

TRR 181 NEWSLETTER



ENERGY INFLOW

It's already this time of the year...

Christmas markets, it's dark and cold outside, you can drink Glühwein or Punsch- it is December again. We look back on an almost refreshing normal year of offline events after the almost three years of pandemic.

There was our RTG Spring School in Plön, our Annual Retreat in Damp and several smaller PL meetings to start preparing the next phase as well as the Young Researchers Meeting and M-Day in Hamburg.

We are now in the process of organising more events for next year and with this hope to keep on meeting in person.

In this Newsletter you find:

- a **report of the RTG Spring School**
- a **report of the Annual Retreat**
- a **report of our last Art&Science event in Berlin**
- **reports** from our PhD candidates in L3+W5 and L4
- an impressive list of **new publications** and an outlook on what will happen next year

If you want to contribute to the newsletter, don't hesitate to get in touch with me.

*****Happy holidays to everyone*****

Jennifer



Group Picture of Christmas market outing at Young Researcher Meeting in Hamburg

REPORT - SPRING SCHOOL 2022

Text by Nicolas Dettling, PhD Candidate

From May 16th-20th, the TRR181 PhD students and PostDocs gathered in Plön for the first offline spring school at Koppelsberg in Plön.

The spring school officially started with the “RTG conference”, a welcome opportunity to practice and refine contributions for upcoming conferences. In the presentations and posters we travelled from Arctic Fjords to the Baltic Sea, to the Tropical Atmosphere and into the realm of internal wave theory, once again showcasing the diversity of research performed within TRR181. Lively discussions and constructive feedback also demonstrate that we have made great progress understanding each other’s work.

Apart from giving talks and presenting posters, the ability to introduce ourselves and to communicate our scientific work in a very limited time is a valuable skill. This is why in the “Elevator Pitch Training”, Manita Coucksey (UHB) and Stephan Juricke (Jacobs University, AWI) encouraged us to

prepare a short introduction to our work and to pitch it to each other for practice. Rumours say that some first successful pitches have already been given during following conferences.

Time for breakout

Visualising results is also an important aspect of our work. The quality of our visualisations may well decide whether we reach and convince our audience. This is why we explored the two high-level visualisation tools “Inkscape” and “Blender” in breakout sessions. Following some simple examples, we obtained a first impression of each program so that now everyone can decide whether to incorporate these tools into their work. In another breakout session, the different areas came together to recap their progress so far and to discuss future directions. There is still work to be done to forge deeper connections between the different subprojects and to explore potential collaborations to bring the whole TRR closer together.

Subsequently, in the “Art and Science Update” Jennifer Fandrich (UHH) gave a review of recent

outreach projects such as the screening of the piece “Die weiße Wand” at Thalia Theater Hamburg. As a special guest, composer Victor Ernesto Gutiérrez Cuiza together with Valentino Neduhall then walked us through the process of writing his musical work “Choreatmosphere” which is based on atmospheric data. This gave everyone the chance to experience the piece which was already presented live at Hochschule für Musik Hamburg.

Another highly anticipated contribution was the SONETT update, reporting on the successes and hardships of the recent TRR field campaign in the South Atlantic. Especially for all the participants who have not been to sea, this was a great opportunity to learn about both the scientific work and the daily life on an oceanographic research vessel. We are now looking forward to seeing first results and keep our fingers crossed for the preparation of the follow-up cruise next year.

At “sea” with canoes at Plöner See

After hearing all the stories about the work at sea, spirits were high to spend some time on the water and so we set out to explore the “Großer Plöner



See" by canoe. Luckily, in comparison to the Atlantic the conditions were calm and sunny and both participants and gear made it back to shore safely. Half way through the tour, all the boat crews came together in the middle of the lake, a picture to be remembered!



Besides discussing our own work, there was also time for some scientific input in the form of three invited talks. In his keynote lecture "Machine learning in the Geosciences - an opinionated review", David Greenberg (Hereon) gave a comprehensive overview of how machine learning can potentially be used in the geosciences. Whether machine learning is a beneficial tool to be used in our subprojects is for everyone to decide. One way to find out is to dive into some simple examples like in the exercise class David graciously provided for us after his lecture.

