RIMORPHIS: River Morphology Information System

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Abstract

Information on river shape, bed morphology and sediment load are critical to help inform research and management issues related to river channels. However, such information is not easily accessible and/or available in public domain. RIMORPHIS fills this information gap by providing a web platform for aggregating, storing, sharing and analyzing river related scientific data. Additionally, it will serve as a clearing house for river morphology data that will help improve our overall understanding of national rivers' health using scientifically-rendered datasets. This paper provides an overview of RIMORPHIS, including its capabilities to: (i) store different types of data, (ii) process and visualize river morphology and hydrodynamics data; (iii) interact with other river data repositories; and (iv) support research related to river hydrodynamics, morphodynamics and sediment transport. Beta version of RIMORPHIS is currently open to public with limited capabilities, and several tools are being developed. Overall, RIMORPHIS is expected to play an important role in advancing river morphology research by not only providing data to the community but also tools to process data and produce new information.

Introduction

Rivers and streams are increasingly recognized for their importance on local and global scale studies. Once thought of as merely inactive pipes benignly transporting water and constituents from one place to another, rivers are now seen as dynamic environments where major interactions and alterations occur. Human populations rely heavily on rivers for essential services, including municipal and agricultural water supply, hydropower, and flood protection, and as such, rivers are among the most heavily human-altered of all ecosystems, with human- caused changes to morphology (damming, diking), hydrology (quantity, quality, temperature, timing), and biogeochemistry (excess nutrients, toxic substances). Despite the significance of rivers to our populations, we have remarkably limited knowledge globally about rivers, including their morphological aspects and how river channels change through time. Most of these knowledge gaps stem from obstacles related to accessing the morphological data existing in various repositories and handling them in an easy, user-friendly manner by a diverse pool of users, from decision-makers to scientists. RIMORPHIS fills this information gap by providing a web platform for aggregating, storing, sharing, and analyzing river-related scientific data. The

overall vision for RIMORPHIS is to create a self-sustaining community platform with ancillary tools for supporting scientific discovery on river morphology progression and enabling integrated multidisciplinary research on riverine environments. The objective of this presentation is to highlight the key components of RIMORPHIS and demonstrate its current functionality.

RIMORPHIS Design and Development

RIMORPHIS connects all data and information through a framework that uses the river network as the skeleton. Within this framework, cross-sections or collections of points along a cross- section or multi-beam data are connected to a reach, which is then connected to a stream network and associated watershed. This framework enables seamless integration across datasets, irrespective of their location, and also enables the building of customized applications utilizing the data for routine management operations or exploratory scientific investigations. The core functionality and capabilities of the system include the following: a) a new specification for data and semantics on river morphology datasets; b) web-based cyberinfrastructure for information sharing and communication of river morphology datasets, including advanced visualization and filtering tools based on a relational database; and c) a data analytics component for modeling and analysis to support test cases in a multi-stakeholder context.

RIMORPHIS Tools

RIMORPHIS aims to provide a convenient and user-friendly environment for the earth sciences community to access, process, and visualize river morphology data. Currently, it provides the following functions: data access and integration from eHydro, coordinate transformation, and integration of river bathymetry with digital elevation models. RIMORPHIS, through its map interface, can access and display the locations of all eHydro surveys. Upon request, it can access all the relevant information, such as bathymetry (x, y) points, depths, and water surface elevations, conversion to UTM zone projection, and interactive visualization on the RIMORPHIS platform. For coordinate transformation, RIMORPHIS can take a centerline and bathymetry points as input and convert the cartesian (x, y) coordinates to channel-fitted (s, n) coordinates, where s is the flow distance along the centerline and n is the distance across the centerline. RIMORPHIS can pre-process and interpolate point river bathymetry data to create a mesh in 3D, which can then be integrated with the surrounding topography to obtain an integrated DEM that fuses both the land topography and river bathymetry. RIMORPHIS will also be interoperable with other public domain repositories, such as HydroShare, for accessing, publishing, and reusing the river morphology data under the terms of the Creative Commons Attribution–NonCommercial License (https://creativecommons.org/licenses/by-nc/4.0).

Concluding Remarks

RIMORPHIS is envisioned as a platform for accessing and processing river morphology data developed with and for the science and practice communities engaged in earth science. The current beta version of RIMORPHIS can access a public repository to provide river morphology data in a form that can be used as input to river simulation models. RIMORPHIS also provides pre-processing of users' data. With ongoing development to access other public resources and interoperate with community resources such as HydroShare (www.hydroshare.org), RIMORPHIS will play an important role in advancing river morphology research by not only providing data to the community but also tools to process data and produce new information. RIMORPHIS can be accessed at www.rimorphis.org