



TRR 181 NEWSLETTER

ENERGY INFLOW

Finally it's spring time

There is a lot going on in the TRR: We had our Annual Spring School and the Project leaders are preparing Phase 3 of the TRR. We hope you all enjoy sun, flowers and green leavess and springtime in general.

In this Newsletter you find:

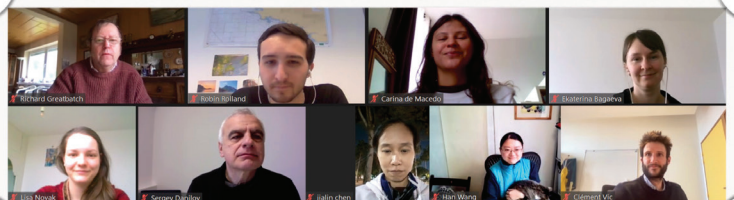
- a report of the RTG Spring School
- a report of the Eddy Wave meeting
- reports from our PhD candidates in T2 and T4
- a list of new publications and an outlook on what will happen the next months.

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

Jennifer



Eddies and Waves: Theory, Models, and Observations
14th-16th February 2023, Universität Hamburg, Germany



REPORT - SPRING SCHOOL 2023

After we had such a wonderful time last year in Plön, we were happy that for this year the youth hostel at Koppelsberg was again available for our RTG ENERGY Spring School from May 10-12.

This year's Spring School was for all of us new in a different way: it was completely organized by PhD students and Postdocs representatives (except for the organizational stuff that RTG coordinator Lea is to thank for).

Arriving with the train in smalltown Plön is quite beautiful: the station is placed directly to the lake area, so you already enjoy a beautiful view stepping outside the train. Everyone knows that with a full stomach you learn better, so starting with lunch seems about right. After some troubles with the wifi in the Posaunenhaus, we switched rooms and luckily coach Daniel Friedrich was nice and friendly and started his workshop Knowledge management for researchers finally in the new seminar room. Software tools like Zotero and Obsidian have been presented, hopefully something helpful for all upcoming PhD theses.

The workshop was followed by a RTG Conference with talks by PhDs and Postdocs. Aside from the science talks, there was also a presentation by Ole Pinner on the OceanAtmosWiki he set up with the aim of collecting general information others might find helpful as well as recommendations of good literature (the Wiki can be found here: https://ocean.miraheze.org/wiki/Main_Page). After dinner the poster session started with a lot of discussion on each topic.

The second day started for some of us quite cold and refreshing: with a swim in the lake. The first agenda point that morning was breakout sessions: Data Visualisation organised by Markus Reinert, a Q&A session with TRR project leaders about their career paths, moderated by Erika Henell, and even sport was included: a yoga session by Peter Dennert helped us refreshing our minds.

After a short coffee break, Project Leader Martin Losch held his talk: What is a (ocean) general circulation model? A Q&A round was the science finish for the afternoon.

I can see clearly now the rain is gone

Luckily the rain that started in the morning stopped shortly after lunch so we could start our canoe trip. Like last year we divided into several canoes, Ole decided to go in a Kayak on his own and Manita Choucksey arrived to join the last canoe (thank you for waiting). Paddling with sun and joy to Plön, enjoy an ice cream and go back, it was again a wonderful trip.

The evenings were enjoyed outside at the lake or inside the "Spielehaus" with pool, kicker, ping pong games and a fire at the fireplace.

Like last time, the last day was dedicated to career paths in academia and beyond: Former TRR project members Kerstin Jochumsen (BSH) and Valerio Lembo (ISAC - Bologna) as well as current member Gerd Baumgarten (IAP) and Anne Gerdes (intersoft AG) and Niklas Kühl (Hamburg Ship Model Basin) talked in small groups about their individual career path.

The Spring School's last workshop was held by Ulrike Schneeberg on Mental health for early career scientists. The workshop was a nice mix of input from Ulrike (e.g. about



the typical stressors early career scientists experience) and exercises done in pairs and small groups. In the closing session, Florian and Lea shared a few updates about credit points for PhDs, reminded all early career scientists about the available funds for research stays in 2023, and asked for course suggestions. After that, the Spring School ended with the last coffee & cake break before everybody started their way back home.

