# EUCLIPSE

EU Cloud Intercomparison, Process Study and Evaluation Project Feb 2010-Feb 2014

www.euclipse.eu

To determine, understand and reduce the uncertainty in Earth System Models (ESMs) due to cloud-climate feedback



Entering the final phase!

#### Over 34 publications....!

#### EUCLIPSE PUBLICATIONS

Bellenger, H., E. Guilyardi, J. Leloup, M. Lengnigne, and J. Vialard (2012): ENSO representation in climate models: from CMIP3 to CMIP5. Submitted for publication in Climate Dynamics.

Blossey, P. N., C.S. Bretherton, M. Zhang, A. Cheng, S. Endo, T. Heus, Y. Liu, A. Lock, S.R. de Roode and K.-M. Xu, (2012): Marine low cloud sensitivity to an idealized climate change: The CGILS LES Intercomparison. Accepted in J. Adv. Model. Earth Syst. pending minor revisions.

Bodas-Salcedo, A., M.J. Webb, S. Bomy, H. Chepfer, J.-L. Dufresne, S.A. Klein, Y. Zhang, R. Marchand, J.M. Haynes, R. Pincus, and V.O. John, (2011): COSP: stabilities simulation software for model assessment. *Bull. Amer. Meteor. Soc.*, 92, 1023-1043, doi: 10.1175/2011BAMS2356.1

Bony S., G. Bellon, D. Klocke, S. Sherwood, S. Fermepin and S. Denvil, (2013): Direct effect of carbon dioxide on future tropical atmospheric circulation and regional precipitation. Submitted for publication in *Nature Geoscience* (in revision).

Brient, F. and S. Bony, (2012): Interpretation of the positive low-cloud feedback predicted by a climate model under global warming. Accepted for publication in *Climate Dynamics*, DOI 10.1007/s00382-011-1279-7.

Brient, F. and S. Bony, (2012): How may low-cloud radiative properties simulated in the current climate influence lowcloud feedbacks under global warming. Published in Geophys. Res. Lett., 39, L20807, doi:10.1029/2012GL053265.

Cattiaux, J., H. Douville, and Y. Peings, (2012): European temperatures in CMIP5 origins of present-day biases and future uncertainties. Submitted for publication in *Climate Dynamics*.

Cattiaux, J.,H. Douville, A. Ribes, F. Chauvin, and C. Plante, (2012): Towards a better understanding of changes in wintertime cold extremes over Europe: A pilot study with CNRM-CM5 and IPSL-CM5 atmospheric models. *Climate Dynamics*, published online. doi:10.1007/s00382-012-1436-7.

Cheruy, F., A. Campoy, J.-C. Dupont, A. Ducharne, F. Hourdin, M. Haeffelin, M. Chiriaco, A. Idelkadi, (2012): Combined influence of atmospheric physics and soil hydrology on the simulated meteorology at the SIRTA atmospheric observatory. Submitted for publication in *Climate Dynamics*.

Crueger, T., C. Hohenegger, W. May, (2012): Tropical precipitation and convection changes in the MPI-ESM in response to CO2 forcing. Submitted for publication in the J. Adv. Model. Earth Syst.

Crueger, T. and B. Stevens, (2012): The Madden-Julian Oscillation in ECHAM6 and the Introduction of an Objective MJO Metric. Submitted for publication in the J. of Climate.

Dussen, J.J. van der, S.R. de Roode, A.S. Ackerman, P.N. Blossey, C.S. Bretherton, M.J. Kurowski, A.P. Lock, R.A.J. Neggers, I. Sandu, and A.P. Siebema, (2012): The GASS/EUCLIPSE Model Intercomparison of the Stratocumulus Transition as Observed During ASTEX: LES results. Submitted for publication in the J. Adv. Model. Earth Syst.

Koenigk T., L. Brodeau, R.G. Graversen, J. Karlsson, G. Svensson, M. Tjernström, U. Willen and K. Wyser, (2012): Arctic climate change in 21st century CMIP5 simulations with EC-Earth. Published in *Climate Dynamics*, DOI 10.1007/s00382-012-1645-0.

Lacagnina, C., F. Selten, (2013): Changes in the cloud properties in response to El Niño: a bivariate approach. Published on line in *Climate Dynamics*, DOI: 10.1175/JCLI-D-11-00178.1.

Lloyd, J., E. Guilyardi and H. Weller, (2012): The role of atmosphere feedbacks during ENSO in the CMIP3 models. Part III: the shortwave flux feedback Published in J. Climate, 25, 4275-4293, DOI: 10.1175/JCLI-D-11-00178.1.

Mauritien, T., et al., (2012): Tuning the Climate of a global model. Submitted for publication in the J. Adv. Model. Earth Syst.

Moebis, B. and B. Stevens, (2012): Factors influencing ITCZ placement on an aquaplanet. Submitted for publication in the J. Adv. Model. Earth Syst.

Nam, C., S. Bony, J.-L. Dufresne and H. Chepfer, (2012): The 'too few, too bright' tropical low-cloud problem in CMIP5 models. Published in *Geophysical Research Letters*, vol. 39, issue 21. doi.org/10.1029/2012GL053421.

