

ISCMEM



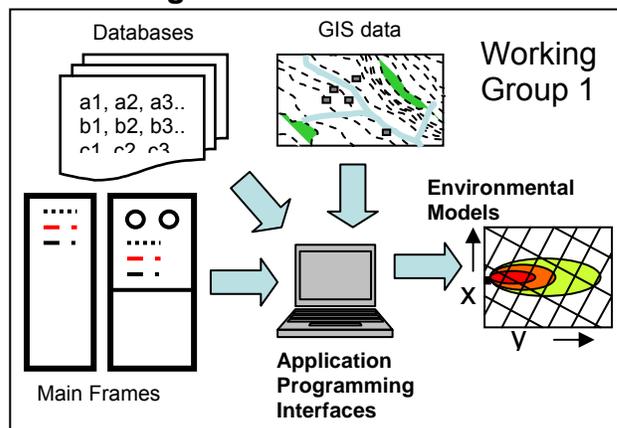
The Interagency Steering Committee on Multimedia Environmental Modeling (ISCMEM) is a consortium of Federal agencies established by a memorandum of understanding (MOU) for the purpose of cooperating and coordinating on research and development of integrated, multimedia environmental models, software, databases, applications, and techniques. Current signatories include the U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), U.S. Nuclear Regulatory Commission (NRC), the National Resources Conservation Service (NRCS), the National Science Foundation (NSF), U.S. Army Corps of Engineers (USACE), and U.S. Geological Survey (USGS) with the National Oceanic and Atmospheric Administration (NOAA) and the National Aeronautics and Space Administration (NASA) in process.

In 2000, several Federal agencies were independently developing methods to track the transport of materials (contaminants, nutrients, etc.) through the environment via air, surface water, and groundwater. Researchers within these agencies realized that significant resources could be saved by coordinating the development of integrated environmental modeling (IEM) technologies. ISCMEM is the formalized agreement among these agencies to share information and collaborate on the development of multimedia models, protocols, frameworks, database linkages, and applications. ISCMEM performs these functions with in-kind or voluntary funding. The MOU was first signed in 2001, and was then revised and renewed in 2006 and again in 2011.

There are five working groups within ISCMEM, with a sixth in the development phase. Working Group 1 (WG1) focuses on the design, development, and implementation of software systems. WG1 has been instrumental in creating data connectivity tools that link a variety of applications (including legacy codes) and databases (e.g., FRAMES). WG1 and ISCMEM leadership recently played a critical role in developing internationally-subscribed IEM guidance documents. (Laniak et al., 2012; Moore et al., 2012). WG1 also develops application programming interfaces (APIs) that allow modelers to more easily link multimedia models with GIS data and databases of varying formats, and with visualization software (e.g., GEOLEM, D4EM).

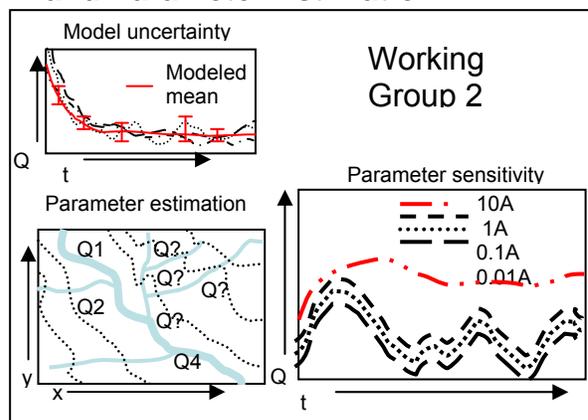
Working Group 2 (WG2) focuses on the development and application of software systems and techniques to assess model uncertainty and parameter estimation. Understanding sources of environmental model uncertainty and providing uncertainty estimates on predictions are of increasing importance to Federal agencies, particularly for risk assessments. WG2 and WG1

WG1: Software System Design and Implementation for Environmental Modeling



researchers developed standard procedures for incorporating calibration, optimization, sensitivity, and uncertainty analyses (COSU-API) into their models. WG2 members have also actively engaged with working groups WG3 and WG4 in incorporating uncertainty analysis into subsurface reactive transport (WG3) and water quality models (WG4). WG2 efforts have resulted in several interagency publications (e.g. NRC documents NUREG/CP-0187 proceedings of an international workshop on uncertainty, sensitivity and parameter estimation for environmental modeling, NUREG/CR-6805 on a comprehensive strategy of hydrogeologic modeling and uncertainty analysis for nuclear facilities and sites, NUREG/CR-6843 on combined estimation of hydrogeologic conceptual model and parameter uncertainty and NUREG/CR-7026 on application of model abstraction techniques to simulate transport in soils; available at NRC's Public Website: <http://www.nrc.gov/reading-rm/doc-collections/>. Cooperative studies to develop and apply the Joint Universal Parameter Identification and Evaluation of Reliability - an Application Programming Interface (API) for model analysis (JUPITER) (<http://pubs.usgs.gov/tm/2006/tm6e1/pdf/tm6e1.pdf>).

