SUPPLEMENT TO TECHNICAL NOTE 1

USING PRISM TO ESTIMATE PRECIPITATION FOR STORM EVENTS

INTRODUCTION

This supplement to the Montana Dam Safety Programôs *Technical Note 1, Determination of the Inflow Design Flood for High Hazard Dams in Montana*, provides short, practical guidance for using an interactive tool provided by the PRISM Climate Group for determining precipitation for historical rainfall events. This data can be used for verification, or calibration, of *HEC-HMS (Hydrologic Model System – US Army Corps of Engineers)* rainfall-runoff models on basins nearby or on the same basin as where the historical storm occurred. In order for this to be a complete verification tool, the rainfall data needs to be coupled with historical streamflow data for the same storm on the same basin.

The PRISM Climate Group is based out of Oregon State University and it ñgathers climate observations from a wide range of monitoring networksò (PRISM Climate Group website www.prism.oregonstate.edu) and develops datasets that account for terrain effects to evaluate short- and long-term climate patterns. PRISM has developed an interactive tool called Explorer that downloads time series values for individual locations in the United States. Steps on how to use the tool are explained below.

USING THE PRISM EXPLORER TOOL

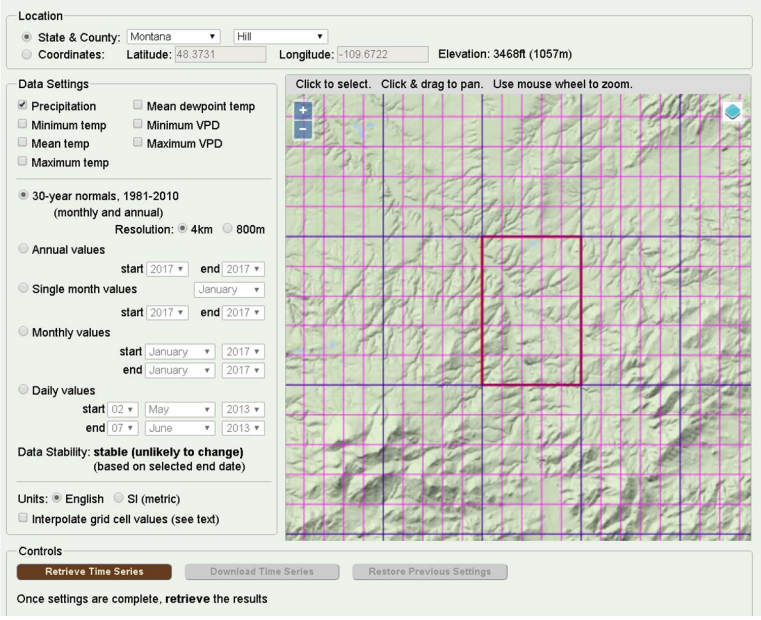
The PRISM Explorer tool is found at www.prism.oregonstate.edu/explorer/. On this page you will find an interactive map, an image of which is shown in Figure 1. Navigating to the area you are considering is easy and straightforward. The easiest way to step through the process is to explain it in an example application.

EXAMPLE USING PRISM EXPLORER TOOL

For this example, we will retrieve data from a storm that occurred in 2013 over the Beaver Creek drainage in Hill County, Montana. This storm was used in a meeting of the Extreme Storm Working Group for the Dam Safety Program as a calibration tool in verifying a rainfall-runoff model in the same drainage. The darker red rectangle shown in Figure 1 is the grid area used for retrieving the precipitation data. Here are the steps in using the Explorer tool:

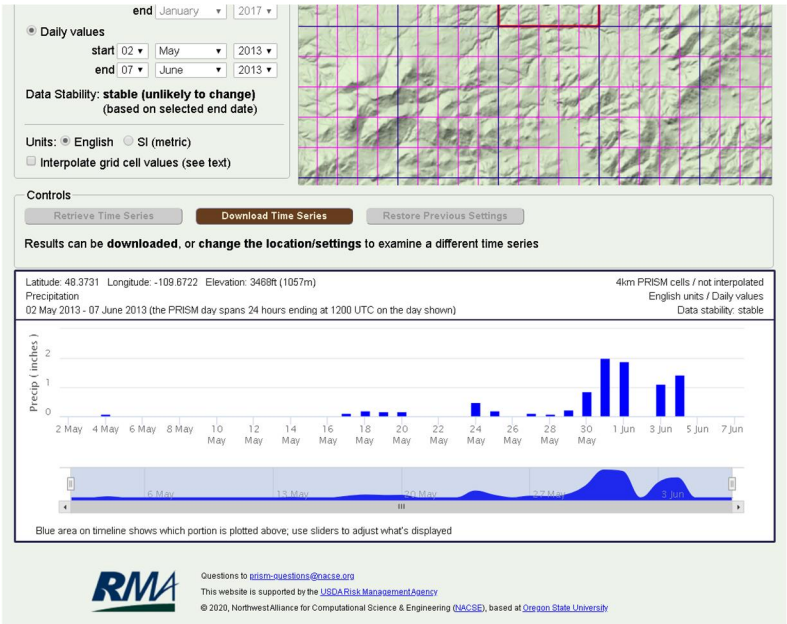
1. In the information text boxes above and to the right of the interactive map, enter the State and County (Montana and Hill). Under Data Settings, check the Precipitation box. Check the Daily Values box and enter a start date of 02 May 2013 and an end date of 07 June 2013. Under units, select English.
2. Click ôRetrieve Time Series.ô

FIGURE 1. PRISM EXPLORER TOOL INTERACTIVE MAP.



