

Wylie, Allan

From: Greg Sullivan [greg@spronkwater.com]
Sent: Monday, November 28, 2011 12:11 PM
To: Wylie, Allan; Raymondi, Rick; Jennifer Johnson ; Bredecke, Chuck; Bryan Kenworthy; Bryce Contor; Chuck Brockway; Dar Crammond; David Blew ; David Hoekema; David Kampwerth; Gary Johnson; Greg Clark; Gregg S. Ten Eyck ; Hal Anderson; J. D. May; Jack Harrison; Janak Timilsena; Jeff Sondrup; Jim Bartolino; Jim Brannon ; John Koreny; John Lindgren ; Jon Bowling; Ken Skinner; Linda Lemmon; McVay, Michael; Mike Beus; Rick Allen; Roger Warner; Sharon Parkinson; Stacey L Taylor; Sukow, Jennifer; Swank, Lyle; Thomas R Wood; Vincent, Sean; Willem Schreuder; Young Harvey Walker
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Subject: RE: Predictive Uncertainty Memo
Attachments: Comments on Model Uncertainty.doc

Allan,

Thank you for your November 7, 2011 memorandum regarding the ESPAM2 Predictive Uncertainty. While you have discussed some of the issues that I had mentioned during the last ESHMC meeting, I think there are additional issues that should be addressed related to the predictive uncertainty of the model. Because of the importance of this matter, and the potential for misunderstanding or misusing the results of the predictive uncertainty analysis, I suggest that a comprehensive "design document" or similar report be prepared on this subject. I realize that there have been various memoranda, emails, white papers, etc. that have been submitted by certain of the ESHMC members. However, it would be helpful to compile all of this excellent information into a single document to help make it easier to understand what the analysis is, how it was performed, and how it should be used.

In the context of the delivery calls, model uncertainty has been used primarily to establish trim lines across the ESPA, beyond which curtailment orders would not apply. However, this is not the only circumstance in the delivery calls in which model uncertainty may be relevant. In addition, knowledge of model uncertainty may be useful in understanding and interpreting model results for other uses (e.g., in evaluating the benefits of managed recharge).

The following are among the information that should be included in the documentation for the predictive uncertainty analysis:

Why the analysis was performed:

- Requested by the Hearing Officer in rulings for the delivery calls by the Spring Users and the Surface Water Coalition.
- Requested by former IDWR Director, David Tuthill.
- Requested by current IDWR Director, Gary Spackman.

Factors affecting the uncertainty of the ESPAM (from 2009 Bredecke comments, attached):

- Conceptual uncertainty.
- Parameter uncertainty.
- Calibration uncertainty (internal).
- Calibration uncertainty (external).

How the predictive uncertainty analysis was performed and the results of the analysis

- It is important that the procedure used in performing the predictive uncertainty analysis be thoroughly documented so that it transparent and repeatable.

Factors considered in the predictive uncertainty analysis

- My understanding is that the proposed predictive uncertainty analysis will only consider the effect of the internal calibration uncertainty on the model results. In other words, the analysis will seek to quantify the potential

variability in the model predictions if the model calibration was varied to some degree from the optimal final calibration (i.e., with objective function scores within X % of the optimal value).

Factors not considered in the predictive uncertainty analysis

- Conceptual uncertainty.
- Parameter uncertainty.
- External calibration uncertainty.
 - o Uncertainty of the calibration targets.
 - o Relative weighting of the calibration targets (e.g., weighting given to water levels, reach gains, spring targets, etc.).

Spatial variability in the predictive uncertainty of the model

- The predictive uncertainty of the model appears to be dependent on (a) what the model is being used to predict (e.g., impacts to a certain spring or a certain river reach), and (b) what stress is causing the impact (e.g., pumping in a certain region of the aquifer). This concept needs to be clearly explained.
- Assuming there is a significant variability in the predictive uncertainties for various combinations of stresses (e.g., pumping in a certain area) and impacts (e.g., depletions to certain springs, certain reaches, etc.), it may be useful to develop an uncertainty matrix.

Limitations on the use of the results

- Description of what can be deduced from the results of the predictive uncertainty analysis, and cautions against inappropriate or unreasonable use of the results.

There may be expectations from some outside of the ESHMC that the predictive uncertainty of the ESPAM can be objectively and conclusively determined, and it is just a matter of doing the work to establish these results. However, as alluded above, it is not a simple task to determine the predictive uncertainty of the model, and the results of an uncertainty analysis will be highly dependent on the sources of uncertainty that are considered and the procedures used to perform the analysis. These matters should be made clear in the documentation report to help ensure appropriate use of the results.

It may be beneficial for there to be some more dialog between the Director and the ESHMC regarding the proposed uses of the results of the predictive uncertainty analysis. The Director should be informed as to the scope and limitations of the proposed uncertainty analysis so that he can judge whether the analysis will conform with his expectations and with the way that he may use the results.

I appreciate your consideration of these comments.

Greg

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Sent: Monday, November 07, 2011 11:34 AM

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Subject: Predictive Uncertainty Memo

Hi

During our October 27 ESHMC meeting Greg Sullivan requested a memo discussing both why the ESHMC should conduct a predictive uncertainty analysis and how the analysis would be conducted. The attached memo represents my attempt to answer both questions. I am assuming that previous presentations and committee discussions adequate cover the strengths and weaknesses of our chosen approach. The file is also posted in the 'ESPA Model Uncertainty' section of the ESHMC web page. Your comments are welcome. If I don't receive any comments by 21 November 2011, I will consider the memo final.

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