

TRR 181 NEWSLETTER

ENERGY INFLOW

DO THEY KNOW IT'S ...

... christmas time at all? We are not so sure this years, since the next proposal has us all in it's grasp. But we think it will be worth all our time and that we have a successfull 2020 to look forward to.

In this issue, you can read about the gender in science workshop with Prof. Schiebinger, our reprentation at the Frankfurter Buchmesse, the kick-off of the "Art&Science" project, Jonas talk at "Science goes public", upcoming events, new publications as well as a scientific report from M1!

Enjoy! Jennifer and Meike



Prof. Londa Schiebinger presenting her work on gender in science.

RESEARCH WITH NUMBERS AND WATER: DO WE HAVE A GENDER DIMENSION?

In November 2019, the TRR 181 and the Cluster of Excellence CLICCS were proud to host Prof. Londa Schiebinger (Stanford University), the leading expert on gender and science, in Hamburg. One of the first results: No, we do not have a gender dimension in research, but does that mean we cannot think about it?

On Thursday, November 21, we started with a workshop for our current and future project leaders about the gender dimension

science. Prof. in Schiebinger distinguishes between three levels of gender dimensions: 1. Fix the numbers of women, 2. fix the institutions and 3. Fix the knowledge. Her work focuses on the third dimension: How is gender influencing science and where do we have to watch out for this? Prof. Schiebinger started the workshop presenting her work on "Gendered Innovations" by providing the participants with some inspirational material for the following task: Does our very theoretical work have a gender dimension? The participants got together in two groups to discuss possible situations and areas were gender could have an impact on their research. First skeptical, the groups did came up with some ideas: Is it important to note if a male or female is taking or handling water samples? Does it matter if you tag male or female seals for measurements underneath the sea ice? An interesting discussion started that got everybody thinking. In the end, we now know that most of our work does not have a gender dimension, but it was an interesting task to understand just how important gender is. Some of the ideas got Prof. Schiebinger very excited and might lead to future collaborations with our project. In the evening, Prof. Schiebinger held an evening lecture about "Gendered Innovations" to a university-wide audience.

On Friday, November 22, we repeated the Thursday workshop

TRR181 @ FRANKFURTER BUCHMESSE 2019

Together with Springer Nature we organized a book presentation of our TRR book "Energy transfers in Atmosphere and Ocean" as part of the Springer-Buchreihe "Mathematics of Planet Earth" at the Campus Weekend of the Frankfurt Book Fair, the biggest Book Fair in the World.

Over 300.000 vistors have been at this years Frankfurter Buchmesse -

we were one of them: Our PI Armin Iske (Universität Hamburg) and our Postdocs Rebecca McPherson (Universität Hamburg) and Stephan Juricke

(Jacobs University Bremen) were invited to a panel discussion, together with Renate Bayaz from Springer Nature TRR outreach coordinator Jennifer Fandrich

KICK-OFF ART & SCIENCE MEETING

End of October we met with two art students and discussed first ideas for our Art&Science Collaboration with Hochschule für Musik und Theater Hamburg at our Kick-Off in Hamburg.

Composer Pedro Gonzales and theater play director Meera Theunert met with interested TRR scientists and developed first ideas for the planned Art & Science Collaboration. It was a first meeting organized the event. After everyone has arrived in Frankfurt on Saturday, October 19we met with Renate Bayaz and science journalist Mike Beckers from journal Spektrum der Wissenschaft, wo

moderated the the panel discussion: "Mit Mathematik das Klima besser

but with a broader audience

of PhDs and Postdocs from all

disciplines. Participants included

biomechanics, historians and IT-

developers. The task done the day

before showed that in other areas

gender of the research subject or

the researcher has a clear impact

on the work done. The feedback of

this workshop was overwhelmingly

positive and we were showered

with thanks for the organization.

This was also the feedback for the

neuroscientists,

geographers,

verstehen - Veranstaltung zur Springer-Buchreihe "Mathematics of Planet Earth".

