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Design of a component-based integrated environmental modeling framework

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ABSTRACT

Integrated environmental modeling (IEM) includes interdependent science-based components that comprise an appropriate software modeling system and are responsible for consuming and producing information as part of the system, but moving information from one component to another (i.e., interoperability) is the responsibility of the IEM software system. We describe and discuss the Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES), a component-based IEM system, from the standpoint of software design requirements which define system functionalities. Design requirements were identified in a series of workshops, attended by IEM practitioners, and reported in the development of a number of IEM software systems. The requirements cover issues associated with standards, component connectivity, linkage protocols, system architecture and functionality, and web-based access, all of which facilitate the creation of plug & play components from stand-alone models through a series of software support tools and standards.

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Software/Data availability

FRAMES-2

Software Developer	Mitch Pelton and Karl Castleton
Address	PNNL, Battelle Boulevard, Richland, WA 99354 USA
Tel	+1 509 372 6551 and +1 970 248 1837
Fax	+1 509 372 4995
E-mail	Mitch.Pelton@pnnl.gov and Karl.Castleton@pnnl.gov
First available	2005
Hardware requirements	700 Mhz CPU 512 MB RAM
Software requirements	Windows 95 Or Newer
Availability	Open source (no license, source code available upon request)
Cost	Free
Program language	Visual Basic and C++
Program size	700 MB on disk after installation
Software Access	(download FRAMES) http://iemhub.org/resources/133/

1. Introduction

Many complex environmental problems can benefit from a multi-disciplinary analysis provided by integrated modeling, and only by implementing systems thinking and integrative approaches that complement traditional single-discipline approaches will we be better able to solve challenging environmental problems (Babendreier et al., 2007; Gaber et al., 2008). Laniak et al. (2013) and Whelan and Laniak (1998) chronicle the evolution of integrated technologies that view the environment from a holistic, systematic viewpoint. A number of researchers (e.g., Gaber et al., 2008; Jakeman and Letcher, 2003; Laniak et al., 2013; MEA, 2005; Parker et al., 2002) have articulated the need to

- solve increasingly complex real-world problems involving the environment and its relationship to human systems and social and economic activities.
- create cost-effective, harmonious, higher-order systems thinking and holistic, equitable solutions that reflect the inherent complexity of environmental systems.
- develop and organize multidisciplinary knowledge through a science-based structure that explains, explores, and predicts

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