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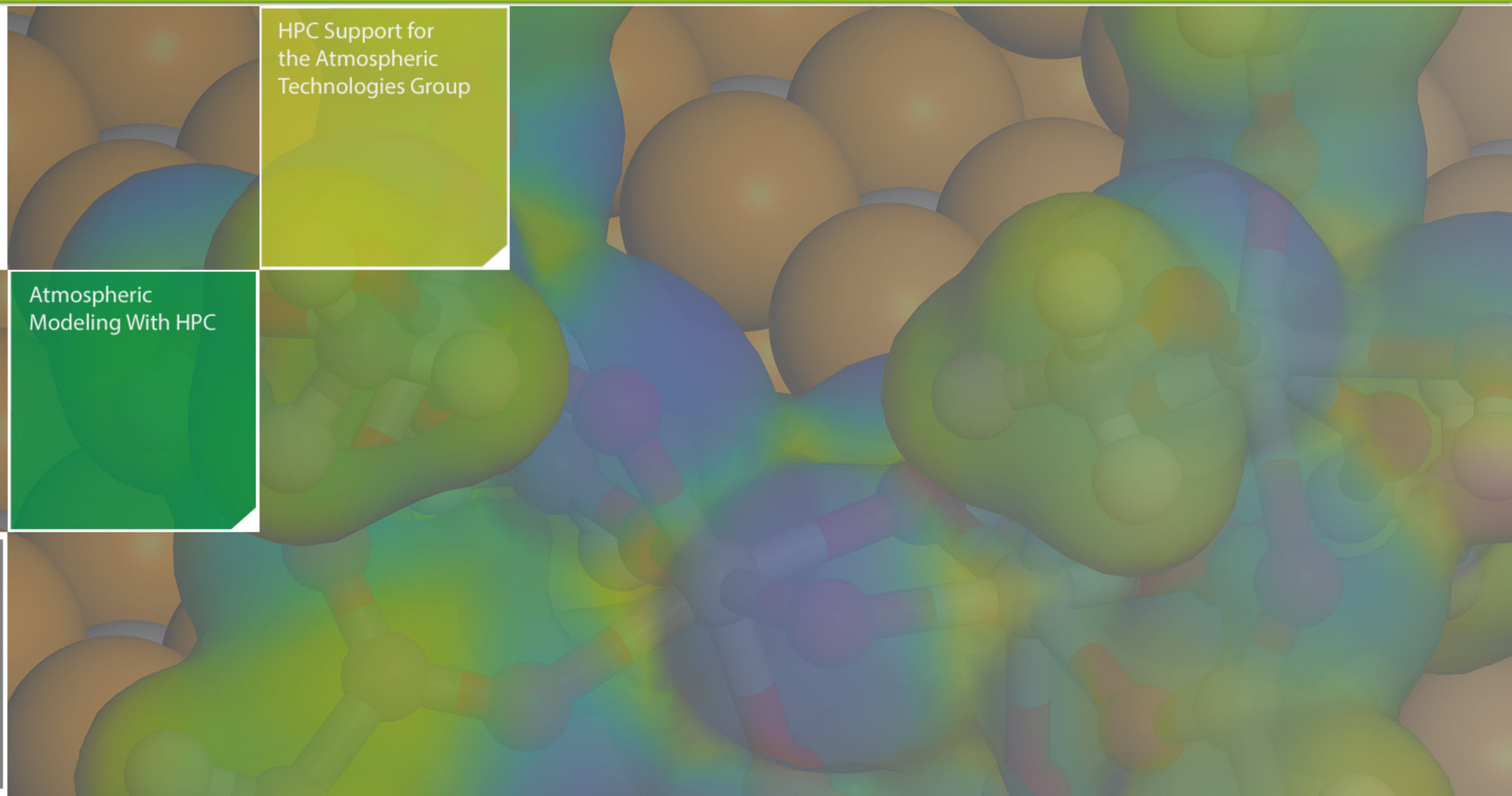
HPC Support for the Atmospheric Technologies Group

