12.801 Steady Circulation of the Oceans (Spring 2007)

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Syllabus

1. Equations of motion and scaling (GFD 6.2-6.3; AOFD 2.1-2.4)
    a) planetary geostrophy (GFD 6.20; AOFD 5.1-5.2)
    b) quasigeostrophy (GFD 6.5-6.9; AOFD 5.3-5.4)

2. Wind-driven ocean circulation
    a) Sverdrup theory (OCT Ch. 1, GFD 6.19)
        i) Ekman layers and pumping (GFD 4.3 & 4.10; AOFD 2.12)
        ii) Sverdrup vorticity equation
        iii)Sverdrup transport relation
    b) Western boundary layers in a homogeneous ocean
        (OCT Ch. 2, GFD Ch. 5; AOFD 14.1-14.7)
        i) Stommel, Munk and inertial layers
        ii) Integral balances
        iii) Fofonoff modes
        iv) inertial-viscous boundary layers
        v) numerical and laboratory experiments
    c) Thermocline theory
        i) Quasigeostrophic models (OCT 3.1-3.9; AOFD 14.7)
        ii)Ventilated thermocline (two-layered)
            (OCT 4.1-4.44, GFD 6.22-6.23; AOFD 16.4)
        iii) Beta-spiral (OCT 4.5)

3. Mean equatorial circulation (OCT 6.1-6.5)

4. Abyssal circulation (OCT 7.1-7.4; AOFD 15.4-15.7)
    a) Stommel-Arons model
    b) local sources and sinks
    c) temporal adjustment

5. Thermohaline circulation
    a) Sandstrom's theorm (AOFD15.2)
    a) Stommel's box model (AOFD 15.3)
    b) modern numerical and theoretical studies

References

Pedlosky, J. 1987. Geophysical Fluid Dynamics, *Springer*
Pedlosky, J. 1996. Ocean Circulation Theory, *Springer*
Vallis, G. 2006. Atmospheric and Oceanic Fluid Dynamics, *Cambridge Univ. Press.*