The panel discussion was a full success: Every seat was taken and

people were also standing in the back, approximately 100 visitors listened to the half-hour discussion. After the panel discussion the "Ask the Expert" event from 14.30-16.00 at the Springer

Q&A with Prof. Schiebinger after the workshop. Participants could ask her questions about her career or opinion on gender issues. It was a very lively discussion and some of the participants networked afterwards to exchange further information or ideas on gender in science.

We like to thank Prof. Schiebinger again for her visit and her thought-provoking research.

More on "Gendered Innovations" can found on the website: genderedinnovations.stanford.edu



climate research in the time of global protests.

We are very glad to be able to present our book and work within the TRR at the Book Fair and to be part of this event – it was a quite effective and at the same time fun way to connect to a science-interested public.

with a lot of short science talks and questions from Pedro and Meera. Now they develop first ideas in the field of music and theater to present at the review in March.

Thanks to everyone who joined and helped start this amazing process of finding a new way to communicate our scientif work to the general public.





OUR PI VALERIO LUCARINI AWARDED WITH EGU RICHARDSON MEDAL

The EGU has named the 49 recipients of next year's Union Medals and Awards, Division Medals and Division Outstanding Early Career Scientist Awards. Our PI Valerio Lucarini is amongst them!

The EGU has named the 49 recipients



of next vear's Union Medals and Awards. Division Medals and Division Outstanding Early Scientist Career These Awards. individuals are honoured for their important

contributions to the Earth, planetary

and space sciences. They will receive their prizes at the EGU 2020 General Assembly, which will take place in Vienna on 3–8 May, 2020.

Our PI Valerio Lucarini was awarded with the Richardson medal. We asked him:

Valerio, you have been awarded with the Lewis Fry Richardson Medal. Could you tell us a little bit more about the nominating process

colleagues formally Two senior nominated me, attaching support letters from five other senior scientists.

Is the Medal an award for a special scientific achievement

The committee awarded me the medal for my research activities in the area of mathematics of climate, rather than for an individual result. *My* research work done in Hamburg at Clisap and then at TRR have been essential for achieving this, and I am very grateful for the opportunities UHH has given me in these years.

Congratulations to Valerio!

TALK AT EVENT SERIES SCIENCE GOES PUBLIC IN BREMEN

Our PhD student Jonas Löb talked about his PhD topic "Interne Wellen -Monsterwellen in der Tiefsee" in a pub in Bremen at event series SCIENCE GOES PUBLIC.

Entertaining science in 30 minutes. You want some exciting insights into unknown worlds? SCIENCE GOES PUBLIC! satisfies your thirst for knowledge. Original science

topics are presented twice a year in selected pubs and bars in Bremerhaven and in Bremen in a humorous way - by scientists.

One of these scientists was our PhD student

Ionas Löb from Bremen University. He held a talk and had luckily a very interested audience - people were standing outside to get in the pub. This shows how important these kind of entertaining outreach events are - because people are interested to know more about scientific topics.

We asked him some questions about the role of science communication and the connection of science and pubs:

What was the talk about?

The talk was about the fundamentals of internal waves. I basically tried to address my science for a public in a cozy and relaxing environment like a pub. I

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important topic for scientist and what is the goal of our TRR181. In the last part I talked about how internal waves can be measured and how that exactly works on a research vessel.

What do you like talking about your science?

I do not necessarily like to talk about

my science in public, but I see it as a kind of obligation which you have to do as a scientist. I think it is the right of every taxpayer to get also information about the knowledge we scientist create with their money and that this knowledge is not exclusively for other scientists. It also helps for the acceptance of science in the broader public in general, if everyone can access the information you can provide. But of course it is very nice to receive such nice feedback and appreciation.

For every interested scientists: How was the collaboration process: did someone approach you or was it through your initiative?

I got directly asked from our P.I. Maren Walter who was asked from the responsible for public relations at the MARUM at University Bremen. So it was more a coincident that I participated but I really enjoyed it and I can only recommend to do the same. Should anyone be interested in presenting themselves and their science, I am happy to pass this

on, or you just visit their homepage sciencegoespublic.de.

What do you like most of about the connection of science and pubs?