In the following talk "Transport, mixing and transfer operators", Kathrin Padberg-Gehle (Leuphana University Lüneburg) provided insights into how mathematical methods can be used to identify persistent features in geophysical flows. Applications include the tracking of mesoscale eddies as well as the description of Polar Vortex splitting.

To conclude the day of lectures, Lars Umlauf (IOW) introduced us to the $k-\varepsilon$ -model, a two equation model representing turbulent properties of the flow. Starting with simple scaling considerations, we quickly moved on to the derivation of the partial differential equations for the turbulent kinetic energy and dissipation, describing the evolution of the energy and scale of turbulence.

"What is next?"

As we progress in our journey as PhD students and PostDocs, the question of "What is next?" has become a recurring theme in our conversations. This is why the last session of the spring school explored career paths in academia

and beyond. Four TRR alumni joined us for this session to tell the stories of their careers: Camilla Nobili (University of Surrey, lecturer) and Meike Ruhnau (UHH, research management) representing careers in academia as well as Veit Lüscho and Almut Gassmann who now work in the fields of climate consulting and medical engineering. The following discussions made us realise that the reasons for pursuing or leaving an academic career are diverse and personal and challenge us to further explore our skills and talents to make a decision ourselves in the future. The opportunity to talk to the TRR alumni was very much appreciated and we thank them for openly sharing their career paths with us.

Finally, we all met again on Friday to summarise what we have learned and experienced. Not only the scientific content and training but also the opportunity to sit around a bonfire, play some volleyball or to go for a swim together was greatly appreciated by all participants. In the very end, we were sent home with a musical rendition of the sad story of the lost SONETT glider: "Here I'm like comet in a deep space, far behind the boat, Navier-Stokes were true and there's nothing I can do..."

REPORT - ANNUAL RETREAT 2022 IN DAMP

by Paula Bäurich, Student assistant

From September 27-30, 2022, the Annual Retreat of our TRR 181 took place in Damp, Schleswig-Holstein.

The Annual Retreat started on Tuesday afternoon in Dampland, which is located directly on the Baltic Sea. The arrival to Damp by train was

different than planned due to a delay. Nevertheless we could start punctually at noon with the registration of all participants and the following lunch. After the welcome speech by speaker Carsten Eden, area M gave a presentation on their current research. This was followed by the area T presentation and the first Poster Session. The

day ended with the movie "Picture a Scientist" as a preparation for the Gender Awareness Workshop that took place on Wednesday.

The second day started with the presentation of area W and L. After lunch break, Lisa Horvath and Sabine Blackmore gave a Workshop on Sexual Harassment

in Academia which consisted of a lecture part and a group work with a very lively discussion on the situation in the TRR. After that, the second Poster Session took place and we ended the day with an informal Postdocs and Young Project Leader Q&A with Project Leaders.

On Thursday, the area 5 presentation took place. This was followed by a discussion on all areas and phase 3 of the project. The afternoon began with the areas breakout sessions, after which breakout sessions on different topics took place: SONETT observations, SMT-WAVE, Outreach, Climate model development and collaboration and TRR Wiki. Then, Bjorn Stevens, who was invited as a guest from MPI-M, gave a lecture on "ICON-S, energies and synergies". A third poster session followed and in the evening, we had a barbecue together at the beach. Despite the somewhat cool outside temperatures the evening offered a nice opportunity to sit together comfortably with all project members.

The last day started with a presentation by Lea Diederichsen and Jennifer Fandrich who gave an insight into their tasks in project coordination. They emphasized a very important point: Please always mention the TRR's project number in your publications so that they can be credited to the TRR (to stress this point again) After that, the career path workshop with focus on academia took place, for which Claudia Stephan, Jan O. Haerter and Melinda

Galfi were invited as guests. Before the last lunch there was a brief summary from the last days including a short presentation from all breakout groups. Early afternoon the bus arrived to take us back to the train station in Eckernförde, from where we all started our journey home.



UPCOMING EVENTS

January 12, 2023

RTG ENERGY Meeting

Every second Thursday at 2 p.m. the TRR PhDs and Postdocs meet online to discuss their research and talk about current TRR issues.

