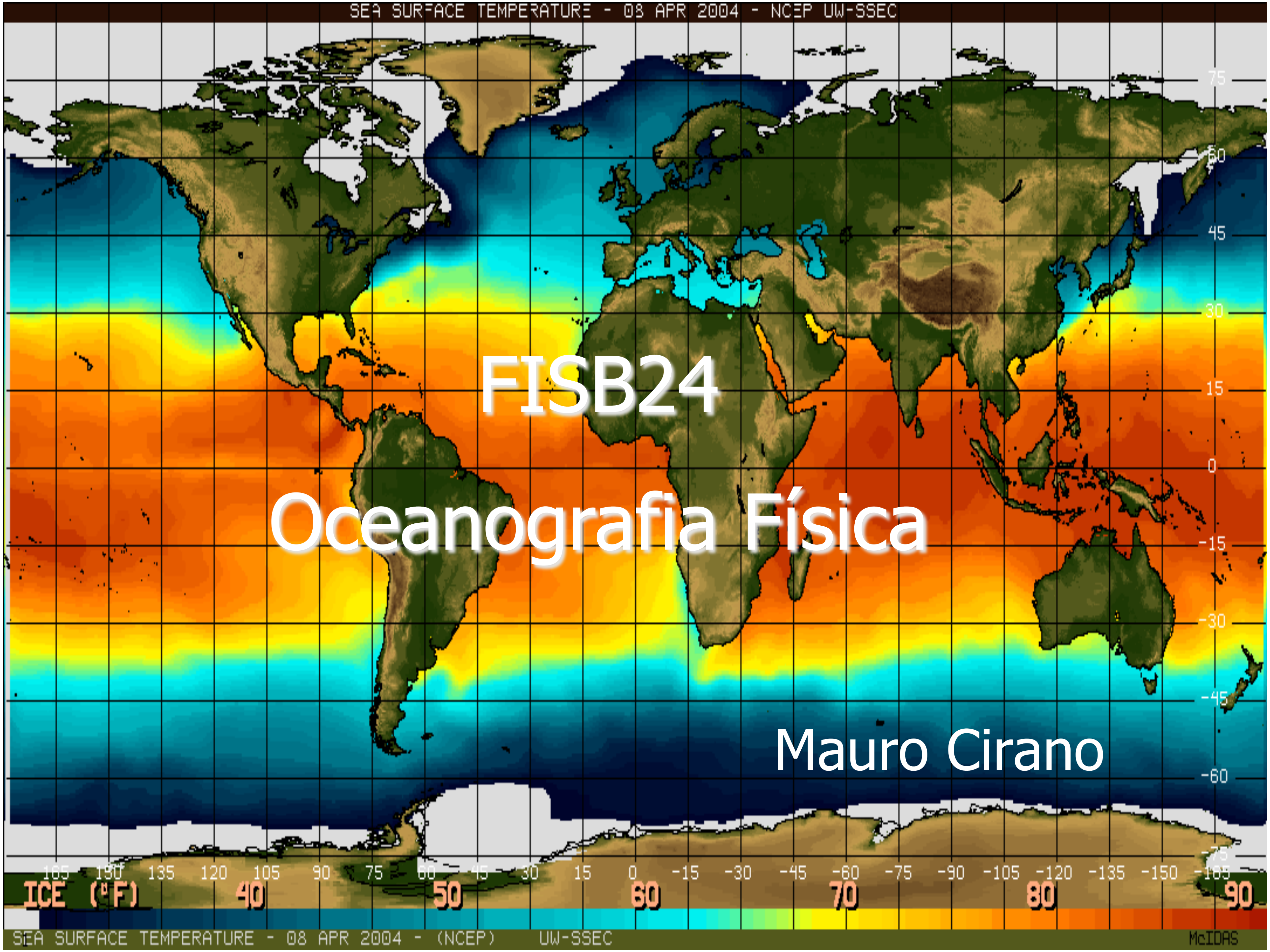


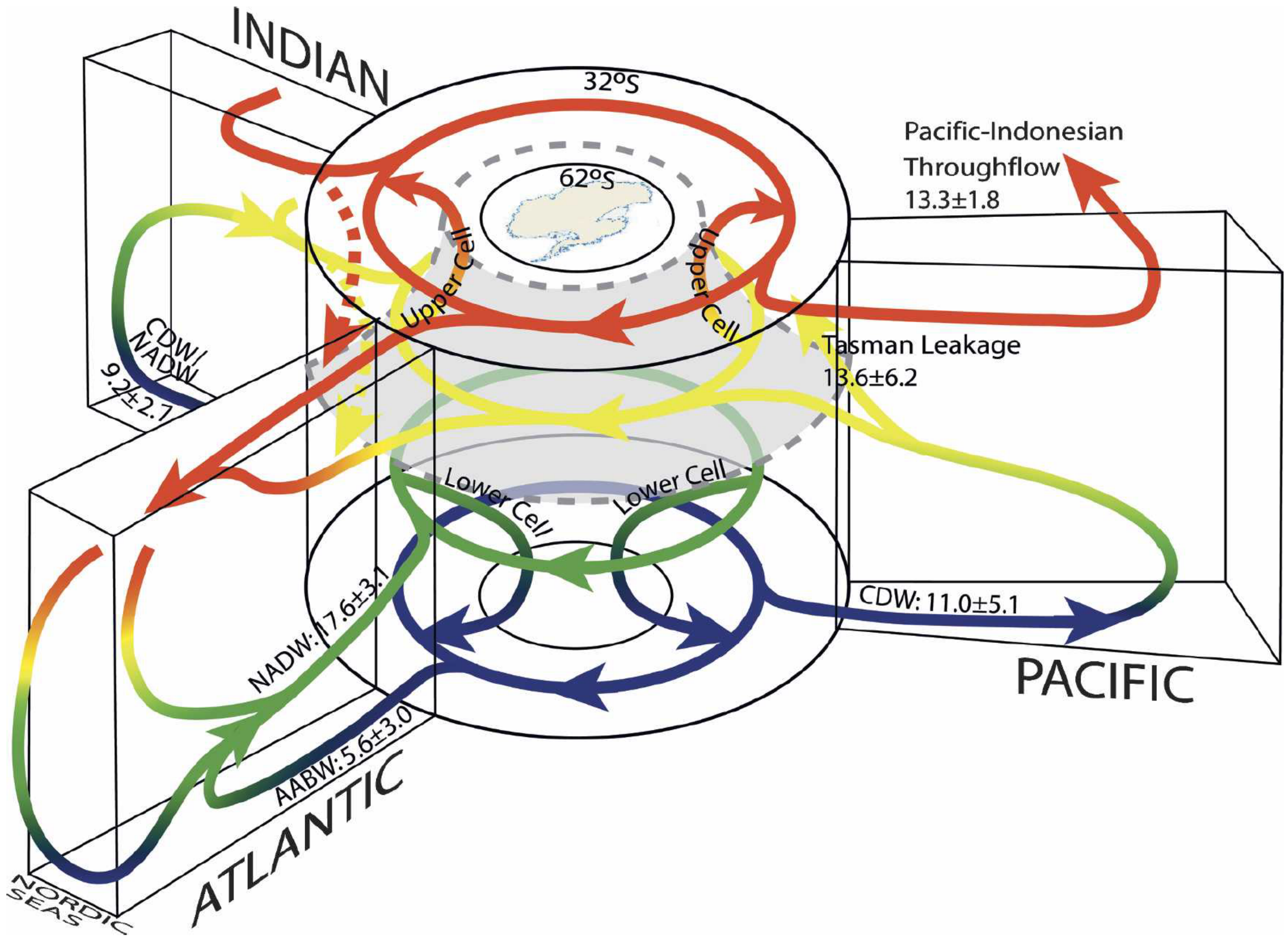
FISB24

Oceanografia Física

Mauro Cirano

Objetivos

- Introduzir a noção de escalas temporais e espaciais
- Descrever as principais propriedades dos oceanos e da atmosfera e como elas interagem
- Descrever as principais forçantes da circulação oceânica e costeira
- Descrever a circulação no âmbito dos Oceanos Atlântico, Pacífico e Índico, bem como para as regiões Ártica e Antártica
- Descrever de forma **qualitativa e abrangente**, temas que serão abordados com mais detalhes nas disciplinas posteriores relacionadas à Oceanografia Física



