Pensum GEF1100 2014

Lærebok

ATMOSPHERE, OCEAN, AND CLIMATE DYNAMICS: AN INTRODUCTORY TEXT
JOHN MARSHALL AND R. ALAN PLUMB

1. Characteristics of the atmosphere
1.1 Geometry
1.2 Chemical composition of the atmosphere
1.3 Physical properties of air
1.3.1 Dry air
1.3.2 Moist air

2. The global energy balance
2.1 Planetary emission temperature
2.2 The atmospheric absorption spectrum
2.3 The greenhouse effect
2.3.1 A simple greenhouse model
2.3.2 A leaky greenhouse
2.3.3 A more opaque greenhouse
2.3.4 Climate feedbacks

3. The vertical structure of the atmosphere
3.1 Vertical distribution of temperature and greenhouse gases
3.1.1 Typical temperature profile
3.1.2 Atmospheric layers
3.2 The relationship between pressure and density: hydrostatic balance
3.3 Vertical structure of pressure and density
3.3.1 Isothermal atmosphere
3.3.2 Non-isothermal atmosphere
3.3.3 Density

4. Convection
4.3.1 The adiabatic lapse rate (in unsaturated air)
4.3.2 Potential temperature
4.5.2 Saturated adiabatic lapse rate
4.5.3 Equivalent potential temperature

5. The meridional structure of the atmosphere
5.1 Radiative forcing and temperature
5.1.1 Incoming radiation
5.1.2 Outgoing radiation
5.1.3 The energy balance of the atmosphere
5.1.4 Meridional structure of temperature
5.2 Pressure and geopotential height
5.3 Moisture
5.4 Winds
5.4.1 Distribution of winds

6. The equations of fluid motion
6.1 Differentiation following the motion
6.2 Equation of motion for a nonrotating fluid
6.2.1 Forces…

6.2.2 Equations of motion
6.2.3 Hydrostatic balance
6.3 Conversation of mass
6.3.1 Incompressible flow
6.3.2 Compressible flow
6.4 Thermodynamic equation
6.6 Equation of motion for a rotating fluid
6.6.2Transformation into rotating coordinates
6.6.3 Rotating equations of motion
6.6.5 Putting things on the sphere

7. Balanced flow
7.1 Geostrophic motion
7.1.1 Geostrophic wind
7.1.2 Synoptic charts
7.1.3 Balanced flows (Gradient and cyclostrophic wind)
7.2 Taylor-Proudman theorem (only 1 slide, introduced)
7.3 Thermal wind equation (not from the book)
7.4 Subgeostrophic flow: The Ekman layer
Surface wind
7.4.2 Ageostrophic flow…
7.4.3 Ageostrophic flow…

8. The general circulation of the atmosphere
8.1 Understanding the observed circulation
8.2 Mechanistic view of the circulation
8.2.1 The tropical Hadley circulation
8.2.2 The extratropical circulation
8.4 Large-scale atmospheric energy and momentum budget
8.4.1Energy transport
8.4.2 Momentum transport
8.5 Latitudinal variations of climate

9. The ocean and its circulation
9.1 Physical characteristics of the ocean
9.1.1 The ocean basins
9.1.3 Properties of seawater; equation of state
9.1.4 Temperature, salinity, and temperature structure
9.2 The observed mean circulation
9.3 Inferences from geostrophic and hydrostatic balance
9.3.1 Ocean surface structure and geostrophic flow
9.3.4 The dynamic method

10. The wind-driven circulation
10.1 The wind stress and Ekman layers
10.1.1 Balance of forces and transport in the Ekman layer
10.1.3 Ekman pumping and suction induced by large-scale wind patterns
10.2 Response of the interior ocean to Ekman pumping
10.2.1 Interior balances
10.3 The depth-integrated circulation: Sverdrup theory
10.3.1 Rationalization of position, sense of circulation, and volume transport of ocean gyres

11. The thermohaline circulation of the ocean
11.1 Air-sea fluxes and surface property distributions
11.1.1 Heat, freshwater, and buoyancy fluxes
11.1.3 Sites of deep convection
11.3 Dynamical models of the thermohaline circulation

11.3.1 Abyssal circulation schematic deduced from Taylor-Proudman on the sphere
11.4 Observations of abyssal ocean circulation

12. Climate and climate variability
12.1 The ocean as a buffer of temperature change
12.2 El Ni˜no and the Southern Oscillation (no math in 12.2 and subsections)
12.2.1 Interannual variability
12.2.2 ‘‘Normal’’ conditions—equatorial upwelling and the Walker circulation
12.2.3 ENSO
12.2.4 Other modes of variability
12.3 Paleoclimate
12.3.1 Climate over Earth history
12.3.2 Paleotemperatures over the past 70 million years: the δ18O record 277
12.3.3 Greenhouse climates
12.3.4 Cold climates
12.3.5 Glacial-interglacial cycles
12.3.6 Global warming 291

IPCC AR5

Pensum er fra tre IPCC-dokumenter som ligger under “Undervisningsmateriell”, “IPCC AR5”

Summary for Policymakers (SPM): hele doknumentet
Chapter 5
Section 5.3.2.1, incl. Figure 5.3
Chapter 6
Section 6.1.1.1, incl. Figure 6.1
Box 6.1
FAQ6.2 (Frequently Asked Questions)

Annet

Oblig 1&2 – ikke Matlab
Ekskursjon: måleprogram