January 16-18, 2023

RTG Course: Stochastic aspects of modelling and parameterisation

Lecturer: Christian Franzke

January 19, 2023

TRR 181 Seminar

The TRR 181 seminar is held by Prof. Dr. Christian Franzke (Pusan National University).

January 20, 2023

Gender & Diversity: Open Task Group Meeting

All interested TRR members are invited to join the meeting.

January 31-February 1, 2023

RTG Course: Differential Equations and Dynamical Systems in Climate Physics

Lecturer: Dirk Olbers

February 14-16, 2023

Eddy-Wave Meeting 2023

Eddy-Wave Meeting 2023 to be held in Hamburg in a hybrid format (online and offline).

March 27-30, 2022

Conference "Scale interactions, data-driven modeling, and uncertainty in weather and climate"

This workshop will take place at TU Eichstätt-Ingolstadt

April 23-28, 2023

EGU 2023, Vienna

TRR 181 Young PLs organize the session session OS4.4 "Eddies,



PUBLICATIONS

*Have you also published your work, but cannot find it here?
Please get in touch with the [project coordination](#). Members
of the TRR 181 are printed in bold.*

Mehlmann, C. & **Gutjahr, O.** (2022). **Discretization of sea ice dynamics in the tangent plane to the sphere by a CD-grid-type finite element.** Journal of Advances in Modeling Earth Systems, doi: <https://doi.org/10.1029/2022MS003010>.

Chrysagi, E., Basdurak, N.B., **Umlauf, L.,** Gräwe, U. & **Burchard, H.** (2022). **Thermocline Salinity Minima Due To Wind-Driven Differential Advection.** JGR Oceans 127(11), doi: <https://doi.org/10.1029/2022JC018904>.

Carpenter, J.R., Buckley, M., & Veron, F. (2022): **Evidence of the critical layer mechanism in growing wind waves.** Journal of Fluid Mechanics 948, A26, doi: <https://doi.org/10.1017/jfm.2022.714>.

Streffing, J., Scholz, P., **Koldunov, N.,** Danilov, S., **Juricke, S.,** Jung, T. et al. (2022): **AWI-CM3 coupled climate model: description and evaluation experiments for a prototype post-CMIP6 model.** Geosci. Model Dev. 15, 6399–6427, doi: <https://doi.org/10.5194/gmd-15-6399-2022>.

Pollmann, F. (2022): **Global characterization of the ocean's internal gravity wave vertical wavenumber spectrum from Argo float profiles [Data set].** Zenodo, doi: <https://doi.org/10.5281/zenodo.6966416>.

Carpenter, J.R., Liang, Y., Timmermans, M.-L., & Heifetz, E. (2022): **Physical mechanisms of the linear stabilization of convection by rotation.** Phys. Rev. Fluids 7(8), 083501, doi: <https://doi.org/10.1103/PhysRevFluids.7.083501>.

Franzke, C.L., Gugole, F., & **Juricke, S.** (2022): **Systematic multi-scale decomposition of ocean variability using machine learning.** Chaos: An Interdisciplinary Journal of Nonlinear Science 32(7), 073122, doi: <https://doi.org/10.1063/5.0090064>.

Chouksey, M., Griesel, A., **Eden, C.** & Steinfeldt, R. (2022). **Transit Time Distributions and Ventilation Pathways Using CFCs and Lagrangian Backtracking in the South Atlantic of an Eddying Ocean Model.** Journal of Physical Oceanography 52(7), 1531–1548, doi: <https://doi.org/10.1175/JPO-D-21-0070.1>.

Chouksey, A., Griesel, A., **Chouksey, M.,** & **Eden, C.** (2022): **Changes in global ocean circulation due to isopycnal diffusion.** J. Phys. Oceanogr. Early Online Release, doi: <https://doi.org/10.1175/JPO-D-21-0205.1>.

Chouksey, M., **Eden, C.** & **Olbers, D.** (2022): **Gravity Wave Generation in Balanced Sheared Flow Revisited.** J. Phys. Oceanogr. 52, 1351–1362, doi: <https://doi.org/10.1175/JPO-D-21-0115.1>.