3. The hyetograph results are displayed in Figure 2.
4. The time series can be downloaded by selecting the ôDownload Time Seriesô button shown in Figure 2.

FIGURE 2. STORM DATA RESULTS, 02 MAY 2013 TO 07 JUNE 2013.



The downloaded data is shown in Figure 3.

FIGURE 3. DOWNLOADED STORM DATA, MS EXCEL *.CSV FORMAT.

PRISM Time Series Data	
Location: Lat: 48.3731 Lon: -109.6722 Elev: 3468ft	
Climate variable: ppt	
Spatial resolution: 4km	
Period: 2013-05-02 - 2013-06-07	
Dataset: AN81d	
PRISM day definition: 24 hours ending at 1200 UTC on the day shown	
Grid Cell Interpolation: Off	
Time series generated: 2020-May-14	
Details: http://www.prism.oregonstate.edu/documents/PRISM_datasets.pdf	
Date	ppt (inches)
5/2/2013	0
5/3/2013	0
5/4/2013	0.08
5/5/2013	0
5/6/2013	0
5/7/2013	0
5/8/2013	0
5/9/2013	0
5/10/2013	0
5/11/2013	0
5/12/2013	0
5/13/2013	0
5/14/2013	0.03
5/15/2013	0
5/16/2013	0
5/17/2013	0.11
5/18/2013	0.21
5/19/2013	0.17
5/20/2013	0.18
5/21/2013	0
5/22/2013	0
5/23/2013	0.01
5/24/2013	0.49
5/25/2013	0.2
5/26/2013	0
5/27/2013	0.12
5/28/2013	0.1
5/29/2013	0.24
5/30/2013	0.86
5/31/2013	1.99
6/1/2013	1.9
6/2/2013	0
6/3/2013	1.12
6/4/2013	1.43
6/5/2013	0
6/6/2013	0
6/7/2013	0

It is downloaded in MicroSoft Excel *.csv (comma-delineated) format. This can be changed to Excel Workbook (*.xlsx) format if desired. As shown in Figure 3, each data entry is a daily precipitation value, in inches. In the training session for the Dam Safety program that used this data, the day with the highest precipitation total (5/31/2013 with 1.99 inches of rain) was used to develop a storm to be used in a rainfall-runoff model with time increments of 1 hour. The distribution of the total daily precipitation was conducted according to the Montana Dam Safety Program spreadsheet supplement *2 - Hyetograph Spreadsheet Calcs_24 hr duration.xlsx*, which

uses US Geological Survey methods for developing storm hyetographs for extreme storms. If you are fortunate to have good records at the reservoir during the storm (flows, outlet discharge, reservoir levels, etc.), this actual storm event can be used to calibrate a rainfall runoff model.

CONSIDERATIONS AND CAUTIONS

The suggested methods in this supplement use data from a third-party organization (PRISM Climate Group) that uses precipitation data from various sources and accounts for terrain effects to produce data for any location in the country. The data used may be subject to variation and interpretation, but it appears to be high quality data and is useful for the purposes outlined in this supplement. Attempts to access National Weather Service (of the National Oceanic and Atmospheric Agency (NOAA)) NEXRAD data proved to be complicated with results in formats that are not common for most engineering applications intended for this supplement.

The PRISM Explorer tool is easy to use, fast, and produces data that can be easily adapted to rainfall-runoff applications.

Note that if this method is used when calibrating a rainfall-runoff model that will later be used to estimate an inflow design flood, it is important to understand the following:

1. A drainage basin subject to an extreme storm, may behave differently than a drainage basin subject to a common rain event used for calibration. Thus, when calibrating using estimated runoff parameters, the modeler must be aware that infiltration loss and other parameters may be quite different for the extreme storm as compared to the calibration storm.
2. It is important to look at the days leading up to the main storm event. Were there many days of drenching rain in advance? If so, initial abstraction estimates may need to be reduced.
3. Calibrating a rainfall runoff model with an actual event is one of many tools that should be used to verify a model, if data are available and applicable to the drainage basin being considered. Due to the many uncertainties described above, the modeler must carefully balance the results from all verification methods used.
4. Rainfall-runoff models of actual storms can be used in HEC-HMS to optimize hydrologic parameters, such as unit hydrographs, infiltration losses, or initial abstraction. The same cautions should be exercised in these types of analyses as is mentioned above.