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Cloud-Optimized Data and Dynamic Analysis Tools for Earth System Science

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Earth system science examines the complex interactions between the atmosphere, biosphere, hydrosphere, and other spheres, with the goal of understanding the planet's dynamic processes. A crucial aspect of this field is the collection and analysis of vast amounts of data, which provide insights into these interactions, both from simulations and observations. A prevalent data type in this field is gridded spatiotemporal data, typically represented as multidimensional arrays, also known as data cubes. In recent years storing and processing these data in cloud environments has gained adoption which resulted in development of new cloud-optimised data formats. In addition, the shift to cloud-based data analysis necessitates the evolution of analysis tools capable of handling gridded data efficiently. A significant challenge in this context is the joint analysis of data from different sources with varying spatial and temporal resolutions. Emerging solutions like on-the-fly data cube generation (kerchunk) and dynamic regridding facilitate seamless integration and analysis of diverse datasets, paving the way for more robust and flexible earth system science research.

Author: REICHSTEIN, Markus (Max-Planck-Institute for Biogeochemistry)

Co-author: GANS, Fabian

Presenter: REICHSTEIN, Markus (Max-Planck-Institute for Biogeochemistry)

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