Modelo da circulação oceânica global, destacando o papel central do Oceano Austral segundo Lumpkin e Speer (2007). As unidades estão em Sv. As cores amarela e vermelha representam a célula superior, enquanto as cores verde e azul representam a célula inferior. É importante destacar o padrão 3D desta circulação, onde a água do fundo (azul) interage com a águas profundas (verde) e intermediárias, que por sua vez conectam-se com a célula superior. Isto demonstra a ligação global os processos convectivos no Oceano Austral e a formação de água de fundo e processos convectivos no Hemisfério Norte.

Estrutura da disciplina e avaliação

- Aulas teóricas (SEG e QUA das 9:30-11:30h) – LFNA
- Avaliação:

2 provas teóricas dissertativas/objetivas (T1 e T2) – 70 %

2 seminários (S1 e S2) – 30 %

- Datas:

T1 – 19/05 SEG **S1 21/05 QUA**

T2 – 23/07 QUA **S2 28/07 SEG**

SEG CHAM T1 e T2 30/07

Lembretes importantes

- Feriados e datas sem aulas:

21/4 – Feriado de Tiradentes

16 e 18/6 – Copa do Mundo

23 e 25/06 – Copa do Mundo

02/07 – Feriado Independência da Bahia

- Aulas a confirmar:

30/6 – Aula a confirmar

Lembretes importantes

- Faltas e chamada: número de faltas > 17 faltas e média final inferior a 7,0 – **reprovação por faltas**
- O uso de aparelhos celulares é **proibido** em aula – se você quiser deixar o seu celular ligado, use o modo silencioso

Referências bibliográficas

Livro texto

Taley, L. D.; Pickard, G. L.; Emery, W. J.; Swift, J. H. *Descriptive Physical Oceanography – An Introduction*. Elsevier, 555 pp. (1 cópia – IFIS 551.463 D449 e versão eletrônica disponível através do Science Direct) http://www.sciencedirect.com/science/book/9780750645522

Livros específicos

Open University, 2001. *Ocean Circulation*. Open University Course: Oceanography. The Open University/Pergamon, Oxford, UK. 238 pp. (6 cópias - IGEO 551.46 O15)

Stewart, R. H., 2005. *Introduction to Physical Oceanography*. Department of Oceanography, Texas A & M University. 346 pp. http://oceanworld.tamu.edu/resources/ocng_textbook/contents.html

Tomczak, M.; J. S. Godfrey, 1994. *Regional oceanography: an introduction*. Pergamon Press, London. 422 pp. (2 cópias – IGEO 55.46 T656)
http://www.es.flinders.edu.au/~mattom/regoc/pdfversion.html

Referências bibliográficas

Livros mais abrangentes

Siedler, G.; J. Church; J. Gould, 2001. *Ocean Circulation and Climate: Observing and Modeling the Global Ocean*. Academic Press. 640 pp. (2 cópias - IGEO 551.46 O15)

Robinson, I. 1994. *Satellite Oceanography. An Introduction for Oceanographers and Remote-sensing Scientists*. Wiley-Praxis. (2 cópias – IGEO 551.46 R661)

Referências bibliográficas

Livros de Oc. Fis.

Pond, S.; G. L. Pickard, 1983. *Introductory Dynamical Oceanography*. Elsevier Butterworth-Heinemann. 349 pp. (5 cópias – IGEO 551.46 P796)

Knauss, J. A. *Introduction to Physical Oceanography*. 2005. Waveland Pr. Inc. 320 pp. (1 cópia – IGEO 551.46 K67)

Mellor, G. L., 1996. *Introduction to Physical Oceanography*. American Institute of Physics. 260 pp (1 cópia – IGEO 551.46 M527)

Neumann,G.; W. J. Pierson. *Principles of Physical Oceanography*. Prentice Hall. (1 cópia IGEO 551.46 N491)

Pedlosky, J. 2003. *Waves in the Ocean and Atmosphere: Introduction to Wave Dynamics*. Springer. 260 pp. (5 cópias – IGEO e 2 cópias IFIS 551.466 P371)

Referências bibliográficas

Livros de Oc. Fis.