Atmospheric Modeling With HPC



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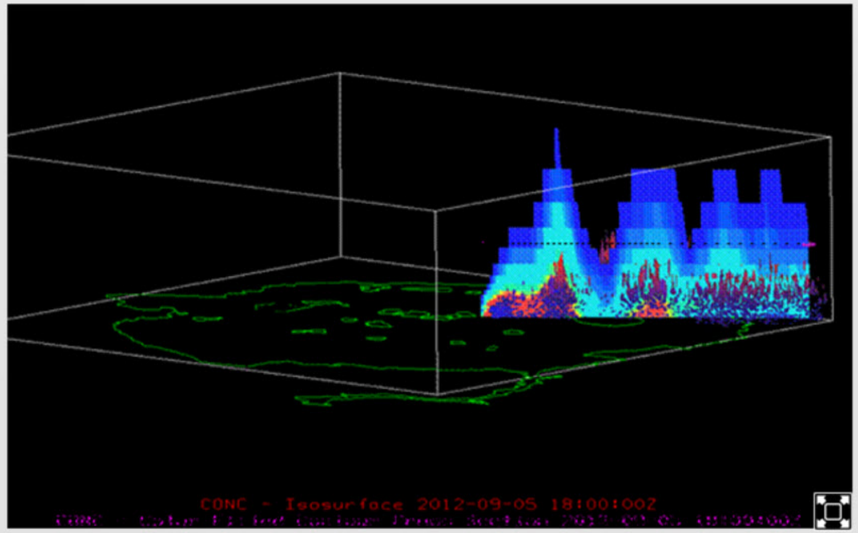
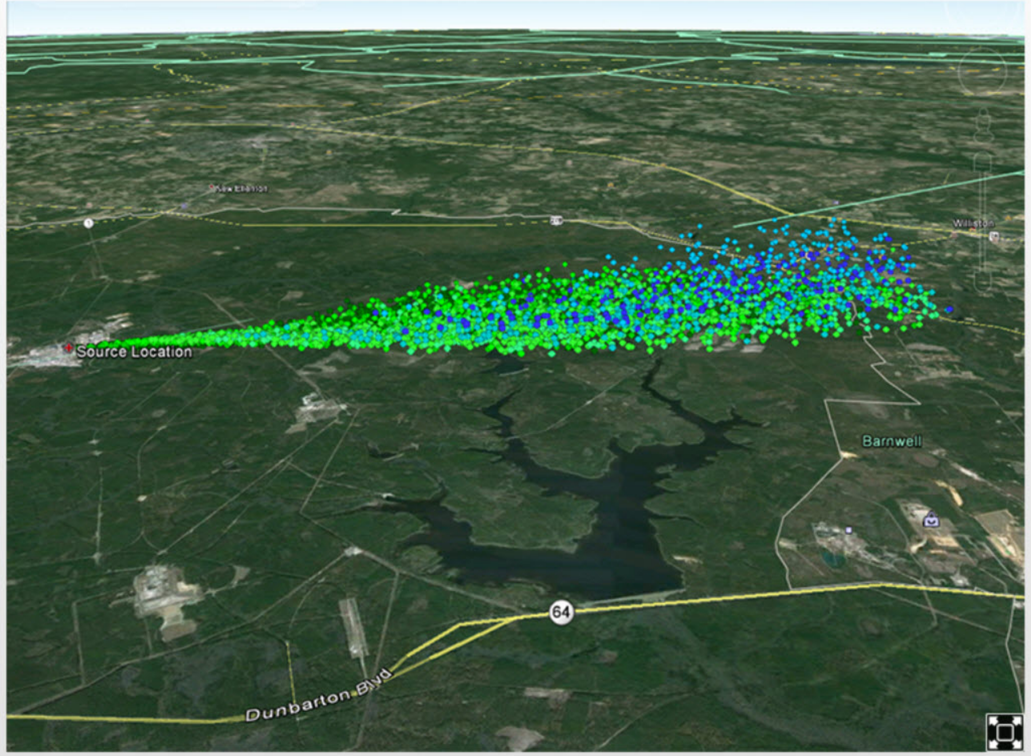
Atmospheric Modeling With HPC

