# NEWSLETTER 2013 | 03


## Sonderforschungsbereich 754

Climate – Biogeochemistry Interactions in the Tropical Ocean

SFB 754

## SFB 754 Summer School 2013

KRISTINEBERG, SWEDEN

Understanding the research of colleagues from another research field is most times fairly difficult. However, exactly this is needed for the interdisciplinary research of the SFB 754 to be successful. To overcome this problem, the SFB754 organised its first summer school that took place at the Kristineberg marine biological field station part of the Sven Lovén Center, Gothenburg University, Sweden, from Aug 18th to 30th, 2013. All SFB 754 financed PhD students and most of the postdocs participated. The aim was to learn from each other. To do exactly this, long poster sessions together with lectures and practicals were organised. Several subproject-leaders of the SFB 754 supported the summer school by giving lectures and answering the many questions. Highlight for many of the young (and old) researchers were the two expeditions with two research vessels to collect various samples that were later analysed during the practicals. In summary, the first SFB 754 summer school was a great success and the output is now a SFB 754 young scientists cohort that has a deep understanding of the SFB 754. First ideas on further inter-disciplinary research with in the SFB 754 have been developed. Therefore, there are already plans for a follow-up summer school next year. We would like to thank everyone who made it possible!

## Publications

2013 (Juli – August)

**J. Deshayes, A.-M. Tréguier, B. Barnier, A. Lecointre, J. Le Sommer, J.-M. Molines, T. Penduff, R. Bourdallé-Badie, Y. Drillet, G. Garric, R. Benshila, G. Madec, A. Biastoch, C.W. Böning, M. Scheinert, A.C. Coward, and J. J.-M. Hirschi (2013) Oceanic hindcast simulations at high resolution suggest that the Atlantic MOC is bistable. GEOPHYSICAL RESEARCH LETTERS, VOL. 40, 3069–3073, DOI 10.1002/grl.50534**

All climate models predict a freshening of the North Atlantic at high latitudes that may induce an abrupt change of the Atlantic Meridional Overturning Circulation (hereafter AMOC) if it resides in the bistable regime. Still, most climate models reproduce a mono-stable strong AMOC, hence predict a gradually decreasing AMOC rather than a collapse. A series of four hindcast simulations of the global ocean at 1/12 degree resolution (produced within the DRAKKAR consortium, http://www.drakkar-ocean.eu), which is presently unique, are used to diagnose freshwater transport by the AMOC in the South Atlantic, an indicator of AMOC bistability. In all simulations, the AMOC resides in the bistable regime: it exports freshwater southward in the South Atlantic, implying a positive salt advection feedback that would act to amplify a decreasing trend in subarctic deep water formation as projected in climate scenarios. This result is robust despite differences in model parameters and forcings and consistent with estimates from observations, which calls for caution when using climate model scenarios that may be overly stable.

**T. Fischer, D. Banyte, P. Brandt, M. Dengler, G. Krahmann, T. Tanhua, and M. Visbeck (2013) Diapycnal oxygen supply to the tropical North Atlantic oxygen minimum zone. Biogeosciences, 10, 5079–5093, www.biogeosciences.net/10/5079/2013, DOI 10.5194/bg-10-5079-2013**

The oxygen minimum zone (OMZ) off northwest Africa is ventilated by advective and diffusive processes along density surfaces (isopycnal) and across density surfaces (diapycnal). Traditionally the diapycnal pathway has been deemed negligible. In this study particularly the diapycnal oxygen supply is investigated using a large observational set of oxygen profiles and diapycnal mixing data from years 2008 to 2010. Diapycnal mixing is inferred from different sources: (i) a large-scale tracer release experiment, (ii) microstructure profiles, and (iii) shipboard acoustic current measurements plus density