Cohen, I. M; P. K. Kundu. 2008. *Fluid Mechanics*. Academic Press. 759 pp. (2 cópias – IGEO 531.3 K96)

Gill, A. E. 1982. *Atmosphere-Ocean Dynamics*. Academic Press. 662 pp. (3 cópias – IGEO e 2 cópias no IFIS 551.463 G475)

Batchelor, G. K. 2000. *An Introduction to Fluid Dynamics*. Cambridge University Press. 635 pp. (5 cópias – IGEO 551.3 B328)

Kreyszig, E. 1999. *Advanced engineering mathematics*. Wiley & Sons. 1156 pp (3 cópias – IGEO 51:62 K92)

Referências bibliográficas

Glossários

Glossary of Meteorology. American Meteorological Society
http://amsglossary.allenpress.com/glossary

Glossary of Physical Oceanography and related disciplines. Texas A & M University. Department of Oceanography (site da disciplina)

home-pages e artigos científicos

A comunicação com os alunos será feita através do site da disciplina e/ou e-mail e a veiculação de todo e qualquer material que estiver em meio digital será feita através do link abaixo:

http://www.mcirano.ufba.br/ftp/aulas/FISB24

Programa

1. Introdução à Oceanografia Física Descritiva
2. A dimensão dos oceanos, seus formatos e a composição do fundo
3. Propriedades físicas da água do mar
4. Distribuições típicas das características das águas
5. Os balanços de massa, sal e calor e o campo de ventos
7. Processos Dinâmicos e Forçantes da Circulação Oceânica
9. Oceano Atlântico
10. Oceano Pacífico
11. Oceano Índico
12. Oceano Ártico e os Mares Nórdicos
13. Oceano Austral
14. Circulação Termohalina Global

Seminários – Temas propostos

Temas individuais

- Artigos recentes publicados em revistas científicas de alto impacto e voltadas para a comunidade científica e publico em geral
- Para este ano foram selecionadas as revistas **Science** e **Nature**, sendo feita uma procura dos artigos mais relevantes publicados desde o ano de 2012 até o presente
- Vide lista completa no link da disciplina

http://www.mcirano.ufba.br/ftp/aulas/FISB24/seminarios/2014/

Seminários – Preparação

Temas individuais

- 22 artigos disponíveis
- Procurar entre os resumos, qual o tema que mais desperta o seu interesse
- Uma vez identificado o artigo, faça uma leitura rápida do mesmo e verifique se é possível fazer uma apresentação de 20 minutos
- Envie um e-mail com os temas selecionados. A escolha do tema é feita por ordem de chegada do e-mail
- Os temas podem eventualmente ser mudados, desde que: i) isto seja feito com antecedência e ii) o novo tema ainda esteja disponível

Seminários – Temas propostos

S1 - 21/05

Apresentação 1
Título:
Autores:
Aluno:

Apresentação 2
Título:
Autores:
Aluno:

Apresentação 3
Título:
Autores:
Aluno:

Seminários – Temas propostos

S2 - 28/07

Apresentação 1
Título:
Autores:
Aluno:

Apresentação 2
Título:
Autores:
Aluno:

Apresentação 3
Título:
Autores:
Aluno:

Seminários – Temas propostos

LETTER

doi:10.1038/nature11358

More extreme swings of the South Pacific convergence zone due to greenhouse warming

Wenju Cai[1], Matthieu Lengaigne[2], Simon Borlace[1], Matthew Collins[3,4], Tim Cowan[1], Michael J. McPhaden[5], Axel Timmermann[6], Scott Power[7], Josephine Brown[7], Christophe Menkes[8], Arona Ngari[9], Emmanuel M. Vincent[2] & Matthew J. Widlansky[10]