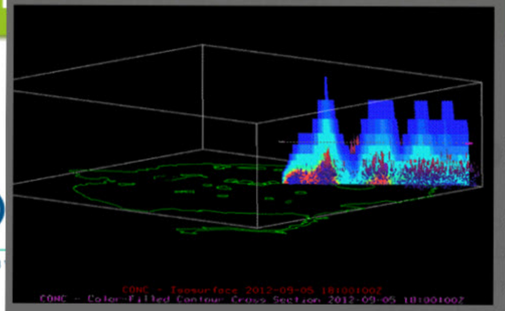
The Atmospheric Technologies Group (ATG) of the Savannah River National Laboratory's Nonproliferation Technologies Section (NTS) performs and publishes research and development projects on advanced atmospheric modeling. These projects serve the needs of the Savannah River Site (SRS) as well as external customers such as the DOE NNSA Office of Defense Nuclear Nonproliferation and the U.S. Forest Service. Using state-of-the-art computational tools, ATG scientists tackle a spectrum of atmospheric modeling problems from long-range transport of toxic or radioactive gases to predicting forest fire risk to investigating the effect of large cooling towers on local atmospheric conditions. Diverse applications such as these require flexible modeling capabilities and creative approaches.

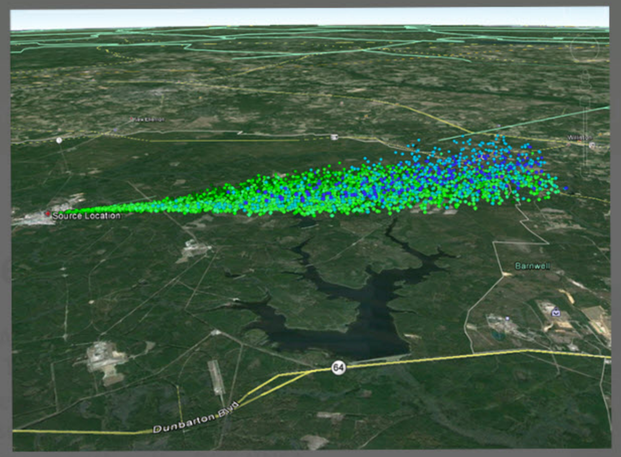




Currently a 20 node cluster is available for ATG standard operations with a larger 90 node cluster for additional research projects. On a daily basis 400-500 operations are run by ATG ranging from testing and plotting routines to large scale forecasting runs. HPC support is provided by the SRNL Scientific Computing group.

FUNDING & CREDITS





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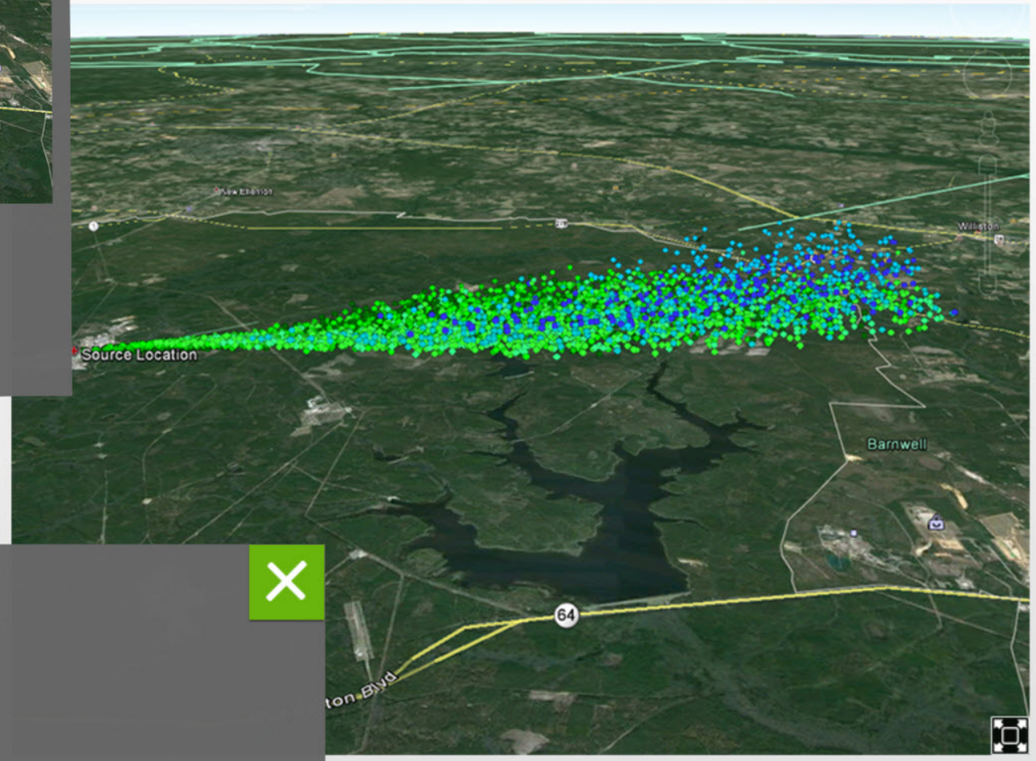

