

Oceans: dynamics, transport/mixing and climate change

Bibliography to accompany 2011 MBI lectures by Emily Shuckburgh

Lecture 1: Dynamics

- Ocean surface/ sub-surface circulation: [see *Marshall and Plumb*, 2008; *Neelin*, 2011; *Talley et al.*, 2011]
- Rotating fluid dynamics: [see *Marshall and Plumb*, 2008 for laboratory experiments]; also <http://paoc.mit.edu/labweb/experiments.htm>
- Equations of motion: [see *Gill*, 1982; *Marshall and Plumb*, 2008; *Neelin*, 2011]
- Eddies in the Southern Ocean: [for extensive detail on eddies and their generation mechanisms see *Vallis*, 2006]; [*Rintoul et al.*, 2001].
- Overturning circulation: [*Marshall and Speer*, 2012](Southern Ocean perspective)
- Ocean measurements: [*Marshall and Speer*, 2012]
- Southern Ocean climate change: [*Boning et al.*, 2008] (ocean); [*Thompson and Solomon*, 2002] (atmosphere); [*G J Marshall et al.*, 2006] (Antarctic Peninsula); [*Domack et al.*, 2005](ice shelf); sea ice [*Turner et al.*, 2009]; krill [*Atkinson et al.*, 2004; *Atkinson et al.*, 2009]
- Other good books: [*Pierrehumbert*, 2010]

Lecture 2. Transport/mixing

- Quantifying mixing by eddies: [*Haynes and Shuckburgh*, 2000; *Nakamura*, 1996; *E. Shuckburgh and Haynes*, 2003]
- Mixing regions and transport barriers:[*E. Shuckburgh and Haynes*, 2003]
- Eddies in the Southern Ocean: [*J Marshall et al.*, 2006; *Emily Shuckburgh et al.*, 2009a; b]
- Air/sea interactions: [*Emily Shuckburgh et al.*, 2011]
- Manifolds: [*d'Ovidio et al.*, 2009; *Samelson and Wiggins*, 2006]
- Tracer evolution: [*Lehahn et al.*, 2007]
- AARDVARK – [*Sallée, Shuckburgh and d'Ovidio*, in prep.]
- Ecological Niches: [*d'Ovidio et al.*, 2010]
- Other useful papers: [*Abraham*, 1998; *Abraham and Bowen*, 2002]

References

- Abraham, E. R. (1998), The generation of plankton patchiness by turbulent stirring, *Nature*, 391(6667), 577-580.
- Abraham, E. R., and M. M. Bowen (2002), Chaotic stirring by a mesoscale surface-ocean flow, *Chaos*, 12(2), 373-381.
- Atkinson, A., V. Siegel, E. Pakhomov, and P. Rothery (2004), Long-term decline in krill stock and increase in salps within the Southern Ocean, *Nature*, 432(7013), 100-103.
- Atkinson, A., V. Siegel, E. A. Pakhomov, M. J. Jessopp, and V. Loeb (2009), A re-appraisal of the total biomass and annual production of Antarctic krill, *Deep-Sea Research Part I-Oceanographic Research Papers*, 56(5), 727-740.

