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Cloud Services Integration Platform (CSIP) Model and Data Services

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Abstract: The Cloud Services Integration Platform (CSIP)¹ is an open platform tailored to develop and deploy microservices for environmental models with data sources. Its emergence responded to needs within the modelling community for rapid and wide access to such modelling resources. CSIP was designed from the ground up (1) to account for modelling service elasticity and scalability, (2) to leverage contemporary computational approaches, (3) to address interoperability and traceability within operational settings, (4) to allow platform and language agnostic service access and cloud agnostic deployment while providing a simple, OMS3 based non-invasive approach to leverage legacy and new modelling solutions with minimal development effort.

Colorado State University (CSU) has developed more than 160 CSIP-based natural resource model and data services that can be integrated into an organization's information system analysing environmental concerns. Model service examples include water and wind erosion prediction (WEPP, WEPS, RUSLE2), soil quality (SCI, STIR), water quality (SWAT-CP, WQM, CFA, AgES-W), stream degradation (SWAT-DEG), hydrology (PRMS, NRCS Hydrotools, CFA, Water Supply Forecasting), hydraulics (Cross-Section), and grazing management (GRAS). Available supporting data services and sources include soil (SSURGO), ecological site (ESIS), climate (CLIGEN, WINDGEN, PRISM), land management and crop rotations (LMOD), and pesticides (WQM). These services are deployed within the CSU OMSLab to facilitate easy dissemination, integration and re-use in stakeholder and partner application systems. The inventory of services continues to grow as new projects are completed and their systems deployed. An always current list of services is available online¹. Instructional material and examples with a step by step tutorial for service development is also available².

CSIP modelling and data services modelling have been and are continued to be integrated into various applications, such as the USDA Natural Resources Conservation Service (NRCS) Integration Erosion Tool (IET) and the Conservation Streamlining Delivery Initiative (CDSI). The "Field-to-Market" alliance for sustainable agriculture is utilizing CSIP erosion services within their Fieldprint Calculator, which allows growers to better evaluate and understand management choices and their effect on overall sustainability performance and operational efficiency. The Colorado Department of Public Health and Environment (CDPHE) uses CFA 'loadest' and flood regression analysis for Wastewater Treatment Plant (WWTP) monitoring regulations. CSIP hydraulics services are being utilized by the National Cooperative Highway Research Program (NCHRP) for cross section geometry sediment transport and yield analysis in waterbodies. The CDPHE watershed rapid assessment program (WRAP) accesses CSIP services for land use assessment, stream, groundwater, and climate monitoring.

The main emphasis of this contribution will be the presentation of publicly available interoperable modeling services to the scientific community and public interest groups in operational settings and the recommended steps to follow for service integration or their use in higher education.

Resources
¹CSIP project website: https://alm.engr.colostate.edu/cb/project/csip
²Getting started with CSIP in Docker: https://alm.engr.colostate.edu/cb/wiki/23468