Use of PRISM Data

for Precipitation Estimates

in ESPAM2

AS BUILT

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DESIGN DOCUMENT OVERVIEW

During calibration of the Eastern Snake Plain Aquifer Model Version 1.1 (ESPAM 1.1), a series of Design Documents were produced to document data sources, conceptual model decisions and calculation methods. These documents served two important purposes; they provided a vehicle to communicate decisions and solicit input from members of the Eastern Snake Hydrologic Modeling Committee (ESHMC) and other interested parties, and they provided far greater detail of particular aspects of the modeling process than would have been possible in a single final report. Many of the Design Documents were presented first in a draft form, then in revised form following input and discussion, and finally in an "as-built" form describing the actual implementation.

This report is a Design Document for the calibration of the Eastern Snake Plain Aquifer Model Version 2 (ESPAM 2). Its goals are similar to the goals of Design Documents for ESPAM 1.1: To provide full transparency of modeling data, decisions and calibration; and to seek input from representatives of various stakeholders so that the resulting product can be the best possible technical representation of the physical system (given constraints of time, funding and personnel). It is anticipated that for some topics, a single Design Document will serve these purposes prior to issuance of a final report. For other topics, a draft document will be followed by one or more revisions and a final "as-built" Design Document. Superseded Design Documents will be maintained in a "superseded" file folder on the project Website, and successive versions will be maintained in a "current" folder. This will provide additional documentation of project history and the development of ideas.

INTRODUCTION

Precipitation values for ESPAM2 were processed from PRISM data as was done in ESPAM 1.1. A general review of the ESPAM1.1 method of processing PRISM data for the model is provided in this design document. For a more detailed review of the ESPAM1.1 approach, refer to the design document DDW-011 (Gilliland, 2003). The purpose of this design document is to explain any differences between the two versions of the model (ESPAM1.1 and ESPAM2).

REVIEW OF ESPAM1.1

PRISM (Parameter-elevation Regressions on Independent Slopes Model) uses point data, a digital elevation model, and other spatial data to generate gridded estimates of several spatial and temporal climatic parameters, such as precipitation. Monthly and annual PRISM data for ESPAM1.1 were acquired from the Spatial Climate Analysis Service and the Oregon Climate Service for the years 1980 to 1997. For the remainder of the calibration period when PRISM data were not available, NOAA precipitation data were collected for January 1998 to April 2002.

PRISM precipitation data were acquired on a two-kilometer by two-kilometer grid scale. GIS was used to format a precipitation dataset for the Recharge tool. Due to the difference in size and orientation of the model grid relative to the PRISM data grids, each cell in the model did not match up perfectly with a

single value of precipitation. Values of precipitation assigned to each cell were based on an average of the PRISM values that touched the cells. Figure 1 below demonstrates how values were assigned to each cell. The black lines represent the model grid. The blue lines represent the raster PRISM grid with each cell in the grid representing a different value for precipitation depth. The one model cell with a red dot in it is touching two cells of the PRISM grid. In order to assign a value to that cell, the "Summarize Zones" functionality of ArcGIS was used to assign an average of those two precipitation values to that particular model cell.
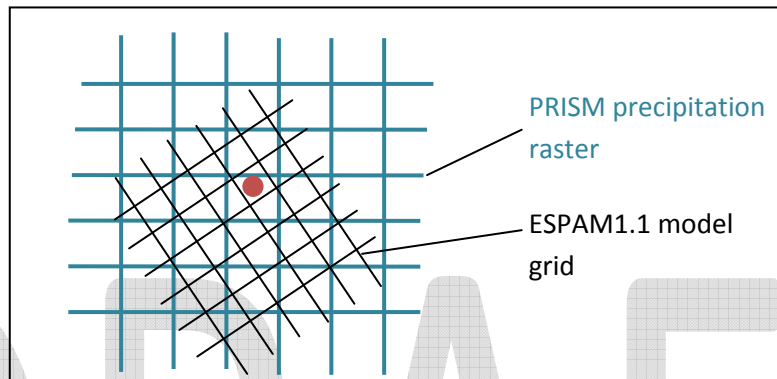

Figure 1. Illustration of the ESPAM1.1 model grid overlaying the PRISM precipitation grid.

ESPAM2 APPROACH

In ESPAM2, PRISM data were also used. For this version of the model, PRISM data were available for the entire calibration period of the model (including when data were not available for ESPAM1.1 between the years 1998 and 2002). As a result, NOAA precipitation data were not necessary to fill in missing data from PRISM.