Seminários – Temas propostos

LETTER

doi:10.1038/nature11593

Rapid coupling between ice volume and polar temperature over the past 150,000 years

K. M. Grant[1], E. J. Rohling[1,2], M. Bar-Matthews[3], A. Ayalon[3], M. Medina-Elizalde[1]†, C. Bronk Ramsey[4], C. Satow[5] & A. P. Roberts[2]

Seminários – Temas propostos

LETTER

doi:10.1038/nature11338

Doubling of marine dinitrogen-fixation rates based on direct measurements

Tobias Großkopf[1]*, Wiebke Mohr[1]*†, Tina Baustian[1], Harald Schunck[1], Diana Gill[1], Marcel M. M. Kuypers[2], Gaute Lavik[2], Ruth A. Schmitz[3], Douglas W. R. Wallace[4] & Julie LaRoche[1]†

Seminários – Temas propostos

nature climate change

LETTERS

PUBLISHED ONLINE: 23 FEBRUARY 2014 | DOI: 10.1038/NCLIMATE2119

Impacts of climate change on marine ecosystem production in societies dependent on fisheries

M. Barange[1*], G. Merino[1,2], J. L. Blanchard[3], J. Scholtens[4], J. Harle[5], E. H. Allison[6], J. I. Allen[1], J. Holt[5] and S. Jennings[7,8]

Seminários – Temas propostos

LETTER

doi:10.1038/nature12882

Australian tropical cyclone activity lower than at any time over the past 550–1,500 years

Jordahna Haig[1], Jonathan Nott[1] & Gert-Jan Reichart[2,3]

Seminários – Temas propostos

SCIENTIFIC REPORTS

OPEN

Deep ocean carbonate ion increase during mid Miocene CO_2 decline

SUBJECT AREAS:
PALAEOCLIMATE
GEOLOGY
PALAEOCEANOGRAPHY
MARINE CHEMISTRY

Sev Kender[1,2], Jimin Yu[3] & Victoria L. Peck[4]

[1]British Geological Survey, Keyworth, Nottingham NG12 5GG, UK, [2]Department of Geology, University of Leicester, Leicester LE1 7RH, UK, [3]Research School of Earth Sciences, The Australian National University, Canberra, Australia, [4]British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, UK.

Seminários – Temas propostos

LETTER

doi:10.1038/nature11300

Persistent near-tropical warmth on the Antarctic continent during the early Eocene epoch

Jörg Pross[1,2], Lineth Contreras[1], Peter K. Bijl[3], David R. Greenwood[4], Steven M. Bohaty[5], Stefan Schouten[6], James A. Bendle[7], Ursula Röhl[8], Lisa Tauxe[9], J. Ian Raine[10], Claire E. Huck[11], Tina van de Flierdt[11], Stewart S. R. Jamieson[12], Catherine E. Stickley[13], Bas van de Schootbrugge[1], Carlota Escutia[14], Henk Brinkhuis[3] & Integrated Ocean Drilling Program Expedition 318 Scientists*

Seminários – Temas propostos

nature geoscience
ARTICLES
PUBLISHED ONLINE: 16 MARCH 2014 | DOI: 10.1038/NGEO2101

Surface-water iron supplies in the Southern Ocean sustained by deep winter mixing

Alessandro Tagliabue[1,2]*, Jean-Baptiste Sallée[3,4,5], Andrew R. Bowie[6], Marina Lévy[3,4], Sebastiaan Swart[2,7] and Philip W. Boyd[8,9]

Seminários – Temas propostos

LETTER

doi:10.1038/nature11576

Slowdown of the Walker circulation driven by tropical Indo-Pacific warming

Hiroki Tokinaga[1], Shang-Ping Xie[1,2], Clara Deser[3], Yu Kosaka[4] & Yuko M. Okumura[5]