Free drinks! Jokes aside, it was really nice to give a presentation in a such a different environment without any presentation. Not having any pictures, graphs or tables really motivates you to think about what exactly you want to tell, in which context and how you explain things in a way that everybody understands. This was also the biggest challenge, but a very interesting one whereby I learned a lot. Furthermore, people really listen to you. If you are on your standard conference the majority of the people is often not focused only on you and your talk. They work, write emails or run in and out all the time. In this format it is really only about you. Another thing I very much noticed is the diversity of the people who were there to listen to my talk. It is also not so bad if you make mistakes. Everybody just wants to know what you have to say, so they are very warm and friendly. And even if you make a mistake, nobody will notice, besides your colleagues ;).

Thanks to Jonas now scienceinterested people in Bremen know more about internal waves and the importance of fundamental research in this field. Well done!

UPCOMING EVENTS

January 16, 2020

TRR 181Seminar

The seminar is held by Kesava Ramachandran (PhD in T1) at tbd, 2 pm.

January 23, 2020 TRR 181 Seminar

The TRR 181 seminar is held byThomas Eriksen (PhD in W4) on January 16, 11 am at tbd.

January 28-31, 2020 Hamburg

Hamburg COMMODORE conference

The Hamburg COMMODORE Conference invites model developers working on all scales and compartments of the ocean, as well as applied mathematicians working on alternative discretisation techniques and/or simplified equation sets relevant to ocean modeling.

February 4, 2020

TRR 181 Seminar The TRR 181 seminar is held by Evridiki Chrysagi (PhD in T2) on February 4, during the TRR 181 Winter School.

February 4-7, 2020 TRR 181 Winter School

Our annual Winter School is held in Ratzeburg.

February 26, 2020

First review rehearsal

The first rehearsal is held in Hamburg.

March 9, 2020

Final review rehearsal

The final rehearsal is held in Bremen.

March 18-19, 2020

TRR 181 Review The review for the second phase is held in Bremen.

April 1, 2020

Gender Symposium "Equal opportunities during scientific careers"

The TRR 181 "Energy transfers in Atmosphere and Ocean" in collaboration with the International Research Training Group "ArcTrain" organizes a one-day symposium to raise awareness for these gendered dynamics and to foster a gender and diversity-sensitive approach to the promotion of early career scientists.



PUBLICATIONS

Have you also published your work, but cannot find it here? Please get in touch with the <u>project coordination</u>. Members of the TRR 181 are printed in bold.

Lucarini, V. (2019). Stochastic Resonance for Non-Equilibrium Systems. arXiv preprint arXiv:1910.05048.

Juricke, S., Danilov, S., Koldunov, N., Oliver, M. & Sidorenko, D. (2019). Ocean kinetic energy backscatter parametrization on unstructured grids: Impact on global eddypermitting simulations, J. Adv. Model. Earth Sys., https://doi. org/10.1029/2019MS001855.

Danilov, S., & Kutsenko, A. (2019). On the geometric origin of spurious waves in finite-volume discretizations of shallow water equations on triangular meshes. Journal of Computational Physics, 398, 108891, https://doi.org/10.1016/j. jcp.2019.108891.

Scholz, P., Sidorenko, D., Gurses, O., Danilov, S., Koldunov, N., Wang, Q., Sein, D., Smolentseva, M., Rakowsky, N., & Jung, T. (2019). Assessment of the Finite VolumE Sea Ice Ocean Model (FESOM2.0), Part I: Description of selected key model elements and comparison to its predecessor version, *Geosci. Model Dev.*, https://doi.org/10.5194/ gmd-2018-329.

Dippner, J. W., Bartl, I., **Chrysagi, E.,** Holtermann, P. L., Kremp, A., Thoms, F., & Voss, M. (2019). **Lagrangian Residence Time in the Bay of Gdansk, Baltic Sea.** *Frontiers in Marine Science*, 6, 725 https://doi. org/10.3389/fmars.2019.00725. Kutsenko, A. A. (2019). Matrix representations of multidimensional integral and ergodic operators. *Appl. Math. Comput.*, Vol. 369, https://doi. org/10.1016/j.amc.2019.124818.

