MASTER Sciences de l'Océan,
de l'Atmosphère et du Climat

SCIENCES SORBONNE UNIVERSITÉ

M2 – Fiche descriptive UE :
Circulation générale de l'atmosphère

UE Tronc commun, 3 ECTS, S1

Équipe pédagogique :
Responsable : François Lott (LMD) DR CNRS
Aymeric Spiga (LMD) Professeur Sorbonne Université

Volumes horaires :
8 séances : 2h cours magistral, 2h de TD

Objectifs / description :
We describe and compare the general circulations of the troposphere, the stratosphere and the mesosphere. This clearly highlights the two main thermodynamical drivers of the atmosphere: in the troposphere, the absorption of the infrared radiation from the ground and oceans by the greenhouse gases and / or the convection ; in the stratosphere and mesosphere, the direct absorption of solar UV radiation by ozone. The global scale circulations produced by these global thermodynamical forcings are nevertheless unstable and modulated by waves that control in good part the weather and the climate variability, and that we described with details. We also discuss how the nature of these waves vary a lot from one medium to the other (troposphere, stratosphere, tropics extra-tropics). We also present the impact of these waves on the local weather (for instance the significance of Eady edge waves on synoptic meteorology). The course also describes the interactions between the waves and the large-scale circulation, yielding to planetary scale modes of variability like the Sudden Stratospheric Warmings in the mid-latitude stratosphere or the Quasi-Biennal Oscillation in the equatorial lower stratosphere.

Notions et contenus :
The course is based on analysis of meteorological observations and global datasets covering the middle latitude as well as the tropics, the troposphere as well as the stratosphere. In this sense its content is in good part descriptive, but the interpretations of the observations is made by using precise tools of geophysical fluid dynamics, like the Eliasen Palm fluxes, and simplified dynamical models like shallow water axisymetric models for the general circulation. These tools are also introduced with some details.

Plan du cours:
1) Mean climatologies and equations of motion
2) Time-mean large scale circulations explained in terms of angular momentum conservation
3) Meridional circulations and the role of the eddies
4) Midlatitudes tropospheric variability
5) Synoptic scale variability and baroclinic instability

6) Midlatitude stratospheric variability and sudden stratospheric warmings
7) Tropospheric equatorial variability
8) Stratospheric equatorial variability

Modalités d'évaluation :

1 Final exam, Attendance + participation, 1 homework