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Potential of knowledge discovery using workflows implemented in the C3Grid

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With the increasing number of climate simulations, reanalyses and observations, new infrastructures to search and analyse distributed data are necessary. In recent years, the Grid architecture became an important technology to fulfill these demands. For the German project „Collaborative Climate Community Data and Processing Grid“ (C3Grid) computer scientists and meteorologists developed a system that offers its users a webinterface to search and download climate data and use implemented analysis tools (called workflows) to further investigate them.
In this contribution, two workflows that are implemented in the C3Grid architecture are presented: the Cyclone Tracking (CT) and Stormtrack workflow. They shall serve as an example on how to perform numerous investigations on midlatitude winterstorms on a large amount of analysis and climate model data without having an insight into the data source, program code and a low-to-moderate understanding of the theortical background.
CT is based on the work of Murray and Simmonds (1991) to identify and track local minima in the mean sea level pressure (MSLP) field of the selected dataset. Adjustable thresholds for the curvature of the isobars as well as the minimum lifetime of a cyclone allow the distinction of weak subtropical heat low systems and stronger midlatitude cyclones e.g. in the Northern Atlantic. The user gets the resulting track data including statistics about the track density, average central pressure, average central curvature, cyclogenesis and cyclolysis as well as pre-built visualizations of these results.
Stormtrack calculates the 2.5-6 day bandpassfiltered standard deviation of the geopotential height on a selected pressure level. Although this workflow needs much less computational effort compared to CT it shows structures that are in good agreement with the track density of the CT workflow. To what extent changes in the mid-level tropospheric storm track are reflected in trough density and intensity alteration of surface cyclones.
A specific feature of C3Grid is the flexible Workflow Scheduling Service (WSS) which also allows for automated nightly analysis runs of CT, Stormtrack, etc. with different input parameter sets. The statistical results of these workflows can be accumulated afterwards by a scheduled final analysis step, thereby providing a tool for data intensive analytics for the massive amounts of climate model data accessible through C3Grid. First tests with these automated analysis workflows show promising results to speed up the investigation of high volume modeling data. This example is relevant to the thorough analysis of future changes in storminess in Europe and is just one example of the potential of knowledge discovery using automated workflows implemented in the C3Grid architecture.