The emerging Earth System Data Cube: Idea, implementation, and first scientific case studies

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Today, scientists are dealing with a plethora of Earth observations (EO) and derived products that await joint exploitation. To tap into this enormous synergistic potential requires overcoming substantial practical obstacles. Among these obstacles are, data archive dispersal, access difficulties, formatting issues, inconsistencies in terms of naming, resolution and many others. In order to overcome these obstacles, we built a novel infrastructure for scientists: a platform that provides a physical Earth System Data Cube focusing on land and atmospheric processes (i.e. a wide range of consistent EOs at different resolutions) accompanied with a multi-language data analytic toolkit. The idea is to build a hyper-data cube that is easily accessible by a wide audience with moderate technical expertise with the objective to tap into the full potential of a data-rich world by revising both: data access opportunities as well as developing a new suite of data analytic tools that can simultaneously explore heterogeneous global data streams. Our grand challenge is to extract characteristic biosphere-atmosphere system trajectories and to understand, e.g., how and where climatological or human-induced extreme anomalies influence this complex feedback system. Here we present a prototype of the Earth System Data Cube and first scientific case studies that reveal the potential of a synergistic approach to data streams in the Earth system – from empirical analytics to a perspective for model-data integration.