Thank you everyone for making this Spring School such a lovely, warm and social event. We hope all of you enjoyed it as much as Lea, Paula and I did.



REPORT - EDDY WAVE MEETING 2023: THEORY, MODELS, AND OBSERVATIONS

by Manita Chouksey, PL

The Eddy-Wave Meeting 2023 was held from February 14th-16th, 2023 at Universität Hamburg, Hamburg.

The meeting covered varied topics on eddies and waves in geophysical fluid dynamics encompassing theoretical, modelling, and observational aspects. This meeting is a continuation of a series of international workshops within the framework of the collaborative project TRR-181 "Energy Transfers in Atmosphere and Ocean". I have been organizing similar meetings on topics related to eddies and waves previously on 'Flow decomposition methodologies' (2018, in-person) and 'Eddies and Waves' (2021, virtual). This time Stephan Juricke (Constructor University and AWI) co-organized with me the Eddy-Wave Meeting 2023, which was a hybrid meeting with about 150 participants from around the world and multiple time-zones.

The scientific contributions of the meeting participants helped enhance our understanding of the interactions and energy transfers between the

mesoscale (balanced) eddies and (unbalanced) internal waves, their generation and dissipation mechanisms and relevance to the global energy cycle, as well as shed light on emerging machine learning applications.

Overall, the meeting program involved 43 talks and two days of poster session, including five keynote talks from the invited speakers: TRR181 Mercator Fellows: Kevin Lamb (University of Waterloo, Canada), Jacques Vanneste (University of Edinburgh, UK), and Laure Zanna (New York University, USA); Jen-Ping Peng (University of Western Australia, Australia), and Jenny Chang (Princeton University, USA). The meeting also included a conference dinner and a pub-quiz organized by TRR181 PhD candidates as social networking events.

The success of the Eddy-Wave Meeting 2023 is a motivation to continue organizing such meetings in the future and bring together the state-of-the-art scientific research worldwide on this meeting

platform.

The help and support of the TRR181 coordinator Jennifer Fandrich and student helpers Lev Kneller and Paula Bäurich is sincerely acknowledged.

I thank all the participants of the Eddy-Wave Meeting 2023 for their contributions and look forward to meeting you in the next meeting!

PUBLICATIONS

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

Brecht, R., Bakels, L., Bihlo, A. & Stohl, A. (2023). Improving trajectory calculations by FLEXPART 10.4+ using single-image super-resolution. *Geosci. Model Dev.* 16(8), 2181–2192, doi: <https://doi.org/10.5194/gmd-16-2181-2023>.

Shi, J., Stepanek, C., Sein, D., Streffing, J., & Lohmann, G. (2023). East Asian summer precipitation in AWI-CM3: Comparison with observations and CMIP6 models. *International Journal of Climatology*, 1– 16, doi: <https://doi.org/10.1002/joc.8075>.

Pithan, F., Athanase, M., Dahlke, S., Sánchez-Benítez, A., Shupe, M. D., Sledd, A., Streffing, J., Svensson, G., & Jung, T. (2023). Nudging allows direct evaluation of coupled climate models with in situ observations: a case study from the MOSAiC expedition. *Geosci. Model Dev.* 16(7), 1857–1873, doi: <https://doi.org/10.5194/gmd-16-1857-2023>.

Pollmann, F. & Nycander, J. (2023). Resolving the horizontal direction of internal tide generation: Global application for the M2-tide's first mode. *J. Phys. Oceanogr.*, doi: <https://doi.org/10.1175/JPO-D-22-0144.1>.

Kutsenko, A.A. (2023). Approximation of the Number of Descendants in Branching Processes. *J. Stat. Phys.* 190(68), doi: <https://doi.org/10.1007/s10955-023-03079-6>.

Olbers, D., Pollmann, F., Patel, A. & Eden, C. (2023). A model of energy and spectral shape for the internal gravity wave field in the deep-sea – The parametric IDEMIX model. *J. Phys. Oceanogr.*, doi: <https://doi.org/10.1175/JPO-D-22-0147.1>.