Seminários – Temas propostos

LETTER

doi:10.1038/nature12376

Onset of deglacial warming in West Antarctica driven by local orbital forcing

WAIS Divide Project Members*

Seminários – Temas propostos

LETTER

doi:10.1038/nature12397

Changes in North Atlantic nitrogen fixation controlled by ocean circulation

Marietta Straub[1], Daniel M. Sigman[2], Haojia Ren[3], Alfredo Martínez-García[1], A. Nele Meckler[1], Mathis P. Hain[2] & Gerald H. Haug[1]

Seminários – Temas propostos

ARTICLE

doi:10.1038/nature11229

Deep carbon export from a Southern Ocean iron-fertilized diatom bloom

Victor Smetacek[1,2]*, Christine Klaas[1]*, Volker H. Strass[1], Philipp Assmy[1,3], Marina Montresor[4], Boris Cisewski[1,5], Nicolas Savoye[6,7], Adrian Webb[8], Francesco d'Ovidio[9], Jesús M. Arrieta[10,11], Ulrich Bathmann[1,12], Richard Bellerby[13,14], Gry Mine Berg[15], Peter Croot[16,17], Santiago Gonzalez[10], Joachim Henjes[1,18], Gerhard J. Herndl[10,19], Linn J. Hoffmann[16], Harry Leach[20], Martin Losch[1], Matthew M. Mills[15], Craig Neill[13,21], Ilka Peeken[1,22], Rüdiger Röttgers[23], Oliver Sachs[1,24], Eberhard Sauter[1], Maike M. Schmidt[25], Jill Schwarz[1,26], Anja Terbrüggen[1] & Dieter Wolf-Gladrow[1]

Seminários – Temas propostos

Pacific Ocean Heat Content During the Past 10,000 Years

Yair Rosenthal,[1*] Braddock K. Linsley,[2] Delia W. Oppo[3]

Observed increases in ocean heat content (OHC) and temperature are robust indicators of global warming during the past several decades. We used high-resolution proxy records from sediment cores to extend these observations in the Pacific 10,000 years beyond the instrumental record. We show that water masses linked to North Pacific and Antarctic intermediate waters were warmer by 2.1 ± 0.4°C and 1.5 ± 0.4°C, respectively, during the middle Holocene Thermal Maximum than over the past century. Both water masses were ~0.9°C warmer during the Medieval Warm period than during the Little Ice Age and ~0.65° warmer than in recent decades. Although documented changes in global surface temperatures during the Holocene and Common era are relatively small, the concomitant changes in OHC are large.

Seminários – Temas propostos

Strong Sensitivity of Pine Island Ice-Shelf Melting to Climatic Variability

Pierre Dutrieux,[1*] Jan De Rydt,[1] Adrian Jenkins,[1] Paul R. Holland,[1] Ho Kyung Ha,[2] Sang Hoon Lee,[2] Eric J. Steig,[3] Qinghua Ding,[3] E. Povl Abrahamsen,[1] Michael Schröder[4]

Pine Island Glacier has thinned and accelerated over recent decades, significantly contributing to global sea-level rise. Increased oceanic melting of its ice shelf is thought to have triggered those changes. Observations and numerical modeling reveal large fluctuations in the ocean heat available in the adjacent bay and enhanced sensitivity of ice-shelf melting to water temperatures at intermediate depth, as a seabed ridge blocks the deepest and warmest waters from reaching the thickest ice. Oceanic melting decreased by 50% between January 2010 and 2012, with ocean conditions in 2012 partly attributable to atmospheric forcing associated with a strong La Niña event. Both atmospheric variability and local ice shelf and seabed geometry play fundamental roles in determining the response of the Antarctic Ice Sheet to climate.

Seminários – Temas propostos

Rapid Reductions in North Atlantic Deep Water During the Peak of the Last Interglacial Period

Eirik Vinje Galaasen,[1*] Ulysses S. Ninnemann,[1,2] Nil Irvalı,[2] Helga (Kikki) F. Kleiven,[1,2] Yair Rosenthal,[3] Catherine Kissel,[4] David A. Hodell[5]

Deep ocean circulation has been considered relatively stable during interglacial periods, yet little is known about its behavior on submillennial time scales. Using a subcentennially resolved epibenthic foraminiferal $\delta^{13}C$ record, we show that the influence of North Atlantic Deep Water (NADW) was strong at the onset of the last interglacial period and was then interrupted by several prominent centennial-scale reductions. These NADW transients occurred during periods of increased ice rafting and southward expansions of polar water influence, suggesting that a buoyancy threshold for convective instability was triggered by freshwater and circum-Arctic cryosphere changes. The deep Atlantic chemical changes were similar in magnitude to those associated with glaciations, implying that the canonical view of a relatively stable interglacial circulation may not hold for conditions warmer and fresher than at present.

