Upper Missouri River Water Resources: Part 1
Enhanced Water Resources Management using Evapotranspiration Data derived from MODIS and GOES observation with the United States Department of Agriculture (USDA), U.S. Army Corps of Engineers, National Oceanic and Atmospheric Administration (NOAA), NOAA National Severe Weather Laboratory, USDA Agricultural Research Center,
and NOAA Missouri River Basin Forecasting Center

NASA DEVELOP - Goddard Space Flight Center

Michelle Morawski, University of Maryland Baltimore County (Project Lead)
Kevin Mathew, University of Maryland College Park
Benjamyn Ward, University of Maryland College Park

Shot 1

NASA DEVELOP Video Beginning

Shot 2

Location: Reports desk in office

>>[Michelle]: Good Morning Viewers and welcome to Science News. Our top headline this morning is the disastrous flooding
in the Upper Missouri River Basin in Montana. We turn to our field reporter Shelley Morawski for more information.

Shot 3

Location: Lake on GSFC

>>[Michelle]: The Upper Missouri River had a major flood event in 2011.
I'm here with Kevin Mathew and Benjamyn Ward of the Applied Sciences DEVELOP Program of NASA. Can you guys
tell me how NASA is using preventative measures to predict floods.

>>[Kevin]: We are currently working with the University of Oklahoma in using the Coupled Routing and Excess Storage Model, CREST.
What CREST does is, simulate the movement of water over a large area, and our advisors are Friz Policelli, John David, and
Amita Mehta.

>>[Benjamyn]: Well Shelley, let me tell you more. The end vision is to have CREST simulate in real time. Then we can tell
these governments when there's a flood, so they can mitigate the damages and lives lost, but first we must calibrate the models.

Shot 4

Screen shot of USACE, NOAA, and NWS: Missouri Basin River Forecasting Center

>>[Kevin]: Using the Coupled Routing Excess Storage (CREST) Flood Model, this project will improve the decision

making process of our partners:
The U.S. Army Corps of Engineers, NOAA Severe Storms Laboratory, and the Missouri Basin River Forecasting Center through the use of remote sensing data.

Shot 5

Location: Lake on GSFC

>>[Michelle]: So can you tell me why the study area was chosen?

>>[Kevin]: The study area is within the state of Montana along the Missouri and Musselshell rivers.

>>[Benjamyn]: So in the past few years, this area has had record rainfall and snowfall events. This is the perfect environment
for testing out CREST simulation and calibration processes.

Shot 6

Location: Lake on GSFC

>>[Michelle]: So what are the inputs for CREST?

>>[Kevin]: CREST uses four inputs, snow, elevation, precipitation, and evapotranspiration.

Screenshot: 4 different CREST inputs.

>>[Michelle]: So what is evapotranspiration?

Screenshot: Evapotranspiration

>>[Kevin]: Evapotranspiration is the combination of evaporated water and transpiration from plants. It is also a very important function in the water cycle.

Shot 7

Location: Lake on GSFC

>>[Benjamyn]: There are two major types of evapotranspiration, Potential and Actual. Well CREST initially just uses potential, we are now focusing on
actual as well because of ALEXI.

Video shot: Global ALEXI distribution

>>[Michelle]: So tell me about the ALEXI evapotranspiration product.

>>[Benjamyn]: Well Martha Anderson of the USDA created this product. It is a daily actual evapotranspiration product with uses multiple remote sensing
data. Now, some of these data types are soil, vegetation, temperature, radiation fluxes, and atmospheric coupling, But this product also includes a cloud
filling algorithm.

Video Shot: ALEXI PET day-to-day distribution across CONUS in 2011

Shot 8

Location: Lake on GSFC

>>[Michelle]: So what other evapotranspiration products are you looking into?

>>[Kevin]: The monthly mean PET estimation uses a climatology approach to take monthly mean data compiled over several years.

Screenshot: Monthly Climatology PET rates for April

>>[Benjamyn]: The goal is to choose the best evapotranspiration product, such that, the CREST simulation and calibration is as accurate as possible.

Shot 9

Location: Lake on GSFC

>>[Michelle]: So how and why was the flux tower data assimilated into this study?

>>[Benjamyn]: So, we're using the flux tower data compiled by Ameriflux. We use this data to calculate an evapotranspiration, which we use for ground truth
when comparing the monthly climatology and the ALEXI evapotranspiration product.

>>[Kevin]: The DEVELOP team had to first convert the precipitation data into PET using the Priestley-Taylor Equation. The team was then able to compare
satellite PET rates to that of ground PET rates.

Shot 10

Location: Lake on GSFC

>>[Michelle]: How does the remote sensing PET rates compare to the flux tower PET rates?

>>[Benjamyn]: Well, the ALEXI product mimicked the trend and the values found in the flux towers. It was the monthly climatology that did not.
Now, this is completely expected because the ALEXI takes in data for that day, where as the monthly climatology is based on decades of values, and it's
just a complete average, that's all it is.

>>[Michelle]: So what PET rate works the best?

>>[Benjamyn]: Definitely ALEXI.

Shot 11

Video shot: Standard Deviation fluctuations between ALEXI PET rates and Monthly Climatology PET Rates for 2011

>>[Michelle]: Is there any future plans for using this information?

>>[Kevin]: Results of the future flood modeling effort will be evaluated by partner organizations to determine the potential enhancement of water resources,
flood monitoring, and disaster management efforts from satellite derived evapotranspiration products to save lives and

property.

>>[Michelle]: Thank you for discussing your findings with Science News. Now back to you Shelley.

Shot 12

Location: Reports desk in office of GSFC

>>[Michelle]: Thank you Shelley for that informative news piece and thank you for watching Science News. Signing off Shelley Morawski.

Shot 13

NASA DEVELOP Mandatory Video Ending