Brecht, R. & Bihlo, A. (2023). Computing the Ensemble Spread From Deterministic Weather Predictions Using Conditional Generative Adversarial Networks. *Geophysical Research Letters* 50(2), e2022GL101452, doi: <https://doi.org/10.1029/2022GL101452>.

Denamiel, C., Vasylykevych, S., Žagar, N., Zemunik, P. & Vilibić, I. (2023). Destructive potential of planetary meteotsunami waves beyond the Hunga Tonga–Hunga Ha'apai volcano eruption. *B. Am. Meteorol. Soc.* 104(1), E178–E191, doi: <https://doi.org/10.1175/BAMS-D-22-0164.1>.

Juricke, S., Bellinghausen, K., Danilov, S., Kutsenko, A., & Oliver, M. (2023). Scale analysis on unstructured grids: Kinetic energy and dissipation power spectra on triangular meshes. *Journal of Advances in Modeling Earth Systems* 15, e2022MS003280, doi: <https://doi.org/10.1029/2022MS003280>.

Pohlmann, H., Brune, S., Fröhlich, K., Jungclaus, J.H., Sgoff, C. & Baehr, J. (2022). Impact of ocean data assimilation on climate predictions with ICON-ESM. *Clim Dyn*, doi: <https://doi.org/10.1007/s00382-022-06558-w>.

UPCOMING EVENTS

June 6, 2023

Workshop: Networking & Impostor This is the fourth workshop of the TRR's Career Development Programme, which is designed for the female PhDs, postdocs and Young Project Leaders.

June 8, 2023

TRR 181 Seminar

The TRR 181 seminar is held by Erika Henell (Leibniz Institute for Baltic Sea Research Warnemünde).

June 15, 2023

RTG ENERGY Meeting

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

June 22, 2023

TRR 181 Seminar

The TRR 181 seminar is held Dr. Andreas Dörnbrack (Deutsches Zentrum für Luft- und Raumfahrt).

June 29, 2023

Gender & Diversity: Q&A Session about Sexual Harassment

Q&A session with Sabine Blackmore on the topic of "How should the TRR deal with reports of sexual harassment?". We invite all TRR members to participate!

July 6, 2023

TRR 181 Seminar

The TRR 181 seminar is held Dr. Han Wang (University of Edinburgh).

September 26-28, 2022

TRR 181 Annual Retreat

The Retreat will take place at ATLANTIC Hotel Sail City, Bremerhaven.



TWO-PHASE FLOW SIMULATIONS OF SURFACE WAVES IN FORCED CONDITIONS

by Malte Loft, PhD student T4

Hello everyone, my name is Malte Loft and I work on the "T4 Surface Wave-Driven Energy Fluxes at the Air-Sea Interface" subproject as a PhD student at the Hamburg University of Technology (TUHH).

I studied dual mechanical engineering at the Hamburg University of Applied Sciences and specialised in fluid mechanics at the University of Rostock as part of a Master's degree. In September 2021, I started my PhD to investigate the energy fluxes at the air-sea interface using high-resolution CFD simulations (WP2).

Our goal is to resolve the small-scale processes that dominate the energy exchange as well as to identify the individual mechanisms as a function of the wind wave conditions, e.g. the wave age or wave slope of the current sea state. Due to mostly very high Reynolds numbers, it is hardly possible to perform Direct Numerical Simulations (DNS). Therefore, a hybrid turbulence model (Detached Eddy Simulation, DES) is used for our simulations. First, a numerical wind-wave tank is developed to reproduce relatively simple laboratory conditions

and to validate the numerical model with experimental results (WP1). In the animation shown, a non-linear surface wave can be seen propagating



from left to right, involving strong wind forcing. Air separation events and highly turbulent structures are clearly visible. Due to our fully coupled model, we are able to extract the pressure fields and surface stresses at any point in space and can also include the influence of

surface tension effects in our investigations. Furthermore, we produce large amounts of data during our simulations in order to determine phase-averaged quantities using triple decomposition. In other words, fields of pressure or velocity that correlate with the respective sea state, detached from turbulent fluctuations. With all this data, we hope to gain deep insights into the physical processes that determine the mechanical energy flow at the air-sea interface.

