CyberConnecter is operational ready for supporting Earth science models with tailored Earth observation data and products

Liping Di, Ziheng Sun, Chen Zhang, Denial Tong, Ben Domenico, Haosheng Huang, Xiaoqing Wu

Earth science models (ESM) are widely used in Earth science research to understand the mechanism and dynamics of the Earth system and predict the future state of the system. Meanwhile, Earth observation (EO) via remote sensing is the most important method for measuring the current state of the Earth system. Products derived from EO data are very useful in model initialization, validation, verification, and inter-comparison. A vision of the future Earth science modeling is the model web where ESMs can be discovered, accessed, integrated, and executed via standard Web interfaces over the Internet in a plug-in-and-play manner. EO data and their derived products can be automatically streamed into ESMs, and ESM outputs can be freely exploited, compared, and analyzed by users. However, realizing such a vision remains a big challenge due to lack of interoperability between ESM and EO domains. CyberConnecter aims to meet this challenge by developing and implementing a set of standards-compliant, interoperable middleware tools and chainable web services that automatically connect the ESMs and EOs with geospatial interoperability technologies. It can customize EO data and products into specialized forms by composing and executing geoprocessing Web services. It leverages Virtual Data Product (VDP) to separate the conceptual workflow design from specific technical details so that average modelers without specific web service and geospatial interoperability backgrounds can take advantage of the solution. With its capabilities and standards-compliances, CyberConnecter provide a general solution to the challenge, which save the massive costs traditionally spent on manually tailoring the data to fit ESM requirements. After development and testing in the past two and a half years, CyberConnecter is now operational ready. The capabilities and generality of the operational-ready CyberConnecter have been demonstrated with three ESMs: FVCOM (Finite Volume Community Ocean Model), CRM (Cloud Resolving Model), and CMAQ (Community Multi-scale Air Quality Model). In all three ESM cases, multiple EO products from different providers were automatically tailored, integrated, and fed into ESMs. The results prove that CyberConnecter significantly reduces the interoperability barriers between ESMs and EOs, expands the use of EO data and products in ESMs, increases the productivity of researchers, and facilitates the quick deployment of ESMs for different real-world scenarios.