GEO4960/9960: The General Circulation of the Oceans

Course outline, spring 2022

- Normally 2x2 hours per week (Wed & Fri). Dates below refer to the Fri of a given week.
- Information in parentheses refer to literature used: 'V' refers to *Atmospheric and Ocean Fluid Dynamics* by G. Vallis, 2nd Ed., 2017; 'CN' refers to class notes to be given out.

04.02 Wind-driven mid-latitude gyres: Stommel and Munk models (V19.1-19.2)
11.02 Some effects of non-linearities (V19.4-19.5)

18.02 Accounting for bottom topography (CN; Mellor, 1982; Bogden et al., 1993)
25.02 Wind-driven flows at high northern latitudes (CN; Nøst & Isachsen, 2003)

04.03 Layered QG PV dynamics and the wind-driven spin-up in a stratified flat-bottom ocean (CN).
11.03 *No classes*

18.03 How to spin up the lower layers of a wind-drivern gyre (Rhines & Young theory; CN + V20.1)
25.03 The wind-driven 'ventilated thermocline' (LPS theory; CN + V20.6)

01.04 The Meridional Overturning Circulation (MOC): Energetics (CN + V21.1-21.2)
08.04 The mixing-driven MOC: Scaling + Stommel-Arons + the geography of mixing (CN + V21.5)

15.04 *No classes (Easter holiday)*

22.04 The wind-driven MOC: the role of a re-entrant channel in the southern ocean (CN + V21.6)
29.04 The wind-driven MOC (contd.)

06.05 Mesoscale eddies and the Antarctic Circumpolar Current (CN + V21.7)
13.05 Mesoscale eddies (contd.)

20.05 Student paper presentations

Papers used:

Bogden et al., 1993: The North Atlantic circulation: Combining simplified dynamics with hydrographic data. *J. Mar. Res.*, **51**, 1–52.

Isachsen & O. A. Nøst, 2012: The air-sea transformation and residual overturning circulation within the Nordic Seas. *J. Mar. Res.*, **70**, 31–68.

Manucharyan & Spall, 2016: Wind-driven freshwater buildup and release in the Beaufort Gyre constrained by mesoscale eddies. *Geoph. Res. Letr.*, **43**, 273-282.

Mellor et al., 1982: A diagnostic calculation of the general circulation of the Atlantic Ocean. *Deep Sea Res.*, **29**(10A), 1171–1192.

Nøst & Isachsen, 2003: The large-scale time-mean ocean circulation in the Nordic Seas and the Arctic Ocean estimated from simplified dynamics. *J. Mar. Res.*, **61**, 175–210.