Sidorenko, D., Goessling, H. F., Koldunov, N. V., Scholz, P., Danilov, S., Barbi, D., Cabos, W., Gurses, O., Harig, S., Hinrichs, Juricke, S., Lohmann, G., C., Losch, M., Mu, L., Rackow, T., Rakowsky, N., Sein, D., Semmler, T., Shi, X., Stepanek, C., Streffing, J., Wang, Q., Wekerle, C., Yang, H., & Jung, T. (2019). Evaluation of FESOM2.0 coupled to ECHAM6.3: Pre-industrial and HighResMIP simulations. Journal of Advances in Modeling Earth Systems, 11, https:// doi.org/10.1029/2019MS001696.

Moritz, M., Jochumsen, **K., North,** R. P., Quadfasel, D., & Valdimarsson, H. (2019). **Mesoscale Eddies observed at the Denmark Strait sill.** Journal of Geophysical Research: Oceans, https://doi. org/10.1029/2019JC015273.

Rackow, T., & Juricke, S (2019). Flow dependent stochastic coupling for climate models with high ocean to atmosphere resolution ratio. Quarterly Journal of the Royal Meteorological Society, 1-17, https:// doi.org/10.1002/qj.3674.

Brüggemann, N., & Katsman, C. A. (2019). Dynamics of downwelling in an eddying marginal sea: contrasting the Eulerian and the isopycnal perspective. J. Phys. Oceanogr., https://doi.org/10.1175/ JPO-D-19-0090.1.

SCREENING THE COUPLED ATMOSPHERE-OCEAN SYSTEM BASED ON COVARIANT LYAPUNOV VECTORS

by Melinda Galfi, Postdoc M1

Covariant Lyapunov vectors (CLVs) reveal the local geometrical structure of the systems's attractor, thus providing valuable information about the basic dynamics. They are physically meaningful since they point into the directions of linear perturbations applied to the trajectory of the system. CLVs are linked to Lyapunov exponents, which describe the growth or decay rate of linear perturbations.



My name is Melinda Galfi, and I am a postdoc in the M1 subproject. I am continuing the work on CLV analysis started by Sebastian Schubert. I use the tangent linear version of the coupled atmosphere-ocean quasi-geostrophic model MAOOAM, and calculate the CLVs based on the so-called Ginelli method. I compute the CLVs in the phase space of the model, spanned by the spectral model variables, which

"I use the tangent linear version of the coupled atmosphere-ocean quasi-geostrophic model MAOOAM, and calculate the CLVs based on the so-called Ginelli method."

can be grouped into four different categories: atmospheric dynamic and thermodynamic variables, as well as oceanic dynamic and thermodynamic variables.

The spectrum of Lyapunov exponents of our systems reveals the existence of a central or slow manifold. This is a basic property ocean-atmosphere of coupled models, and has to do with the multiscale character of this type of chaotic system. Based on the CLVs, we hope to understand more deeply the dynamical properties of the system itself, and especially of the slow manifold. To achieve this, one can use several CLV based indicators. One of these indicators is the variance of CLVs, showing the contribution of each model variable to the growth or decay of perturbations. By computing the variance of the CLVs in MAOOAM, we see that the atmospheric variables have the strongest contribution to the evolution of perturbations in our system. However, we detect an exception in case of instabilities growing or decaying on long time

scales, where the contribution of the oceanic thermodynamic variables is approximately as strong as the

one of the atmosphere. This shows that the d y n a m i c s of the slow manifold is

governed by interactions between atmosphere and ocean, with the main coupling taking place through the ocean thermodynamics. The contribution of the ocean is the strongest in case of perturbations decaying over long time scales. Another useful indicator is the angle between CLVs, revealing the local structure of the attractor. Our results show that the angle between the CLVs corresponding to the slow manifold is dominantly very near zero, hinting to multiscale instabilities and geometrical degeneracies.

As a next step, we would like to repeat the CLV analysis for a substantially higher model resolution. The currently used resolution consists of 5x5 atmospheric and 5x5 oceanic modes. Our final goal is to study the energy transfers between atmosphere and ocean based on CLVs.

SOMETHING FUNNY FOR THE END

Main content created by Jennifer Fandrich and Meike Ruhnau other authors are credited respectively

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