Seminários – Temas propostos

Reorganization of Southern Ocean Plankton Ecosystem at the Onset of Antarctic Glaciation

Alexander J. P. Houben,[1]*† Peter K. Bijl,[1] Jörg Pross,[2,3] Steven M. Bohaty,[4] Sandra Passchier,[5] Catherine E. Stickley,[6] Ursula Röhl,[7] Saiko Sugisaki,[8] Lisa Tauxe,[8] Tina van de Flierdt,[9] Matthew Olney,[10] Francesca Sangiorgi,[1] Appy Sluijs,[1] Carlota Escutia,[11] Henk Brinkhuis,[1] and the Expedition 318 Scientists‡

The circum-Antarctic Southern Ocean is an important region for global marine food webs and carbon cycling because of sea-ice formation and its unique plankton ecosystem. However, the mechanisms underlying the installation of this distinct ecosystem and the geological timing of its development remain unknown. Here, we show, on the basis of fossil marine dinoflagellate cyst records, that a major restructuring of the Southern Ocean plankton ecosystem occurred abruptly and concomitant with the first major Antarctic glaciation in the earliest Oligocene (~33.6 million years ago). This turnover marks a regime shift in zooplankton-phytoplankton interactions and community structure, which indicates the appearance of eutrophic and seasonally productive environments on the Antarctic margin. We conclude that earliest Oligocene cooling, ice-sheet expansion, and subsequent sea-ice formation were important drivers of biotic evolution in the Southern Ocean.

Seminários – Temas propostos

Increased Dust Deposition in the Pacific Southern Ocean During Glacial Periods

F. Lamy,[1,2]* R. Gersonde,[1,2] G. Winckler,[3,4] O. Esper,[1] A. Jaeschke,[1,2] G. Kuhn,[1] J. Ullermann,[1] A. Martinez-Garcia,[5] F. Lambert,[6] R. Kilian[7]

Dust deposition in the Southern Ocean constitutes a critical modulator of past global climate variability, but how it has varied temporally and geographically is underdetermined. Here, we present data sets of glacial-interglacial dust-supply cycles from the largest Southern Ocean sector, the polar South Pacific, indicating three times higher dust deposition during glacial periods than during interglacials for the past million years. Although the most likely dust source for the South Pacific is Australia and New Zealand, the glacial-interglacial pattern and timing of lithogenic sediment deposition is similar to dust records from Antarctica and the South Atlantic dominated by Patagonian sources. These similarities imply large-scale common climate forcings, such as latitudinal shifts of the southern westerlies and regionally enhanced glaciogenic dust mobilization in New Zealand and Patagonia.

Seminários – Temas propostos

Channelized Ice Melting in the Ocean Boundary Layer Beneath Pine Island Glacier, Antarctica

T. P. Stanton,[1*] W. J. Shaw,[1] M. Truffer,[2] H. F. J. Corr,[3] L. E. Peters,[4] K. L. Riverman,[4]
R. Bindschadler,[5] D. M. Holland,[6] S. Anandakrishnan[4]

Ice shelves play a key role in the mass balance of the Antarctic ice sheets by buttressing their seaward-flowing outlet glaciers; however, they are exposed to the underlying ocean and may weaken if ocean thermal forcing increases. An expedition to the ice shelf of the remote Pine Island Glacier, a major outlet of the West Antarctic Ice Sheet that has rapidly thinned and accelerated in recent decades, has been completed. Observations from geophysical surveys and long-term oceanographic instruments deployed down bore holes into the ocean cavity reveal a buoyancy-driven boundary layer within a basal channel that melts the channel apex by 0.06 meter per day, with near-zero melt rates along the flanks of the channel. A complex pattern of such channels is visible throughout the Pine Island Glacier shelf.

