Project: **1178**

Project title: **Analysis of representation of wind fields in the models participating in DYAMOND I and II**

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The project was outlined for two main tasks: i) statistical analysis of the wind fields simulated by the models participating in the DYAMOND project and ii) investigating the effects on modelled global mineral dust emissions. However, only task i) could be tackled since the staff originally interested in working on task ii) left the institute to follow the offer of a professorship. Due to lack of manpower, partly interfered by the Sars-COV-2 outbreak since the free position could not be filled timely, this task could not be taken on, yet, by someone else. We therefore want to ask for prolongation of the project with the same expected amount of resources. Recruiting of new staff is under way, including the offer for bachelor and master theses on the topic. Due to the termination of other projects in 2022, also I will be able to spend time to lead this effort as PI. For task i), the planned resources (mostly storage) were used, however, the computation time that would have been required for task ii) could not be consumed.

Results of statistical analysis of DYAMOND model's wind fields

For the analysis, the vertical wind fields were translated into histograms showing frequencies of occurrence with 0.1 m s-1 resolution for all models and available horizontal resolutions. Apart from the global field (3D + time), also subdomains (lowest 500 m vs full troposphere, Central Europe) were analyzed similarly. In addition, such histograms were created for the high-resolution regional simulations performed with the ICON-LEM model over Germany during the HD(CP)2 project, which are also hosted at DKRZ. The different model data were compared to observations of vertical velocity derived from doppler lidars and windprofilers. The observational datasets comprise several years and is representative for Central German Lowlands (observations situated at Leipzig and Lindenberg, Germany). From the observational datasets comparable histograms were created.

The comparison revealed a large spread between the different high-resolution models in terms of the frequency of occurrence of strong vertical wind speeds (+/- 5 m s-1, factor of 2-3 for updrafts and factor 10-100 for downdrafts). As expected also the model resolution has a large impact on the occurrence rate of vertical velocities due to the more smoothed wind fields. In comparison to the observed vertical velocity frequencies at the two locations in Germany, it could be seen that none of the global high resolution models reaches similar high frequencies in the observable range with sufficient statistics between +/- 0.5 - 7 m s-1 (and opposite overestimating low vertical velocity frequencies). Naturally, the available horizontal resolutions of 2.5 km and more miss the observed small scale structures. Observation and model can be brought closer together, if the observations are averaged to time intervals of a few minutes. Furthermore, the vertical velocities frequencies derived from the 156 m ICON-LEM simulations show a good agreement with the observed frequencies. However, the interpretation needs some caution since the selection of simulated cases with ICON-LEM during HD(CP)2 is not necessarily representative to the observation period of several years. However, the occurrence of high vertical velocities is mostly driven by convective situations, which was a key target for the HD(CP)2 project.

A publication on this analysis is currently in preparation.