When assigning the PRISM grid of values to the model cells in ESPAM2, the nearest neighbor method was used. The nearest neighbor method involves assigning a value to a point (or cell in this case) with a value that is closest to that cell. Figure 2 demonstrates how this was done. The green points represent the values in the PRISM raster grid and the yellow grid represents the model cells. The highlighted purple cell is assigned with a value from the highlighted red point since it is the closest point to that cell and happens to be enclosed in that cell. Values assigned to the ESPAM2 model grid using nearest neighbor are not changed, making it different from the averaging done in ESPAM1.1.
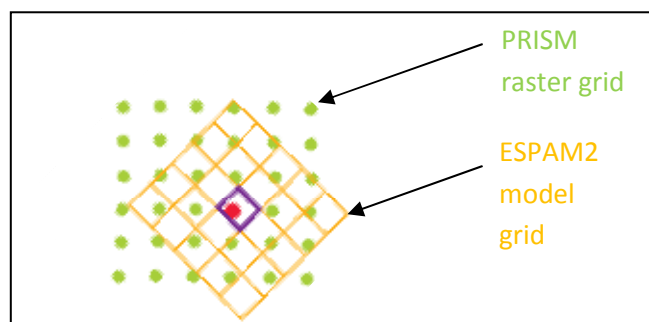

Figure 2. Illustration of the ESPAM2 model grid overlaying the PRISM precipitation grid.

(Figure adapted from ArcGIS online glossary at http://resources.arcgis.com/glossary/term/692)

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COMPARING ESPAM1.1 AND ESPAM2

As a result of using a different method of assigning values to the grid cells, there was some change in precipitation data between the two versions of the model. This change was discussed at the November 17, 2009 ESHMC meeting and is presented in a memorandum to the ESHMC dated November 18, 2009. The change resulted in a spatial change and a change in values by cell. Table 1 below shows the change in precipitation from the GIS data formatted for the Recharge-tool method (ESPAM1.1 version) to the nearest neighbor values (ESPAM2 version). In order to show the change, the column titled "Ratio" is the new precipitation value (sum of the precipitation depths by model cell, across the active study area) divided by the old precipitation value. A few stress periods were randomly chosen to make this comparison. In addition, October 2006 was selected because its "old" value was based on preliminary PRISM data and its "new" value was based on final PRISM data. In the stress periods chosen, the ratio was very close to 1 implying a minor change in value between ESPAM1.1 and ESPAM2.

Table 1. Comparing the ESPAM1.1 method to the ESPAM2 method of assigning precipitation.

Stress Period	Actual Month-Year	OLD version - SUM of Stress Period (precip in ft)	NEW version - SUM of Stress Period (precip in ft)	Ratio (New/Old)
SP001	May-80	3080.7	3050.3	0.990
SP051	Jul-84	1701.1	1682.1	0.989
SP101	Oct-88	212.2	212.7	1.002
SP151	Nov-92	792.7	782.2	0.987
SP201	Jan-97	1803.3	1843.3	1.022
SP257	Sep-01	506.1	505.0	0.998
SP301	May-05	3064.6	3064.0	1.000
SP318	Oct-06	1225.0	1223.4	0.999
SP329	Sep-07	853.6	853.5	1.000