In the future, we will extend the application of our model to more complex scenarios, e.g. to highly non-linear sea states of the Baltic Sea, including further phenomena such as wave breaking. Another goal is to formulate the findings into improved parameterisations, in particular to improve the boundary conditions of current ocean models (WP3).

RESEARCH STAY IN BREST

In December 2022, Mariana Lage did a research stay at Ifremer (Institut français de recherche pour l'exploitation de la mer) in Brest, France.

Text: Mariana Lage, PhD student T2

One of the best parts of being a scientist in my opinion is to go abroad, meet new researchers and discuss ideas. It is amazing to see what other scientists are doing and how different the institutes are. Last year I had the opportunity to go to Ifremer (Institut français de

recherche pour l'exploitation de la mer), in Brest, Brittany, France, and all started with a simple email to Claire Ménesguen introducing myself and asking whether I could visit the institute.

Claire is one of the team leaders of the Ocean Scale Interactions group at the Laboratory for Ocean Physics and Satellite remote sensing (LOPS) together with Jonathan Gula. The main focus of the group is to study ocean dynamics with a particular

interest in small horizontal and temporal scales. Once the collaboration was settled and I arrived in Brest, we had several meetings to start planning the structure of the upcoming work. The infrastructure at Ifremer is great, and I met many PhD students and posdocs. As the time and work progressed, we decide to slightly modify our initial plan. Science is highly non-linear, so we had to adapt given the results we obtained

with some of the analyses. The good part about that is that I was able to constantly discuss not only with Claire (and Jeff), but also with a lot of people from both Ifremer and LOPS. Because people have different backgrounds, we were able to approach my research topic from many different angles, which led to many nice ideas.

Apart from work (because it would be a shame not to enjoy Brittany's landscape), I enjoyed the weekends hiking and traveling to small cities around Brest, and, of course, eating! Brittany is very well-known for crêpes, sea food (oysters!) and caramel, which are musts to try when you are there. Brest is on the west coast of France and the landscape is just stunning! The color of the water, the lighthouses and the shape of the coast make this city quite unique. There is also an Aquarium which is really worth visiting.

One curiosity from there is that they have their own language (Breton, or Brezhoneg), although nowadays French is the main language spoken. Another curiosity is that it rains a lot, and the weather can easily change from heavy storm to shining sun in a matter of hours.

After my return, Claire and I are still in close contact and we are already planning the next steps regarding our collaborative research. My time there was really pleasant and fruitful and a second research stay is planned in October 2023. I really recommend sometime abroad for everyone especially because the TRR provides the most

difficult thing to get: money. This is a unique opportunity to gather different opinions about one's research topic and to get people to know you too. I left behind many open doors and I am really excited to continue working with all the people I met!



RESEARCH STAY IN MIAMI

Text: Janina Tenhaus, PhD student T4



Last year I was asked if I would like to participate in a wind-wave project at the Alfred C. Glassell, Jr. SUSTAIN Laboratory in Miami, USA, for three weeks. After listening to the song "Miami" by Will Smith several times, I felt well prepared and started organizing the trip, especially the funding by the TRR. The wind-wave tank is top-notch, and I was very excited when everything was approved. After

my arrival, I met the scientists from Columbia University, U.S. Naval Research Laboratory, University of New Hampshire, and of course University of Miami. From now on, we spent almost every day in the dark lab with no daylight – thanks to the Particle Image Velocimetry measurements. Outside it was summer and mosquito season, so we did not complain much. We survived working on weekends with strong Cuban coffee (do you really want the real one and no sleep for a week?). But the experimental work did not only take place in the lab;

discovering the great dive sites of Miami was also part of my tight schedule. Shortly before my return flight, we cooled the tank, whereupon it began to leak as all the silicone seals contracted. This reminded me of the rainy weather in Hamburg, and I knew it was time to come home. I am very grateful for this experience and would recommend everyone not miss the opportunity to do a research stay.

Main content created by Jennifer Fandrich,
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