Michail D. Vrettas & Inez Y. Fung University of California at Berkeley

Application of a new hydraulic conductivity model to simulate rapid groundwater fluctuations in the Eel River Watershed in Northern California[1]

High-frequency multi-year observations of the water table at several wells in the Angelo Coast Range Reserve in the Eel River Watershed in northern California show rapid fluctuations, where the water table, some 10-15 meters below the surface, rises by as much as 1 meter in a day or two after the first storms of the rain season. The observations highlight preferential flow through weathered bedrock, which can store as much as 30% of the moisture in the column ("rock moisture"). This rapid transfer of moisture and storage at depth could have a significant impact on ecosystem dynamics and the water and energy budgets of the atmosphere on various time scales.

Despite its high importance, preferential flow through weather bedrock is not routinely captured in most climate models. This work presents a new hydraulic conductivity parameterization that captures the preferential flow, with straightforward implementation into current global climate models. The hydraulic conductivity is represented as a product of the effective saturation (normalized water content) and a background hydraulic conductivity K_{bkg}, drawn from a depth dependent lognormal distribution. A unique feature of the parameterization is that the variance of hydraulic conductivity is large when there is little rock moisture, and decreases with increasing saturation, mimicking flow through fractures.

The new method is applied to seven wells locations on a steep (35 degrees) hill-slope in the Eel River watershed in Northern California, for the duration of six years and estimates of the model parameters are provided by assimilating, into Richards' equation, measurements of precipitation [mm] and water table depths [m] at 30-minute time intervals.

The simulation results show that the new approach yields a good agreement of the rapid rise of the observed water table at the tested well locations. Furthermore, the water stored in the weathered bedrock is estimated to be in the range between 32% and 41%, which could account for a large fraction of water in the column.

[1] **Accepted** (final paper number: **GC23A-1126**) at the 2015 AGU Fall Meeting.