Li, X., Lorenz M., **Klingbeil, K.,** **Chrysagi, E.,** Gräwe, U., Wu, J. & **Burchard, H.** (2022): **Salinity Mixing and Dialine Exchange Flow in A Large Multi-outlet Estuary with Islands.** J. Phys. Oceanogr., doi: <https://doi.org/10.1175/JPO-D-21-0292.1>.

Gutjahr, O., **Jungclaus, J. H.,** **Brüggemann, N.,** Haak, H. & Marotzke, J. (2022): **Air-Sea Interactions and Water Mass Transformation During a Katabatic Storm in the Irminger Sea.** Journal of Geophysical Research: Oceans. 127, e2021JC018075, doi: <https://doi.org/10.1029/2021JC018075>.

UPPER-OCEAN ENERGY SPECTRUM, FLUX & DISSIPATION

by Ilmar Leimann PhD Candidate, L3+W5

Hi! My name is Ilmar and I work as a PhD student at the MARUM/University of Bremen. I am supervised by Dr. Maren Walter (MARUM/University of Bremen) and Dr. Alexa Griesel (Universität Hamburg) and am part of the TRR subprojects L3 entitled "Meso- to Submesoscale Turbulence in the Ocean" and W5 „Internal Wave Energy Dissipation and Wavenumber Spectra: Adaptive Sampling in the Ocean Interior“.

Before I joined TRR, I lived in Kiel, where I got a bachelor degree in Physics of Earth and master degree in Climate Physics: Meteorology and Physical Oceanography at Christian Albrechts University Kiel & GEOMAR. I started my work as a part of TRR in September 2022.

In the first phase of L3, we assessed turbulence regimes with a focus on the Benguela upwelling region. Using a new scaling method and with adequate subsampling of the deployed surface drifters, we estimated a consistent energy transfer rate and identified an inverse cascade for scales 30-500 km close to the upwelling current. Now our aim in the second phase is to extend the Lagrangian analyses and apply the structure-function diagnostic (in addition to the classical Lagrangian dispersion estimates) in an area offshore from the Benguela region that is characterized by high internal tide and eddy activity but

without a deep baroclinic current. In a concerted effort (targeted measurements with gliders, ship



ADCP, drifters) we will quantify horizontal wavenumber spectra for the upper ocean in the Walvis Ridge Region in close collaboration with W5 and W2. The subsampling methods developed from the analyses in the Benguela and Walvis Ridge regions, together with high-resolution modelling, will be used to extrapolate to the global ocean using the global drifter program.

The W5 Project is concerned with the shape of the internal wave energy spectrum, where our aim is to simultaneously observe the oceanic

energy spectrum below the submesoscale range and the spatial distribution of energy dissipation, using adaptive/reactive sampling to guide the observations. For this purpose, we will deploy a new hybrid pelagic glider (developed by Prof. Ralf Bachmayer) using an innovative approach of combining advanced numerical model informed sampling techniques in real-time to observe internal wave spectra and turbulence in the ocean interior. As a key sensor, a pressure rated microstructure probe will be integrated into the pelagic glider system; this use of a new technology combined with new sampling algorithms potentially offers unprecedented insights into deep ocean mixing and internal wave climate. Obtained observational data will be contextualized by idealized and regional numerical modelling studies carried out in L3 and L2 and the results of this project will complement the observations, that will be jointly used to construct the upper- and pelagic oceanic energy spectrum within L3, and the observations towards obtaining a local energy budget.

DIURNAL WARM LAYERS AND RAIN LAYERS: DYNAMICS, TURBULENCE AND ATMOSPHERIC FEEDBACKS

by Mira Schmitt, PhD Candidate, L4

My name is Mira, I am a PhD at the Institute for Baltic Sea Research in Warnemünde and working in subproject L4, supervised by Lars Umlauf. To start off with something

about myself: I studied physics at the University of Göttingen with a focus on Astro- and Geophysics during my masters. After an internship on sea ice physics at the University of Otago in New Zealand, I studied double-diffusive convection during my

master thesis. I love hiking and backpacking, so before, during and after my studies I spent a lot of time abroad, travelling, discovering new countries and meeting interesting people. When the pandemic started

I had to change my plans and, by a chain of coincidences, started this phd position, which I am very happy about. I very much enjoy to live this close to the ocean and I spend a lot of time by the beach.