The following figures show that there is some change in spatial representation of precipitation. Figure 2 is the ESPAM1.1 representation of precipitation and figure 3 is the ESPAM2 representation of precipitation, each figure representing the same stress period. Each color is a range of values for precipitation depth. The color scale in figure 2 is the same it is for figure 3 so that the representation is comparable. Note that the spatial variation is difficult to discern.
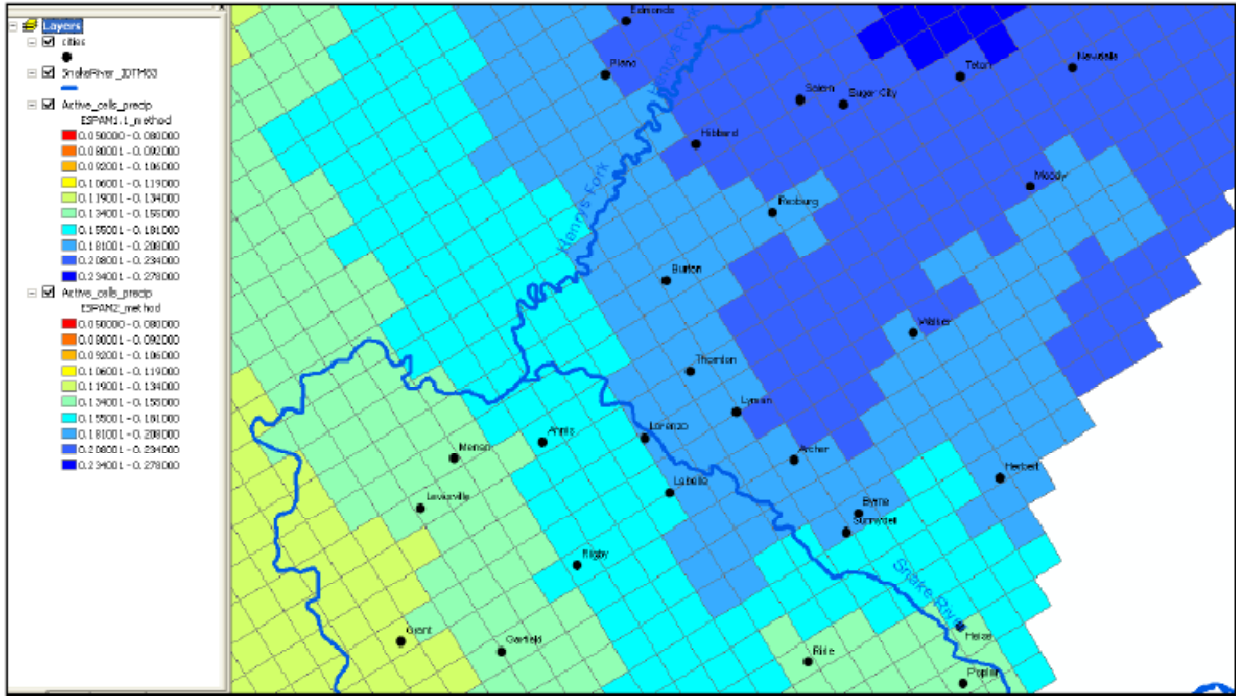
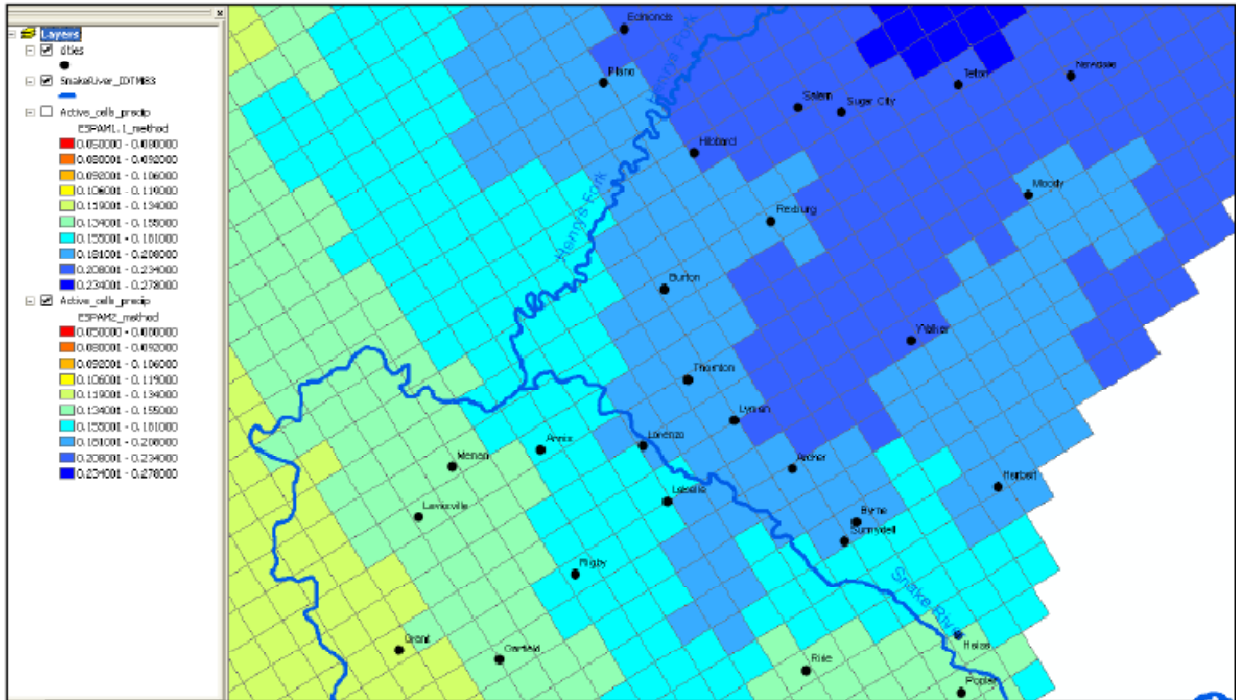**Figure 2. ESPAM1.1 spatial representation of precipitation for a given stress period.**

Figure 3. ESPAM2 spatial representation of precipitation for a given stress period.

SUMMARY AND DESIGN DECISION

Monthly PRISM precipitation data were collected for the study period of 1980 through 1997 from the Spatial Climate Analysis Service and the Oregon Climate Service for ESPAM1.1. The NOAA precipitation data collected for ESPAM 1.1 were not used for ESPAM2. Instead, PRISM data available between 1997 and 2008 were applied to ESPAM2. The PRISM data used in ESPAM2 is available on the ESHMC website in the "Current Data" folder of ESPAM 2 development under "PRISM Files" at this website: http://www.idwr.idaho.gov/Browse/WaterInfo/ESPAM/model_files/Version_2.0_Development/Current _Data/PRISM%20Files/.

REFERENCES

Gilliland, Brenda K., 2003. Prism Precipitation Data. Idaho Water Resources Research Institute Report 04-013. Eastern Snake River Plain Aquifer Model Enhancement Project Scenario Document Number DDW-011.