- Boning, C. W., A. Dispert, M. Visbeck, S. R. Rintoul, and F. U. Schwarzkopf (2008), The response of the Antarctic Circumpolar Current to recent climate change, *Nat. Geosci.*, *1*(12), 864-869.
- d'Ovidio, F., E. Shuckburgh, and B. Legras (2009), Local Mixing Events in the Upper Troposphere and Lower Stratosphere. Part I: Detection with the Lyapunov Diffusivity, *Journal of the Atmospheric Sciences*, *66*(12), 3678-3694.
- d'Ovidio, F., S. De Montec, S. Alvain, Y. Dandonneau, and M. Levy (2010), Fluid dynamical niches of phytoplankton types, *Proc. Natl. Acad. Sci. U. S. A.*, *107*(43), 18366-18370.
- Domack, E., D. Duran, A. Leventer, S. Ishman, S. Doane, S. McCallum, D. Amblas, J. Ring, R. Gilbert, and M. Prentice (2005), Stability of the Larsen B ice shelf on the Antarctic Peninsula during the Holocene epoch, *Nature*, *436*(7051), 681-685.
- Gill, A. (1982), *Atmosphere-Ocean Dynamics*, Academic Press.
- Haynes, P., and E. Shuckburgh (2000), Effective diffusivity as a diagnostic of atmospheric transport 1. Stratosphere, *Journal of Geophysical Research-Atmospheres*, *105*(D18), 22777-22794.
- Lehahn, Y., F. d'Ovidio, M. Levy, and E. Heifetz (2007), Stirring of the northeast Atlantic spring bloom: A Lagrangian analysis based on multisatellite data, *Journal of Geophysical Research-Oceans*, *112*(C8).
- Marshall, G. J., A. Orr, N. P. M. van Lipzig, and J. C. King (2006), The Impact of a Changing Southern Hemisphere Annular Mode on Antarctic Peninsula Summer Temperatures, *Journal of Climate*, *19*(20), 5388-5404.
- Marshall, J., and R. A. Plumb (2008), *Atmosphere, Ocean and Climate Dynamics: An Introductory Text*, Elsevier Academic.
- Marshall, J., and K. Speer (2012), Closure of the meridional overturning circulation through Southern Ocean upwelling, *Nat. Geosci.*
- Marshall, J., E. Shuckburgh, H. Jones, and C. Hill (2006), Estimates and implications of surface eddy diffusivity in the Southern Ocean derived from tracer transport, *Journal of Physical Oceanography*, *36*(9), 1806-1821.
- Nakamura, N. (1996), Two-dimensional mixing, edge formation, and permeability diagnosed in an area coordinate, *Journal of the Atmospheric Sciences*, *53*(11), 1524-1537.
- Neelin, J. D. (2011), *Climate Change and Climate Modelling*, Cambridge University Press.
- Pierrehumbert, R. (2010), *Principles of Planetary Climate*, Cambridge University Press.
- Rintoul, S., C. Hughes, and D. Olbers (2001), The Antarctic Circumpolar Current System, in *Ocean Circulation and Climate: Observing and Modeling the Global Ocean*, edited by G. Siedler, J. Church and J. Gould, pp. 271-302, Academic Press.
- Samelson, R. M., and S. Wiggins (2006), *Lagrangian Transport in Geophysical Jets and Waves*, Springer.
- Shuckburgh, E., and P. Haynes (2003), Diagnosing transport and mixing using a tracer-based coordinate system, *Physics of Fluids*, *15*(11), 3342-3357.

- Shuckburgh, E., H. Jones, J. Marshall, and C. Hill (2009a), Robustness of an Effective Diffusivity Diagnostic in Oceanic Flows, *Journal of Physical Oceanography*, 39(9), 1993-2009.
- Shuckburgh, E., H. Jones, J. Marshall, and C. Hill (2009b), Understanding the Regional Variability of Eddy Diffusivity in the Pacific Sector of the Southern Ocean, *Journal of Physical Oceanography*, 39(9), 2011-2023.
- Shuckburgh, E., G. Maze, D. Ferreira, J. Marshall, H. Jones, and C. Hill (2011), Mixed Layer Lateral Eddy Fluxes Mediated by Air-Sea Interaction, *Journal of Physical Oceanography*, 41(1), 130-144.
- Talley, L., G. Pickard, W. Emery, and J. Swift (2011), *Descriptive Physical Oceanography: An Introduction*, Elsevier Academic.
- Thompson, D. W. J., and S. Solomon (2002), Interpretation of recent Southern Hemisphere climate change, *Science*, 296(5569), 895-899.
- Turner, J., J. C. Comiso, G. J. Marshall, Lachlan, T. A. Cope, T. Bracegirdle, T. Maksym, M. P. Meredith, Z. Wang, and A. Orr (2009), Non-annular atmospheric circulation change induced by stratospheric ozone depletion and its role in the recent increase of Antarctic sea ice extent, *Geophys. Res. Lett.*, 36(8), L08502.
- Vallis, G. K. (2006), *Atmospheric and Oceanic Fluid Dynamics*, Cambridge University Press.