Report for project 854 “Erdsystemmodellevaluierung”

Project: **854**
Project title: **Erdsystemmodellevaluierung**
Project leader: **Veronika Eyring**
Report period: **January 1, 2018 – December 31, 2018**

Analysis and evaluation of first CMIP6 results

A visualization system for routine evaluation of CMIP6 models as soon as output is submitted to the ESGF has been set up. The analyses and model evaluation is done with the Earth System Model Evaluation Tool (ESMValTool, http://www.esmvaltool.org/) and has been tested with CMIP5 results as no CMIP6 data are available in the CMIP6 data pool at DKRZ yet. For this reason, about 500 node-h of the requested computing time were not used. In addition, the space requested on the long-term archive for documentation of data (doku) has not been used as no data for publication could be generated yet.

As an example for the visualization system set up for ESMValTool results, Figure *1* shows the result browser that allows for sorting and filtering of results by diagnostic / metric (ESMValTool namelist), project, CMIP realm, theme, domain, plot type, statistics, reference, variable and model (including multi-model mean and observations). Each plot includes a figure caption and includes provenance metadata such as ESMValTool configuration, input files processed, references, etc. that are displayed when clicking on the figure. The visualization system aims at providing an easy way to the modeling groups to obtain an overview on their model’s performance as a starting point for analyzing selected results in more detail. Once CMIP6 data are available at DKRZ, in particular the following science questions will be addressed using the ESMValTool: How well can state-of-the-art ESMs simulate climatological mean, variability and trends in selected variables? What is the progress achieved in CMIP6 compared with CMIP5?

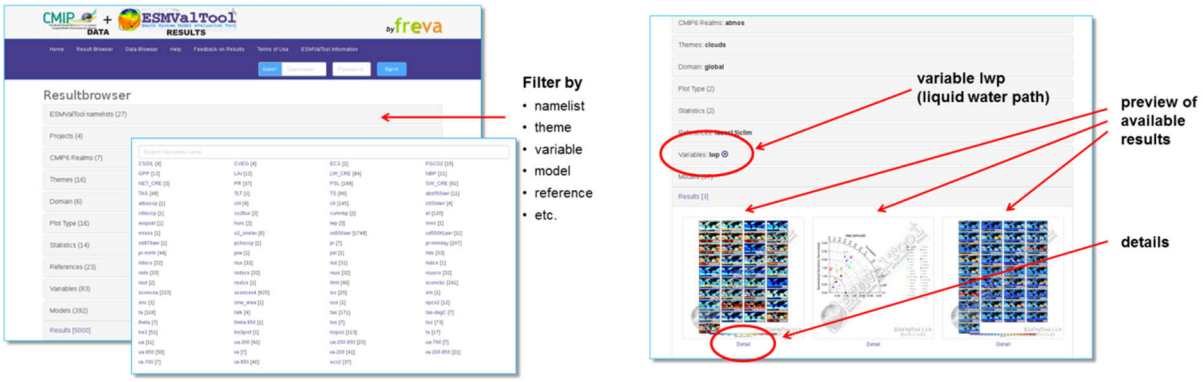

Figure 1 Example from the visualization system for ESMValTool results implemented within the BMBF project CMIP6-DICAD project for routine evaluation of CMIP6 models as soon as output is submitted to the ESGF. In this example the ESMValTool has been applied to CMIP5 data. The result browser is available at http://cmip-esmvaltool.dkrz.de/.

Analysis of the aircraft measurement campaign HALO ESMVal

The initially planned 1-year simulation with the ECHAM/MESSy Atmospheric Chemistry (EMAC) model to support analysis of the aircraft measurement campaign HALO ESMVal tuned out to be not needed: the analysis and a contribution to interpreting the measured trace gas concentrations could be done using existing model simulations. In this study, HALO research aircraft observations obtained during the Earth System Model Validation (ESMVal) campaign in September 2012 in the upper-tropospheric Asian summer monsoon anti-cyclone (ASMA) were put into the context of regional and intra-annual variability by hindcasts with EMAC. The results have been published in Gottschaldt et al. (2018). As an example from

this publication, a sequence of simulated CO and HCl fields at 355 K illustrating the stirring associated with the splitting-up event of the ASMA that occurred during the HALO ESMVal campaign in September 2012 is shown in Figure *2*.

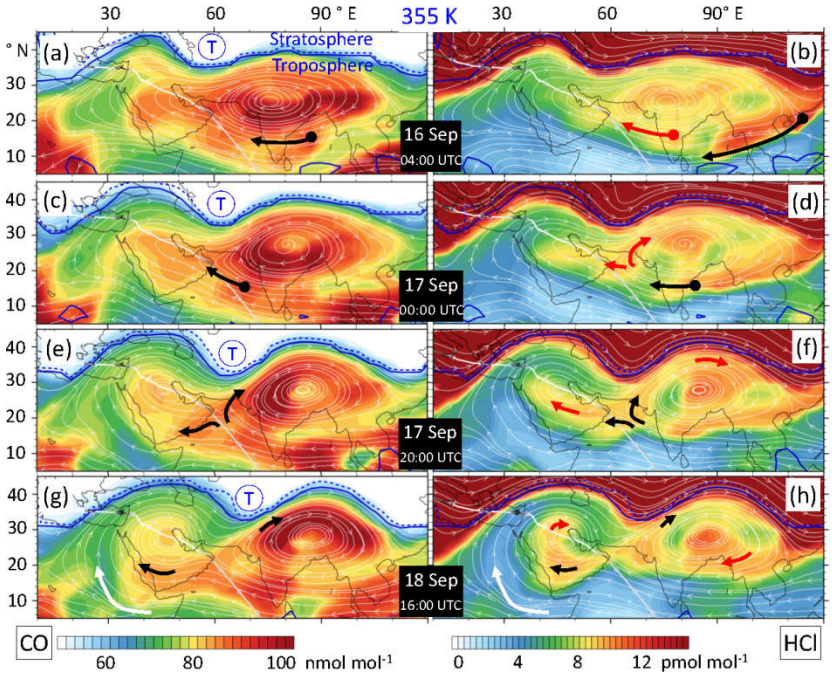

Figure 2 Sequence of simulated CO and HCl fields at 355 K illustrating the stirring associated with the splitting-up event of the ASMA that occurred during the HALO ESMVal campaign in September 2012. Streamlines (gray) represent instantaneous wind fields, and arrows highlight the redistribution of selected air masses. The sequence starts with an elongated anticyclone on 16 September 2012. Then a tropopause trough (T) evolves from the west along the northern ASMA flank. The anticyclone succumbs to the perturbation and splits up into a Tibetan and an Iranian part, shortly after the HALO flight from Male to Larnaca had passed through (from Gottschaldt et al., 2018).

References

Gottschaldt, K.-D., Schlager, H., Baumann, R., Cai, D.S., Eyring, V., Graf, P., Grewe, V., Jöckel, P., Jurkat, T., Voigt, C., Zahn, A., Ziereis, H. (2018), Dynamics and composition of the Asian summer monsoon anticyclone, Atmos. Chem. Phys., 5655-5675, doi: 10.5194/acp-18-5655-2018.