

PART 2 OF THE COURSE, *BOUNDARY LAYERS, TRANSPORT AND MIXING* (BLT&M-2) is concerned with role of transport and mixing in the General Circulation of the atmosphere. The question is, how does the non-linear interaction between radiative transfer, transport of water (i.e. the water cycle) and transport of heat, momentum, vorticity and mass, and mixing of potential vorticity, determine the temperature distribution in the atmosphere and, with it, the intensity, position and seasonal cycle of the principal zonal mean jet streams.

BLT&M-2 in Spring 2021 consists of 6 lectures on the following 6 topics. (1) The main features of the General Circulation of the atmosphere, (2) the influence of radiative transfer and thermal inertia on the temperature distribution in the atmosphere, (3) simulations of the general circulation with a two-dimensional statistical-dynamical general circulation model: the role of the radiation, water cycle, ozone and “planetary wave drag”, (4) wave/eddy - zonal-mean flow interaction according to quasi-geostrophic theory and according to the “PV-theta view”, (5) the connection between zonal mean jets and the distribution of potential vorticity, (6) some aspects of the philosophy and sociology of science.

Structure of the course the spring of 2021

Part 2 of the course consists of lectures (on 7, 21 and 28 May, and on 4, 11 and 25 June 2021) and reading and studying specific sections of the lectures notes (especially chapters 11 and 12) and doing a set of hand-in assignments. The final grade for part 2 of the course BLT&M is based on the weighted grades for the following set of 4 assignments or problems.

Problem 12.2 (see page 24) is a small assignment to make you start thinking about the interaction between radiation and dynamics (weight: 5% - **read section 12.1-12.2**).

Problem 12.3 is concerned with the mass/pressure distribution in the atmosphere determined by radiative transfer (see page 29) (weight: 22.5% - **read section 12.3-12.4**).

Problems 12.7, 12.8 & 12.9 are three “what-if questions” (see page 80) (weight: 50% - **read chapter 8 (about the Hadley circulation), sections 12.5-12.8 (about the 2D-GCM) and search the literature on CO₂-doubling model experiments and on the sensitivity of the global water cycle to changes to the character of the earth’s surface**).

Problem 12.18 is concerned with the theory of wave/eddy zonal-mean flow interaction (see page 84) (weight: 22.5% - **read sections 11.6-11.9 and 12.8-12.12**).

Deadlines

Problem 12.2, page 24: Wed. 12 May 2021

Problem 12.3, page 29: Wed. 26 May 2021

Problem 12.7, 12.8 & 12.9, page 80: Wed. 16 June 2021

Problem 12.18, page 84: Wed. 23 June 2021

All assignments can be handed in in groups of **up to 3 students**.

Hand in the answers to the problems as pdf-files *before or on* the following dates to a.j.vandelden@uu.nl.

Note: these deadlines are not carved in stone! Please let me know if you need more time.

Questions about part 2 of the course can be sent to a.j.vandelden@uu.nl or on TEAMS