## SFB 754 Colloquia & more

**VINCENT ECHEVIN AND FRANCOISE COLAS: MESOSCALE AND SUBMESOSCALE PROCESSES IN THE HUMBOLDT CURRENT SYSTEM**

September 17, 2013 at 8:30 h

Hörsaal GEOMAR, Westshore

**LOTHAR STRAMMA: SFB 754 EDDY WORKSHOP**

November 25 – 26, 2013

Application Deadline: September 27, 2013

### SFB 754 Gender Measures

**STEPHAN NADENAU: SFB 754 ASSERTIVENESS AND SELF-DEFENCE TRAINING**

start: September 26, 2013 at 16.45 h

Large Conference Room GEOMAR, Westshore

**DEBORAH RUGGIERI: "GENDER COMPETENCE AS KEY QUALIFICATION"**

Workshop, November 20 – 21, 2013

## News

**ALBERT-DEFANT-MEDAL FOR LOTHAR STRAMMA**

On the 3rd September 2013 Lothar Stramma received the Albert-Defant-Medal 2013 at the DACH conference in Innsbruck. The Deutsche Meteorologische Gesellschaft awarded the medal in recognition of Lothar Stramma's pathbreaking work on large-scale circulation in the tropical and South Atlantic and his analyses of dynamics and changes of tropical oxygen minimum zones.

profiles. The average diapycnal diffusivity in the studied depth interval from 150 to 500m is estimated to be $1\times10^{-5}$ $m^2$ $s^{-1}$. Diapycnal mixing is found to contribute substantially to the oxygen supply of the OMZ. Within the OMZ core, about one-third of the total oxygen demand is supplied via diapycnal mixing.

**J. Getzlaff and H. Dietze (2013) Effects of increased isopycnal diffusivity mimicking the unresolved equatorial intermediate current system in an earth system climate model. GEOPHYSICAL RESEARCH LETTERS, VOL. 40, 2166–2170, DOI 10.1002/grl.50419**

Earth system climate models generally underestimate dissolved oxygen concentrations in the deep eastern equatorial Pacific. This problem is, at least partially, caused by a deficient representation of the Equatorial Intermediate Current System (EICS). Emulating the unresolved EICS in the UVic earth system climate model by locally increasing the zonal isopycnal diffusivity (1) resolves most of the local "nutrient trapping" and associated oxygen deficit in the eastern equatorial Pacific and, (2) reduces spurious zonal temperature gradients on isopycnals without affecting other physical metrics such as meridional overturning or air-sea heat fluxes. Finally, climate projections of low-oxygenated waters and associated denitrification change sign and, apparently, become more plausible.

**N. Glock, J. Schönfeld, A. Eisenhauer, C. Hensen, J. Mallon, and S. Sommer (2013) The role of benthic foraminifera in the benthic nitrogen cycle of the Peruvian oxygen minimum zone. Biogeosciences, 10, 4767–4783, Vol. 488: 81–88, 2013, DOI 10.3354/meps10403**

The authors present estimates of benthic foraminiferal denitrification rates from six stations at intermediate water depths in and below the Peruvian oxygen minimum zone (OMZ). Foraminiferal denitrification rates were calculated from abundance and assemblage composition of the total living fauna in both surface and subsurface sediments, as well as from individual species specific denitrification rates. A comparison with total benthic denitrification rates as inferred by biogeochemical models revealed that benthic foraminifera probably account for the total denitrification in shelf sediments between 80 and 250m water depth. The estimations also imply that foraminifera are still important denitrifiers in the centre of the OMZ around 320 m, but play only a minor role at the lower OMZ boundary and below the OMZ between 465 and 700 m. The estimated foraminiferal denitrification rates contribute 2 to 46 % to the total nitrate loss across a depth transect from 80 to 700 m, respectively. Furthermore the authors show that the amount of nitrate stored in living benthic foraminifera can be higher by three orders of magnitude as compared to the ambient pore waters in near-surface sediments sustaining an important nitrate reservoir in Peruvian OMZ sediments. The substantial contribution of foraminiferal nitrate respiration to total benthic nitrate loss at the Peruvian margin underpins the importance of the previously underestimated role of benthic foraminifera in global biogeochemical cycles.

