Geophysical Research Abstracts,
Vol. 10, EGU2008-A-11725, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-11725
EGU General Assembly 2008

Simulation of thermal stream loadings using a fully-integrated surface/subsurface modeling framework

A.E. Brookfield, E.A. Sudicky, Y.J. Park, B. Conant Jr.

Department of Earth and Environmental Sciences, University of Waterloo, Waterloo, Ontario, Canada (aebrookf@scimail.uwaterloo.ca)

Thermal stream loadings from both natural and anthropogenic sources have significant relevance with respect to climate change, ecosystem health, and water resources management. In recent years, there has been an increase in field-based research directed towards characterizing thermal transport exchange processes that occur at the surface water/groundwater interface of streams. In spite of this effort, relatively little work has been performed to simulate these exchanges and elucidate their roles in mediating surface water temperatures where the pertinent hydrological, meteorological and surface/variably-saturated subsurface processes are simultaneously taken into account. To address this issue, HydroGeoSphere, a fully-integrated surface/subsurface flow and transport model, has recently been enhanced. HydroGeoSphere can simulate water flow, evapotranspiration, and advective-dispersive heat and solute transport over the 2D land surface and in the 3D subsurface under variably-saturated conditions. In order to demonstrate the capabilities of the enhanced model to capture thermal transport and exchange processes, a high-resolution 3D numerical simulation was performed for a highly-characterized stream segment in Ontario, Canada. It is shown that the transient model can mimic the spatio-temporal thermal patterns observed in the streambed, the surface water and the groundwater. The computed thermal regime is shown to vary markedly both spatially and temporally depending on the intensity of the groundwater discharge/recharge patterns along and across the streambed. The computational framework can be used to provide quantitative guidance towards establishing the conditions needed to maintain a balance between a healthy ecosystem and

consumptive water use.