Neggers, R.A.J. and A.P. Siebeuma, (2012): Constraining a system of interacting parameterizations through multipleparameter evaluation: Tracing a compensating error between cloud vertical structure and cloud overlap. Submitted for publication in the J. of Clauste.

Neggers, R.A.J., A.P. Siebesma and T. Heus, (2012): Continuous single-cohummodel evaluation at a permanent meteorological supersite. Published in Bull. Am. Meteorol. Soc., 93, 1389-1400, DOI:10.1175/BAMS-D-11-00162.1.

Oueslati, B. and G. Bellon, (2012): Tropical precipitation regimes and mechanisms of regime transitions: contrasting two aquaplanet general circulation models. Published in *Climate Dynamics*, DOI 10.1007/s00382-012-1344-x.

Oueslati, B. and G. Bellon, (2013): Convective entrainment and large-scale organization of tropical precipitation: sensitivity of the CNRM-CMS hierarchy of models. In press Journal of Climate.

Popke, D., B. Stevens, A. Voigt, (2012): Investigation of climate change using a radiative convective equilibrium configuration of ECHAM6. Submitted for publication in the J. Adv. Model. Earth Syst.

Roode, S.R. de, A.P. Siebeuma, S. Dal Gesso, H.J.J. Jonker, J. Schalkwijk, and J. Sival, (2012): The stratocumulus response to a single perturbation in cloud controlling factors. Submitted for publication in the J. of Climate.

Schalkwijk, J., H.J.J. Jonker and A.P. Siebetma, (2012): Simple Solutions to Steady-state Cumulus Regimes in the Convective Boundary Layer. Submitted for publication in the J. Atm. Sci.

Schubert, J.J., B. Stevens, T. Crueger, (2012): The Madden-Julian Oscillation as Simulated by the MPI Earth System Model: Over the Last and Into the Next Milleanium. Submitted for publication in the J. Adv. Model. Earth Syst.

Stevens, B., et al., (2012): The Atmospheric Component of the MPI-ESM: ECHAM6 Submitted for publication in the J. Adv. Model. Earth Syst.

Tselicudis, G., W. Rossow, Y. Zhang and D. Konsta, (2012): Global Weather States and their Properties from Passive and Active Satellite Cloud Retrievals. Submitted for publication in the J. of Climate.

Tsushima, Y., M.A. Ringer, M.J. Webb and K.D. Williams, (2012): Quantitative Evaluation of the Seasonal Variations in Climate Model Cloud Regimes. Published in Climate Dynamics, DOI 10.1007/s00382-012-1609-4

Vial, J., J.-L. Dufresne and S. Bony, (2013): On the interpretation of inter-model spread in CMIP5 climate sensitivity estimates. Submitted for publication in Climate Dynamics

Webb, M.J. and A.P. Lock, (2012): Coupling between subtropical cloud feedback and the local hydrological cycle in a climate model. Published in *Climate Dynamics*, DOI 10.1007/s00382-012-1608-5

Zelinka, M.D., S.A. Klein, K.E. Taylor, T. Andrews, M.J. Webb, J.M. Gregory, and P.M. Forster, (2013): Contributions of Different Cloud Types to Feedbacks and Rapid Adjustments in CMIP5. In press, J. Climate. doi: 10.1175/JCLID-12-00555.1.

Zhang, M., C.S. Bretherton, P.N. Blossey, P.A. Austin, J.T. Barmeister, S. Bony, F. Brient, A. Cheng, S.R. De Roode, S. Endo, A.D. Del Genio, C.N. Franklim, J.-C. Golaz, C. Hannay, T. Heus, F.A. Isotta, J.-L. Duffesne, I.-S. Kang, H. Kawai, M. Koehler, S. Kumar, V.E. Larvon, Y. Liu, A.P. Lock, U. Lohman, M.F. Khairoutdinov, A.M. Molod, R.A.J. Neggers, P. Rasch, I. Sandu, R. Senkbeil, A.P. Siebeuma, C. Siegenthale-Le Drian, B. Stevens, M.J. Suarez, K.-M. Xu, K. von Salzen, M.J. Webb, A. Wolf, M. Zhao, (2012): CGLS First results from an International Project to Understand the Physical Mechanisms of Low Cloud Feedbacks in General Circulations Models. Submitted for publication in the Bull. Am. Meteorol. Soc.

Zhang, M., C.S. Bretherton, P.N. Blossey, S. Bony, F. Brient and J.-C. Golaz, (2012): The CGILS experimental design to investigate low cloud feedbacks in general circulation models by using single-column and large-eddy simulation models. Submitted to the J. Adv. Model. Earth Syst.



#### MSE-hypothesis: from SCM to coupled climate model (IPSL)

To be continued in the Cookie experiments for other ESM's



Brient &Bony (2012)



$$\kappa = \frac{\Delta \theta_{e}}{\left(L_{v}/c_{p}\right)\Delta q_{T}} = 1 + \frac{\Delta \theta_{L}}{\left(L_{v}/c_{p}\right)\Delta q_{T}}$$



- Each GCM has its own kappa-cc relation
- These kappa-cc relation carries from SCM to GCM
- •Justifies the use of SCM to understand GCM behaviour.

Roel Neggers et al 2013

And let's not forget.....

## And let's not forget.....

### **EUCLIPSE OBJECTIVES**

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

# Enjoy the Meeting, and enjoy Hamburg!