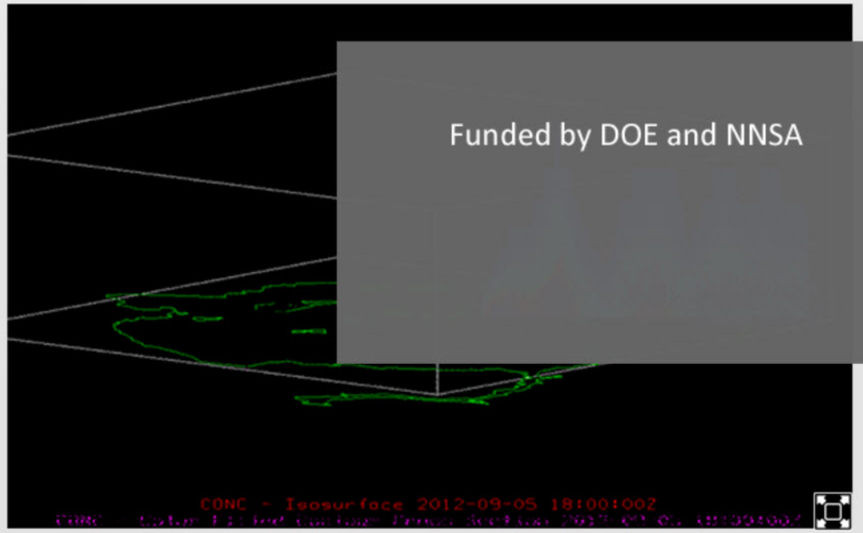

Funded by DOE and NNSA

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HPC Support for the Atmospheric Technologies Group

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Operational Modeling

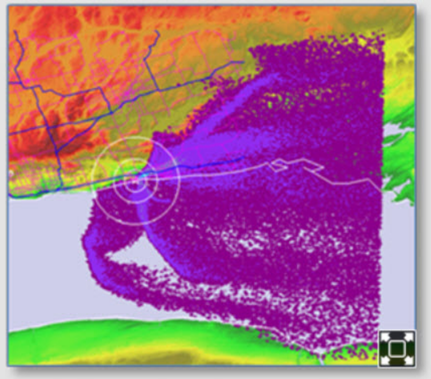
The Atmospheric Technologies Group produces 36-hour forecasts every 6 hours. These simulations provide guidance from routine daily operations to site safety initiatives and emergency response operations. The increased computing capabilities provided at SRNL allow these simulations to complete in just a few hours. Simultaneously, the grid resolution has also been improved providing more accurate operational forecasting.

