EUCLIPSE EU CLOUD INTERCOMPARISON, PROCESS STUDY & EVALUATION PROJECT

EUCLIPSE ORGANISATION

The work is divided into 4 work packages:

WP1: Evaluation techniques & Climate model experiments

WP1 will provide new evaluation tools and CMIP5 climate simulation data for the cloud feedback analyses.
Chaired by: George Tselioudis (Email: gt9@columbia.edu)

WP2: Climate model Evaluation and Analysis

WP2 will analyze the CMIP5 climate simulations executed in WP1, in support of the 5th Assessment Report of the IPCC, by climate and weather prediction GCMs.
Chaired by: Sandrine Bony (Email: sandrine.bony@lmd.jussieu.fr)

WP3: Process-Level Evaluation

WP3 aims to evaluate how the large-scale forcing conditions control cloud cover, cloud amount and precipitation, as well as how these cloud properties influence the radiative budget and to what extend this is faithfully reproduced by the ESMs.
Chaired by: Stephan de Roode (Email: s.r.deroode@tudelft.nl)

WP4: Sensitivity Experiments and Hypothesis Testing

The goal of this work-package is to test new hypotheses and parameterizations to explain and reduce inter-model spread in cloud feedback and climate sensitivity in ESMs.
Chaired by: Bjorn Stevens (Email: bjorn.stevens@zmaw.de)

PROJECT MEMBERS

EUCLIPSE is a collaborative effort of 12 institutes:

- Royal Netherlands Meteorological Institute, The Netherlands
- Max Planck Institute for Meteorology, Germany
- Met Office, UK
- Centre National de la Recherche Scientifique – Institute Pierre Simon Laplace, France
- Academy of Athens, Greece
- European Centre for Medium Range Weather Forecasts, UK
- Delft University of Technology, The Netherlands
- Météo-France – Centre National de Recherches Météorologiques, France
- University of Stockholm, Sweden
- Eidgenössische Technische Hochschule Zürich, Switzerland
- University of Warsaw, Poland
- German High Performance Computing Centre for Climate- and Earth System Research, Germany.

FIND OUT MORE

EUCLIPSE started in February 2010 and will be funded for four years. Please visit the EUCLIPSE website for more detailed information, document downloads, links to observational and model data sets, links of the various intercomparison studies and to the websites of the Work Packages.

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THE CHALLENGE

Cloud Feedbacks in Earth System Models (ESMs) remain the largest source of uncertainty in projections of future climate. Consequently, the central challenge of EUCLIPSE is:
to determine, understand and reduce the uncertainty due to cloud-climate feedback.

This research is supported by the European Commission under the 7th Framework Programme. Priority: Environment.

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CLIMATE SIMULATIONS AND UNCERTAINTY

Earth system models (ESMs) are our major modeling tools used to address how our climate will respond to increasing greenhouse gases such as atmospheric carbon dioxide. Nevertheless, the global warming of the various ESMs that participated in the World Climate Research Programme's WCRP) third phase of the Coupled Model Intercomparis on Project (CMIP3) in support of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (AR4) exhibit a large spread of global equilibrium temperature insrease ranging from 2.3 to 4.2 K as a response of carbon dioxide doubling (see Figure 1).

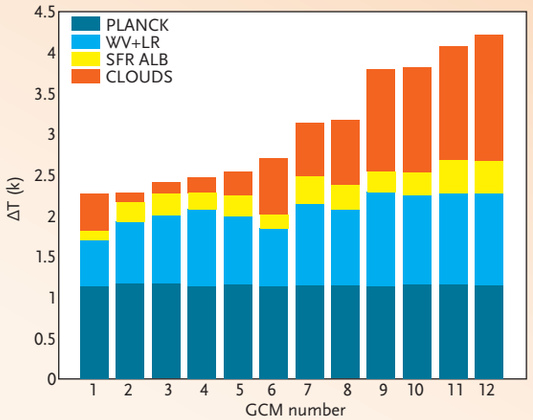

Figure 1 (source Dufresne and Bony, J. of Climate 2008)

The global warming of each ESM can be broken down into different contributions: i) direct warming due to doubling of carbon dioxide (dark blue), ii) enhanced warming due to an increase of water vapour in the atmosphere, the so called water vapour feedback (light blue), iii) enhanced warming due to a decrease of the Earth's surface albedo as an result of decreasing ice coverage (yellow) and iv) enhanced warming due changes in cloud amount and cloud properties, also known as the cloud feedback (orange). This analysis illustrates one of the main conclusions of the IPCC:

"Cloud effects remain the largest source of uncertainty in model based estimates of climate sensitivity."

EUCLIPSE OBJECTIVES

EUCLIPSE represents a focused multi-disciplinary effort to respond to the challenge of determining, understanding and reducing the uncertainty in cloud feedback by fostering coordinated research in the area of cloud processes in relation to climate change. The specific objectives of EUCLIPSE to achieve this are:

- Evaluation of cloud processes in Earth System Models.
- Development of physical understanding of how cloud processes respond and feedback to climate change.
- Development of a metric to measure the relative credibility of the cloud feedbacks by different Earth System Models.
- Improvement of the parameterization of cloud related processes in current Earth System Models.

METHODOLOGY

EUCLIPSE will achieve these objectives by making use of revolutionary developments in both observational and numerical simulation techniques by

- Exploiting the full hierarchy of entirely new observations of clouds. These include active space-borne remote sensing, the use of advanced atmospheric profiling stations and the use of data from recent observational field experiments.
- Exploiting the full hierarchy of Modeling Tools. These include a set of proposed ESM experiments along with targeted cloud-resolving simulations to answer specific questions identified in the analysis of these experiments.
- Designing idealized simulations to help to isolate and diagnose the effect of key cloud-climate feedback processes.

EXPECTED RESULTS

- Improvement of the representation of cloud related processes in ESMs.
- A metrics to quantify the ability of Earth System Models to represent clouds, radiation and precipitation.
- Reduction of the uncertainty of model-based estimates of climate change due to cloud related processes
- Dissemination of new tools, analysis methods, simulations and observations that will provide a useful database for the model development community at large.