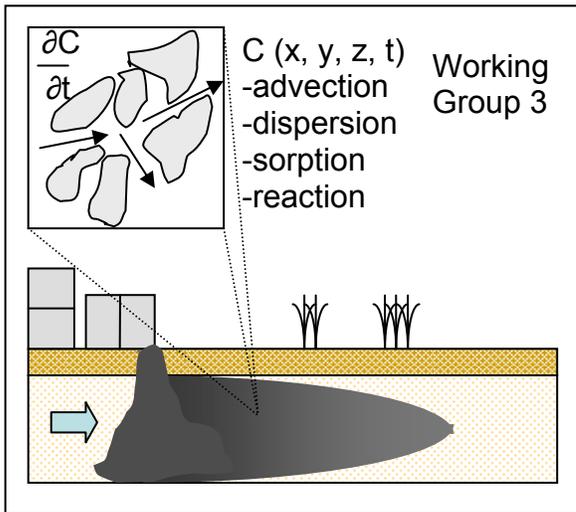
WG2: Model Uncertainty Analysis and Parameter Estimation



Working Group 3 (WG3) members are engaged in understanding and defining practical methods to improve subsurface reactive solute transport models. Proper validation of a site conceptual model is crucial to guiding development of field-relevant models of reactive solute transport. WG3 members have helped guide

science directions and investments for reactive transport modeling and for the definition of practical methods to develop valid site conceptual models. For example, the WG3 hosted workshop on reactive subsurface transport in April 2004 and associated white paper (*EOS* 85:449, 455) has been used by DOE and NRC funding solicitations addressing important priorities for research on the coupling and scaling of reactive transport mechanisms. More broadly, ISCMEM efforts have also contributed to the successful collaborative research. As part of the Advanced Simulation Capability for Environmental Management (ASCEM) initiative, DOE is in the process of developing a state-of-art high-performance computing approach for predicting contaminant fate and transport in natural and engineered systems.

WG3: Subsurface Reactive Solute Transport Modeling



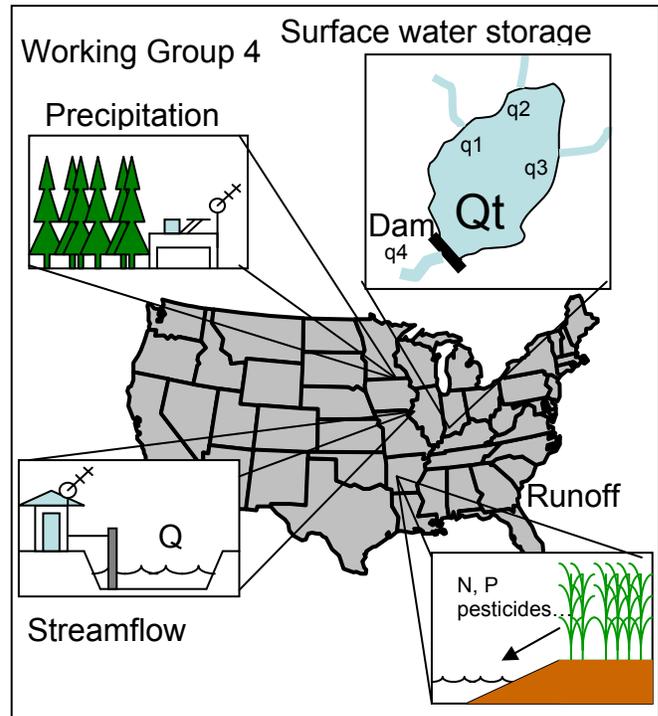
Monitoring and modeling of water quality and water quantity across entire watersheds is the focus of working Group 4 (WG4). Integration and interoperability of models, remote sensing, and monitoring networks used by different agencies is an ISCMEM goal that aims to provide more comprehensive information on water resources for flood and drought prediction, nutrient flux from non-point pollution, irrigation planning, erosion and contaminant transport. In addition to modeling nutrients and contaminants, members are integrating terrestrial and aquatic plant models with water quality and contaminant models in order to better describe the interaction of plants on flow and sediment as well as nutrient and contaminant uptake, plant growth, and plant mortality based on species type. In addition, WG4 members are collaborating with members of WG1 and WG2 to develop better mechanisms for software linkage and to integrate water quality and contaminant models into risk and uncertainty risk analysis and parameter estimation. Finally, members of WG4, WG1 and WG2 are involved in large Federal initiatives such as NIDIS (National Integrated Drought Information System) and ESTCP (Environmental Security Technology Certification Program).

Working Group 5 (WG5) was created in September 2010 with the aim of sharing information on the development and application of environmental forecasting tools and methodologies that could facilitate the discussion, definition, quantification, and

use of environmental sustainability, ecosystem services and ecosystem health concepts in environmental modeling.

Working Group 6 (WG6) is under development with a focus on the integration of monitoring activities and modeling approaches, in order to reduce uncertainties and lifecycle costs of environmental cleanup and closure programs.

WG4: Distributed Watershed/Water Quality Monitoring



Starting in 2011, while preserving its founding Federal interagency responsibilities, ISCMEM joined an international community of practice (CoP) on IEM. This was facilitated by ISCMEM's participation as a formal member group in the [iemHub web portal and CoP](#). The iemHUB is an IEM electronic meeting hall with over 2000 users within the past year with nearly 1800 downloads. The CoP promotes information exchange, offers integrated modeling solutions, provides technical and software expertise, and assists in the characterization of models and tools. It captures community knowledge and gives access to a wealth of resources, including recent member group publications and presentations, and supporting documentation of models, databases, and frameworks. It seeks to reduce IEM fragmentation and duplication, and improve interoperability, reusability, and adaptability of modeling components (meeting the diverse needs of end users or consumers).

ISCMEM actively solicits participation among researchers within other agencies and encourages those agencies to join the ISCMEM MOU and support the broader iemHUB CoP. More information about ISCMEM can be found on its website on [iemHUB \(https://iemhub.org/groups/iscmem/\)](https://iemhub.org/groups/iscmem/), or by contacting the ISCMEM Chair, Dr. Ming Zhu at Ming.Zhu@em.doe.gov.