NOAA NWS RFC Soil Moisture Model Output
Product Description Document

1. Product/Service Description

The North Central River Forecast Center (NCRFC) has been exploring usability of National Weather Service (NWS) river forecast model soil moisture model output for applications beyond river flood forecasting. This valuable output could be used to support various activities related to economic cost savings for industry sectors involved in land resource management.

An example of how the soil moisture model output can be used was recently developed when the NCRFC was approached by the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) to explore the usability of National Weather Service hydrological models to provide insight into risk for agricultural field runoff of applied manure due to future rainfall and/or snowmelt. An project was initiated with the state of Wisconsin in 2011. The website for the Wisconsin Manure Management Advisory System is, http://www.manureadvisorysystem.wi.gov/app/runoffrisk (see attachment for more details). The process is extendible to anywhere the Sacramento Soil Moisture Accounting (SAC-SMA) model is run and the cooperating entity has observed field-scale runoff data to compare to SAC-SMA calibration datasets for the development of thresholds.

Part I – Mission Connection

a. Product Description – In meeting its hydrologic forecast responsibilities to protect life and property and to enhance the Nation's economy, the National Weather Service (NWS) River Forecast Centers (RFCs) continuously simulate, in time and space, moisture within the soil column using the Sacramento Soil Moisture Accounting model.

   Calibration archives of internal model parameters are analyzed with respect to observed small-scale runoff events, to develop indices and thresholds consistent with observed small scale runoff events at the sub-watershed level. An example of a small scale runoff event is the movement of freshly applied organic fertilizer off the farm field due to rain or snow melt, and into nearby creeks and streams. These small scale runoff events, below river flooding thresholds, have consequences at the agricultural field level for economic loss of valuable fertilizer and environmental implications for elevated nutrient levels in waterways.

b. Purpose – Direct output from the SAC-SMA model is watershed averaged areal runoff to river stream flow. Internal model parameters reflect the many components that comprise that runoff to stream flow. These internal parameter states can be analyzed to define indices and thresholds for prediction of sub-watershed scale runoff events.
c. Audience – The target audience is industry sectors, environmental or natural resource agencies looking for insight about soil moisture levels and the resultant sensitivity of the landscape to runoff events from future meteorological events such as snow melt and rainfall.
d. Presentation Format – A text file in a comma-delimited format. The data fields include: watershed ID, event number, event begin date and time, event end date and time, total amount of interflow runoff (units) for the event duration, number of 6 hour periods for the event, total time of the event in hours, flag for indication or rain only (0), snowmelt only (1), rain and snowmelt (2).
e. Feedback Method – Feedback may be provided through an online feedback survey on the NCRFC web page where the output file is available for download. The output file can also be sent to interested users upon request.

   http://www.crh.noaa.gov/ncrfc/?n=runoff_files

   Comments may also be provided to:
   North Central River Forecast Center
   1733 Lake Drive West
   Chanhassen, MN 55317
   Attn: Dustin Goering and Brian Connelly
   952-361-6650
   Dustin.Goering@noaa.gov, Brian.Connelly@noaa.gov

Part II – Technical Description

Example .csv file.
Column A: Basin Identifier
Column B: Runoff Event Number (there can be more than one event per basin over the entire forecast period.)

Runoff event definition: All three factors below being true. Event continuous until one factor false.
1. Upper Zone Tension Water Deficit (UZTWD) = 0 (internal soil moisture accounting model parameter)
2. Rainfall + Snow Melt (RAIM) > 0 (model forcing value derive from snow model output and mean areal precipitation calculation)

3. Interflow runoff > 0 (soil moisture accounting model output)

Column C: Event Start Date/Time
Column D: Event End Date/Time
Column E: Total Event Interflow Runoff
Column F: Total number of 6 hour periods of event
Column G: Total number of hours of event
Column H: RAIM flag (0=event rain only, 1=event snowmelt only, 2=event rain and snowmelt)

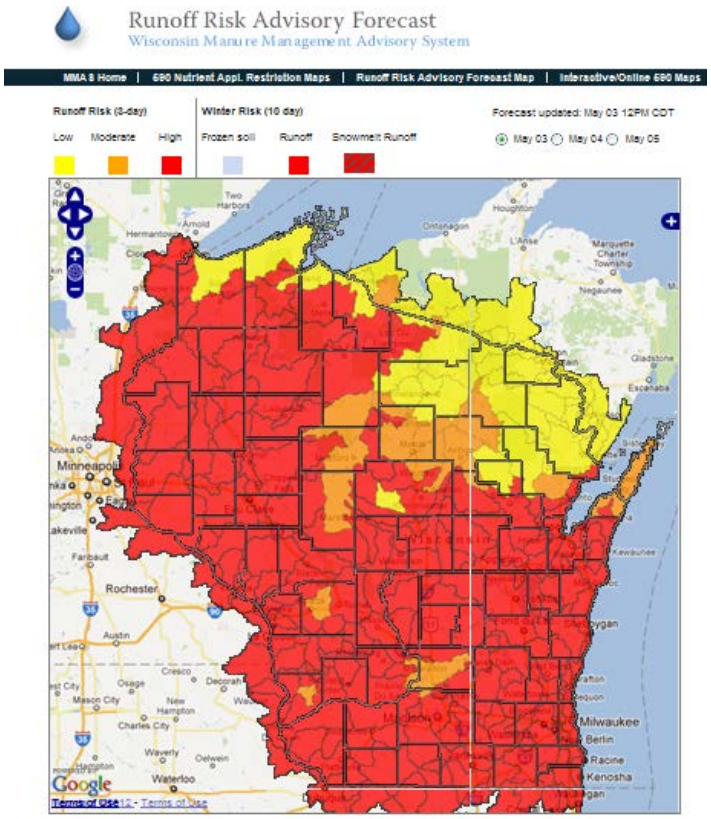
The State of Wisconsin takes this file and post-processes the data against their established basin runoff thresholds to make the categories of risk depicted on the map.

A	B	C	D	E	F	G	H
The ID	Event Number	Start Date	End Date	Running Total	NumberPeriods	Number Hours	RAIM_flag
AFBI2	1	5/3/2012 0:00	5/3/2012 18:00	1.26	3	18	0
AFBI2	2	5/3/2012 18:00	5/6/2012 18:00	6.52	12	72	0

Product Availability – The text files are created 2 times per day and are available for download on the NCRFC web page.

Attachment

The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) approached the NWS North Central River Forecast Center to discuss the capabilities of the hydrologic modeling program. It was determined in concept that the soil moisture accounting model may be leveraged to provide indices of sub-watershed runoff risk on the time-scales desired by the DATCP. An NWS employee, studying as a graduate student at the University of Arizona under Professor Phil Guertin, was enlisted to conduct the research into the feasibility of using the SAC-SMA model to be a predictor of these indices. The research (Goering to be published 2012) had positive results and an experimental period was initiated in 2011.



May 3, 2012 http://www.manureadvisorysystem.wi.gov/app/runoffrisk

The state of Wisconsin has a significant livestock based agricultural industry that generates quantities of manure that must be spread on the landscape throughout the year. The state desired a comprehensive advisory system for manure applicators to consult prior to application that would help them make decisions about whether to apply that day or wait for better conditions. The state wanted to develop a tool that not only took into account precipitation and snowmelt, but also incorporated the impact soil moisture conditions would have on the likelihood of runoff occurring that would move the freshly applied manure into surface water bodies. Runoff is bad for the farmer in that expensive crop nutrient is lost from the field, and bad for stream and lake water bodies as excessive nutrients cause fish kills and contribute to the Gulf of Mexico hypoxia zone.