigh/Mie/Raman (RMR) Lidar is used to study temperatures and winds in the middle atmosphere. This Lidar has the unique capability to operate even under full daylight. IAP is operating several Lidars, one of them being located in Kühlungsborn, Germany, and another one in Andenes, Northern Norway. This allows for studying the impact of latitudinal difference and upper atmospheric dynamics regarding gravity waves.
We are comparing the seasonal variability of temperature fluctuations from both locations to available reanalysis and satellite retrievals. A step further will be to approve the results with our highly resolving models at IAP. My mission as a part of TRR181 is to develop data analysis from our observations and also apply it to the output from the Kühlungsborn Mechanistic Circulation Model (KMCM). Furthermore, I plan to construct time series of gravity wave spectra from temperature and wind data to study the behavior of power spectral indices and compare them to expectations from theory.

REDUCING SPURIOUS DIAPYCNAL MIXING IN OCEAN MODELS

by Margarita Smolentseva, PhD M5

Hi everyone, my name is Margarita and I'm a PhD student of the subproject M5 "Reducing spurious diapycnal mixing in ocean models."

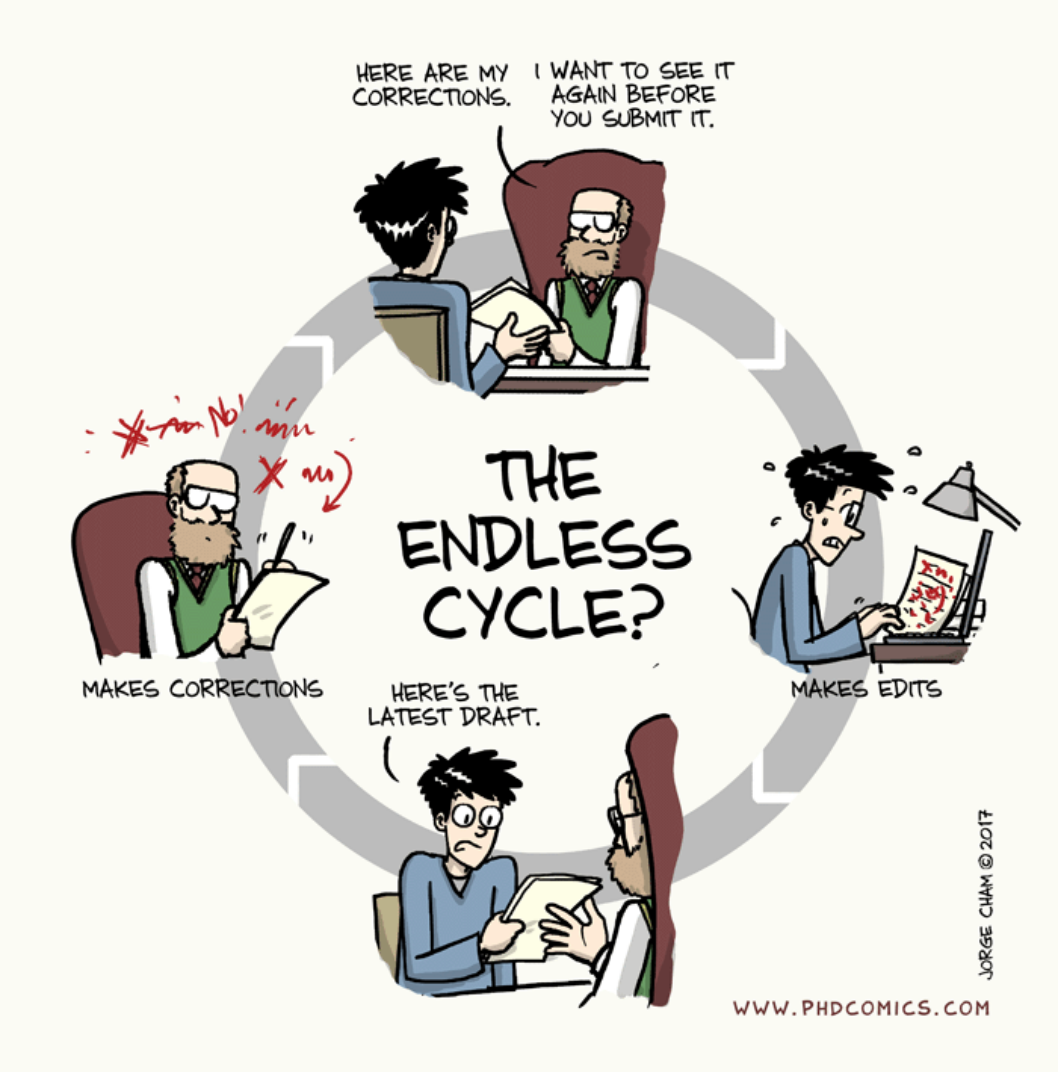
This project is about development and analysis of algorithms leading to reducing spurious mixing in ocean models.
Particularly my part of work is studying the newly proposed methods of rotating the diffusive part of the advection schemes into the isoneutral plane. I work in AWI under supervision of Sergey Danilov.

By the moment adapted to triangular meshes with vertex-based and cell-based placement of scalar variables algorithm described by Lemarie at al. (2012) was implemented on the sea-ice model FESOM2.0. I started doing residual potential energy (RPE) analysis of the implemented harmonic version of the algorithm. Also biharmonic version is to be implemented soon. RPE analysis will be held for both versions and also on dissorted meshes. This analysis allows to determine spurious mixing depending on advection schemes and meshes type.

" My part of work is studying the newly proposed methods of rotating the diffusive part of the advection schemes into the isoneutral plane."

The future work includes analysis of spurious mixing with variance decay technique (by Knut Klingbeil et al.), analysis of regular and irregular meshes, carrying of realistic ocean simulations and analysis of spurious mixing under real conditions.

SOMETHING FUNNY FOR THE END



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