The focus of my project is on diurnal warm layers and rain layers on the ocean surface. These thin, stratified layers influence air-sea fluxes and turbulence in the ocean interior, but are usually not resolved in climate models.

My work so far has been to simulate idealized cases using a 1D turbulence model. With that I can identify the non-dimensional parameters that govern these processes and perform



Hohenegger, who study diurnal warm layers and their effect on the atmosphere using the coupled ICON model.

parameter space studies, which can be the basis for a parameterization. I also work in close collaboration with Mira Shevchenko and Cathy

SOMETHING SCIENCE-ARTSY FOR THE END



"Encoding Seas" at Universität der Künste, Berlin



After the concert: Talk with VictorPiano

by Lev Kneller, Outreach student assistant

On Sunday, December 04, 2022, the Berliner Symphoniker (Berolina Orchester e.V.) played the concert "Luft & Wasser" (Air & Water) of the series Um-Welt-Klang in the concert hall of the Berlin University of the Arts (Universität der Künste). This is a collaboration project together with Berliner Symphoniker out of our

Art&Science subproject. Science always searches for ways and means to reach as many people as possible. In this quest to fulfil its enlightening mission, the two Um-Welt-Klang concerts were created, so that musical pieces by artists of the 20th and 21st centuries meet scientific contributions from researchers in the fields of geoscience, climate science

and environmental science in a new format.

The conductor Howard Griffiths opened the concert with the work "Four Sea Interludes" from the opera "Peter Gramms" (OP. 33a) by the British composer Benjamin Britten. From the dusky,

almost dangerous twilight (Dawn), the orchestra gently transitions to the versatile, charged, curious and at times joyous Sunday morning (Sunday Morning). Equally successful is the passage Moonlight and Storm, where the idyllic nightfall dissolves into a mighty storm. In the aftermath of the musical masterpiece, a no less turbulent topic began: Climate change. The Potsdam professor for climate change and sustainable development Dr. Jürgen P. Kropp began his presentation with a short film in which the history of earth is explained as an account in a social network. After the video clip he went on to discuss the current and future course of climate change, its consequences and possible solutions.

“Encoding Seas”

Now we come to the part where the Art&Science subproject of our TRR started: The work “Encoding Seas” by the young artist Víctor Ernesto Gutiérrez Cuiza (VíctorPiano) began with a repositioning of the orchestra. This piece, commissioned by TRR 181 “Energy transfers in Atmosphere and Ocean”, is based on oceanic measurement data from a 2016

research cruise and explores the senses of a machine in the ocean. The multimedia composition was composed of three movements or poems. Thereby, the poetry is recited by a synthetic voice-off and describe the perception of the environment: the scanning of the radar, the drifting, as well as the loneliness and fear of the unknown in the deep ocean. Accompanied by the orchestra and the visuals, a space is created in which the machine shares its feelings with the audience. Those present experience an expansion of their human perception.

In this intense atmosphere the hydrologist Prof. Dr. Thorsten Wagener took the floor. With his presentation about droughts and floods he refers to the historical circumstances, current events and the necessity of new climate protection measures.

Last but not least, the concert concluded with the piece “The Sea” by Frank Bridge. The impressionistic piece describes the sea. Beginning with an idyllic sunrise at the sea (Seascape), it slowly transitions into the gently well (Sea Foam) to then unfold in a calm moonlit

night (Moonlight) into a storm (Storm). The structural similarity of the master Frank Bridge and his student Benjamin Britten is hardly to be overlooked, the more strongly their differences and subtleties unfold in the perception of nature.

Hopefully we will find a way to present our TRR Symphony “Encoding Seas” at another function or even go on working on this piece. Thank you for everyone who made the journey to Berlin and listen to the sound of TRR :).

Main content created by Jennifer Fandrich,
other authors are credited respectively

E-Mail: trr181.cen@uni-hamburg.de

Web: www.trr-energytransfers.de

Twitter: [@TRREnergy](https://twitter.com/TRREnergy)

Youtube: [TRR 181 YT Channel](https://www.youtube.com/channel/UC...)