**N. Olgun, S. Duggen, B. Langmann, M. Hort, C. F. Waythomas, L. Hoffmann, P. Croot (2013) Geochemical evidence of oceanic iron fertilization by the Kasatochi volcanic eruption in 2008 and the potential impacts on Pacific sockeye salmon. MARINE ECOLOGY PROGRESS SERIES (Mar Ecol Prog Ser) Vol. 488: 81–88, DOI 10.3354/meps10403**

The Kasatochi volcanic eruption that occurred in August 2008 in the central Aleutian Islands in Alaska (USA) is thought to have induced a massive diatom bloom in the iron (Fe) limited waters of the Gulf of Alaska. The authors report the first seawater experiments involving volcanic ash ejected from the Kasatochi eruption, showing that the Kasatochi ash released 61 to 83 nmol Fe, 374 to 410 nmol $NO_3^-$, 5 to 6 nmol $PO_4^{3-}$ and 170 to 585 nmol $SiO_2$ when it contacted seawater. The study suggests that the amount of Fe released from Kasatochi ash was indeed sufficient to cause the observed phytoplankton bloom in the northeastern Pacific, while the impact of macronutrient release was minimal. The authors further evaluated the multiple, interdependent processes in the oceanic food web related to the diatom bloom, involving the increased ocean survival of juvenile salmon that entered the northeast Pacific Ocean in the summer of 2008.

**K. Wuttig, M.I. Heller, and P.L. Croot: Pathways of Superoxide ($O_2^-$) decay in the Eastern Tropical North Atlantic (just accepted) Environ. Sci. Technol., Just Accepted Manuscript, DOI: 10.1021/es401658t, Publication Date (Web): 05 Aug 2013**

In this paper the authors examine the decomposition rate of superoxide ($O_2^-$) throughout the water column, using new data collected in the Eastern Tropical North Atlantic (ETNA) Ocean. For this approach the authors applied a semi factorial experimental design, to identify and quantify the pathways of the major identified sinks in the ocean. In this work they occupied 6 stations, 2 on the West African continental shelf and 4 open ocean stations, including the CVOO time series site adjacent to Cape Verde. The results indicate that in the surface ocean impacted by Saharan aerosols and coastal sediment resuspension, the main decay pathways for superoxide is via reactions with Mn(II) and organic matter.

**K. Wuttig, M. I. Heller, and P. L. Croot: Reactivity of inorganic Mn and Mn Desferrioxamine B with $O_2$, $O_2$- and $H_2O_2$ in seawater. Environ. Sci. Technol., Just Accepted Manuscript, DOI: 10.1021/es4016603, Publication Date (Web): 05 Aug 2013**

This study examines the connections between ROS and dissolved Mn species in the upper ocean using field and laboratory experimental data. Results suggest it is unlikely that significant concentrations of Mn(III) are produced in the euphotic zone, as in the absence of evidence for the existence of strong Mn(III) ligands, Mn(II) reacts with $O_2^-$ to form the short lived transient manganous superoxide, $MnO_2^+$, which may react rapidly with other redox species in a similar manner to $O_2^-$. Experiments with the strong Mn(III) chelator, desferrioxamine B (DFB), in seawater indicated that the Mn(III) species are unlikely to form, as formation of the pre-cursor Mn(II) complex is hindered due to the stability of the Ca complex with DFB.

## Conferences

### 2013

**AGU FALL MEETING 2013**
December 9 – 13, 2013
San Francisco, USA

### 2014

**OCEAN SCIENCES MEETING 2014**
February 23 – 28, 2014
Honolulu, Hawai'i

**LOW OXYGEN ENVIRONMENTS IN MARINE, ESTUARINE AND FRESH WATERS**
May 5 – 9, 2014
Liège, Belgium

**IMBER OPEN SCIENCE CONFERENCE 2014**
June 23 – 27, 2014
Bergen, Norway

EDITORIAL
Dr. Chris Schelten
Phone 0431/600-4242
cschelten@geomar.de