Seminários – Temas propostos

Periodic Variability in the Large-Scale Southern Hemisphere Atmospheric Circulation

David W. J. Thompson* and Elizabeth A. Barnes

Periodic behavior in the climate system has important implications not only for weather prediction but also for understanding and interpreting the physical processes that drive climate variability. Here we demonstrate that the large-scale Southern Hemisphere atmospheric circulation exhibits marked periodicity on time scales of approximately 20 to 30 days. The periodicity is tied to the Southern Hemisphere baroclinic annular mode and emerges in hemispheric-scale averages of the eddy fluxes of heat, the eddy kinetic energy, and precipitation. Observational and theoretical analyses suggest that the oscillation results from feedbacks between the extratropical baroclinicity, the wave fluxes of heat, and radiative damping. The oscillation plays a potentially profound role in driving large-scale climate variability throughout much of the mid-latitude Southern Hemisphere.

Seminários – Temas propostos

Recent Changes in the Ventilation of the Southern Oceans

Darryn W. Waugh,[1]* Francois Primeau,[2] Tim DeVries,[3] Mark Holzer[4]

Surface westerly winds in the Southern Hemisphere have intensified over the past few decades, primarily in response to the formation of the Antarctic ozone hole, and there is intense debate on the impact of this on the ocean's circulation and uptake and redistribution of atmospheric gases. We used measurements of chlorofluorocarbon-12 (CFC-12) made in the southern oceans in the early 1990s and mid- to late 2000s to examine changes in ocean ventilation. Our analysis of the CFC-12 data reveals a decrease in the age of subtropical subantarctic mode waters and an increase in the age of circumpolar deep waters, suggesting that the formation of the Antarctic ozone hole has caused large-scale coherent changes in the ventilation of the southern oceans.

Seminários – Temas propostos

Detecting Ozone- and Greenhouse Gas–Driven Wind Trends with Observational Data

Sukyoung Lee[1]* and Steven B. Feldstein[1]

Modeling studies suggest that Antarctic ozone depletion and, to a lesser degree, greenhouse gas (GHG) increase have caused the observed poleward shift in the westerly jet during the austral summer. Similar studies have not been performed previously with observational data because of difficulties in separating the two contributions. By applying a cluster analysis to daily ERA-Interim data, we found two 7- to 11-day wind clusters, one resembling the models' responses to GHG forcing and the other resembling ozone depletion. The trends in the clusters' frequency of occurrence indicate that the ozone contributed about 50% more than GHG toward the jet shift, supporting the modeling results. Moreover, tropical convection apparently plays an important role for the GHG-driven trend.

Seminários – Temas propostos

Two Modes of Change in Southern Ocean Productivity Over the Past Million Years

S. L. Jaccard,[1] C. T. Hayes,[2,5] A. Martínez-García,[1] D. A. Hodell,[3] R. F. Anderson,[2,5] D. M. Sigman,[4] G. H. Haug[1]

Export of organic carbon from surface waters of the Antarctic Zone of the Southern Ocean decreased during the last ice age, coinciding with declining atmospheric carbon dioxide (CO_2) concentrations, signaling reduced exchange of CO_2 between the ocean interior and the atmosphere. In contrast, in the Subantarctic Zone, export production increased into ice ages coinciding with rising dust fluxes, thus suggesting iron fertilization of subantarctic phytoplankton. Here, a new high-resolution productivity record from the Antarctic Zone is compiled with parallel subantarctic data over the past million years. Together, they fit the view that the combination of these two modes of Southern Ocean change determines the temporal structure of the glacial-interglacial atmospheric CO_2 record, including during the interval of "lukewarm" interglacials between 450 and 800 thousand years ago.

Seminários – Exemplo Science

- Artigo baseado em um tema discursivo com figuras
- Material complementar
- Vide artigo

Seminários – Exemplo Nature

- Artigo baseado em um tema discursivo com figuras
- Material complementar
- Vide artigo