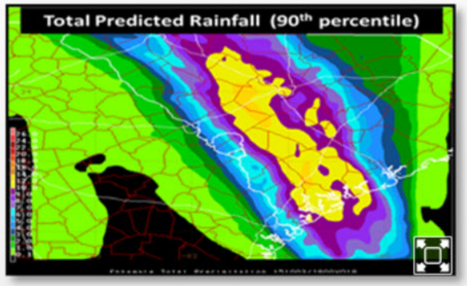
Operational Modeling Workflow:

Receive Satellite Data Stream from NOAAPort → Confirm Data Stream → Generate Model Input Files → Perform WRF Simulation → Post-Process Data → Publish to public web page

Ensemble Modeling

The HPC cluster also allows the Atmospheric Technologies Group to concurrently run 20 different model simulations as part of its ensemble modeling initiative. Each model in the ensemble is initialized using a perturbed set of initial conditions, resulting in a range of possible solutions. The goal of ensemble modeling is that the range of solutions will encompass the actual occurring conditions and provide information to the forecaster regarding the confidence level of any particular solution in the ensemble. This information has been used to support analysis and forecasting of specific weather events such as the extensive flooding in South Carolina in October, 2015, as well as to support a variety of field sampling projects to optimize the chances for a successful field campaign.





Case Study: South Carolina Flood, October 2015

20 Forecast Members x 4 CPU per Member
Forecast Initialized 8 PM Friday, Oct 2, 2015

- Ensemble Best Estimate Total Rainfall (Top)
- Storm Verification (Bottom)

A 20-member ensemble can show the variation in potential atmospheric dispersion scenarios. Individual plumes representing individual solutions can be identified in the figure.

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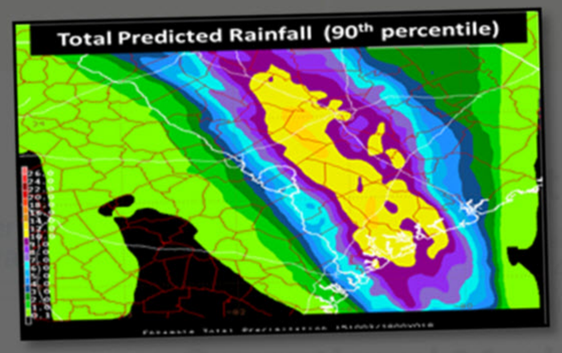

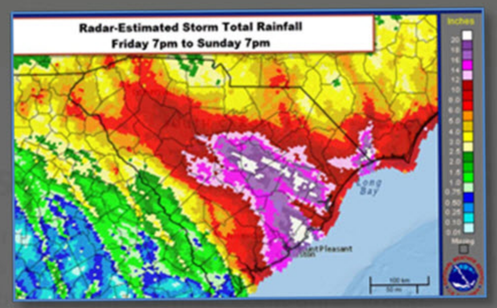

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Operational Modeling

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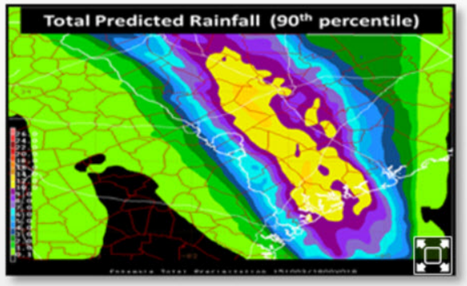

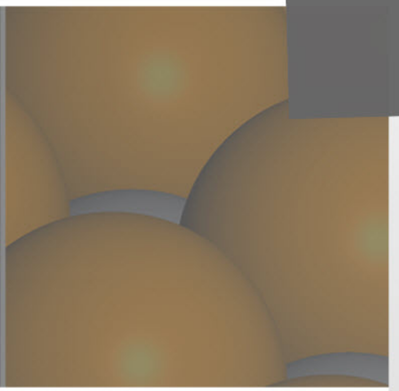

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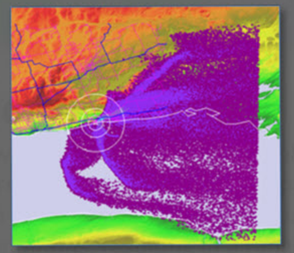

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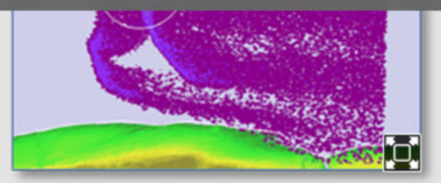

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Credited to Brain Viner
brian.viner@srnl.doe.gov

...ood, October 2015
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...al Rainfall (Top)

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