HLWYM HEmails

From: Randall Fedors
Sent: Tuesday, February 12, 2008 6:21 AM
To: Jack Guttmann
Subject: Re: ACTION - UZ2

I'll look at the entries in the annotated outline, and consider rewording portions for better understanding from outside readers or moving to another slot in the outline. Reading the entry and noting the location in the outline, I can see why Tim brought up his concern. I didn't intend to question the equipment; it's the best we have for the UZ.

Part of the issue is the steady state assumption in the flow model versus point measurements in a transient system. While this sounds bad for the modeling approach, it is a common approach that is reasonable when the parameters reflect the long-time behavior of the system. Time length scales for flow behavior versus climate (and thus percolation) changes is another way to think of this issue. Another part of this problem is to make sure we clearly separate the capabilities of different observations and how they are used in the DOE UZ flow approach. In the big picture, there is a variety of indirect information that needs to be put together in understanding and quantifying UZ flow.

So, no, we are not going to question the equipment, only their capability to reflect flow in fractures. It's a long-standing issue that the general unsaturated zone scientific field realizes as a concern. For example, Shlomo Neuman (Univ of Arizona) quantified the flux missed by the array of probes set up in the Apache Leap experiment (fractured tuff). We would lose credibility if we didn't speak to this issue. This is not one of the big issues, just a glaring one that we have to speak to (or reconcile). If Tim was worried that we would spend time questioning the the validity of these tools for generic porous media, he should not be concerned. The widespread usage of these probes for unsaturated zone measurements has a long history. The probes provide useful information in fractured rock terrains. We just want to to address the caution for interpreting data obtained from fractured rocks.

The readings from these probes are dominated by the conditions in the measurement volume (3D zone around the probe), which is mostly matrix. Neutron probes and psychrometers mostly reflect the matrix signal because the volume around the probe is 99.9% matrix, if it hits a fracture; 100% if the probe is not installed as intersecting a fracture. DOE flow models have a disequilibrium in water potential (also called matric pressure or tension) between the matrix and fracture. There are no observations of water potential in fractures.

Neutron probes provide estimates of water content (which leads to estimates of saturation). From these measurements in non-fractured porous media, one could estimate flux rates. Using one more step, one could also use the psychrometer data (water potential data). At YM, this estimate of flux could be done using the nonwelded PTn saturation data where matrix flow dominates (~90% of total flux), but not for the welded tuffs where fracture flow dominates. DOE has not utilized the calculation of flux through the PTn.

I mentioned psychrometers in the outline bullet, but DOE also used heat dissipation probes to estimate water potential. Psychrometers are appropriate for water potentials <1 bar. In the ESF, DOE used heat dissipation probes when they saw that water potentials were more in the 0.1 to 0.5 bar range.

In the IIRSR, we noted that the thermocouples probably better reflect the fracture-flow signal because of the propagation of heat by conduction through fractured rocks. But recently, even DOE has modified their thermohydrological models to account for a thermal disequilibrium between matrix and fractures. They needed to change their model so that they could better fit indirect field observations in thermal tests.

--Randy

>>> Jack Guttmann 02/11/08 4:36 PM >>>

Randy,

During our meeting on the SER Outline, Time raised a question on the statement: "evaluate capability of neutron probes, phsychrometers, and thermocouples to reflect matrix and fracture flow."

Is the purpose of that item to assess if the equipment support DOE's matrix diffusion and fracture flow? The way Tim interpreted the item is that we question the instruments.

Please clarify in the attached file. (Page 20)

Thanks,

jack G.

Hearing Identifier: HLW_YuccaMountain_Hold_EX
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Mail Envelope Properties (Randall.Fedors@nrc.gov20080212062034)

Subject: Re: ACTION - UZ2
Sent Date: 2/12/2008 6:20:34 AM
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From: Randall Fedors

Created By: Randall.Fedors@nrc.gov

Recipients:
"Jack Guttmann" <Jack.Guttmann@nrc.gov>
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MESSAGE	4271	2/12/2008 6:20:34 AM

Options
Priority: Standard
Return Notification: No
Reply Requested: No
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