1996 Fall Meeting
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TI: Application of a System Dynamics Model to Understand Processes Affecting Spatial and Temporal Changes in the Isotopic Composition of Grounc
AU: *M D Abbott, R S Stanley, A Lini, P R Bierman
MN: Fall Meeting 1996
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AN: H72G-10
TI: Application of a System Dynamics Model to Understand Processes
    Affecting Spatial and Temporal Changes in the Isotopic
    Composition of Groundwater
AU: M D Abbott
AU: R S Stanley
AU: A Lini
AU: P R Bierman
AF: Geology Department, University of Vermont, Burlington, VT
    05405-0122
EM: mdabbott@zoo.uvm.edu
AB:
    Using the STELLA system dynamics modeling code, we have
    developed a model to represent processes that affect the
    isotopic composition of groundwater as a function of
    location and time within a fractured metamorphic bedrock
    groundwater system. This model is part of an effort to
    characterize groundwater recharge and flow in the upper
    basin of the Browns River in northwestern Vermont. Mount
    Mansfield (elev. 1440 meters ASL) forms the head of the
    study basin. The bedrock contains many interconnected
    vertical and subvertical fractures capable of transporting
    flow from the highlands to the valleys where groundwater is
    drawn from the rock by residential wells. Spatial and
    temporal measurements of the stable isotopes, 18O and 2H,
    and the radioisotope, 3H, in precipitation and groundwater
    have indicated that the isotopic composition of recharge,
    strongly influenced by elevation and seasonal temperature
    changes, is reflected in the isotopic composition of
    groundwater. However, the degree of modification of the
    isotopic signal by mixing within the bedrock fracture system
    is unknown. The purpose of the system dynamics model is to
    provide an instrument with which to examine chemical and
    physical processes within the groundwater flow system that
    govern the spatial and temporal evolution of groundwater
    isotopic composition within the bedrock aquifer. Development
    of such a model allows assessment of the sensitivity of
    groundwater movement to such parameters as bedrock hydraulic
    conductivity, fracture interconnectivity, storage, and
    anisotropy. The model incorporates field data from the study
    basin including bedrock structural information, and more
    than 800 spatial and temporal isotope measurements. Lesser
    understood parameters are systematically varied to reproduce
    observed isotopic trends, thus achieving realistic estimates
    of groundwater flow rates. The model can be applied to
    prediction of sustainable yield for groundwater supply
    development and remediation of contaminant problems. Work is
    funded by a USGS Vermont Water Resources Grant.
SC: H
DE: 1829
DE: 1832
DE: 3210
MN: Fall Meeting 1996
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