

FDEPS Lectures, November 2007

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These lectures will address the dynamics of oceans and atmospheres, as seen through theory, laboratory simulation and field observation. We will look particularly at high latitudes and climate dynamics of the ocean circulation coupled to the atmospheric storm tracks. We will emphasize the dynamics that is difficult to represent in numerical circulation models. We will discuss properties of oceans and atmospheres that are both fundamental, unsolved questions of physics, and are also important, unsolved problems of global environmental change.

Lecture 1:

Is the ocean circulation important to global climate? Does dense water drive the global conveyor circulation? Fundamental questions about oceans and atmospheres that are currently under debate.

The field theory for buoyancy and potential vorticity.
Basic propagators: Rossby waves and geostrophic adjustment.
Potential vorticity: inversion and flux.

Lecture 2:

How do waves and eddies shape the general circulation, gyres and jet streams?
Almost invisible overturning circulations.
Lessons from Jupiter and Saturn.
The peculiar role of mountains, seamounts and continental-slope topography.

Lecture 3:

Dynamics of ocean gyres and their relation with the global conveyor circulation.
Water-mass transport, transformation and air-sea exchange of heat and fresh water.
Ocean overflows and their mixing.
Decadal trends in the global ocean circulation.

Lecture 4:

Heat, fresh-water, ice: convection in oceans and atmospheres and the texture of geophysical fluids.

Lecture 5:

Teaching young students about the global environment using the GFD laboratory: science meets energy and environment in the lives of Arctic natives

Seminar:

Exploring high-latitude ocean climate with Seagliders and satellites

