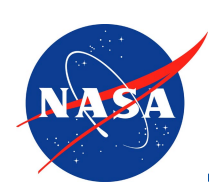




Learning Automation Update

September 18, 2013

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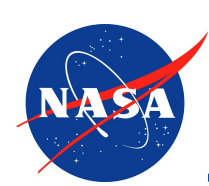


Research Objective

Given relevant NAS status, weather and traffic information determine the “best” collection of Traffic Management Initiatives to implement for day-of-operation planning purposes.

Assumption:

- 2013 work focused exclusively on using weather observations
- Future work will consider weather forecasts



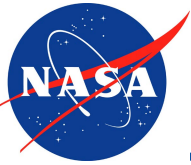
2013 Accomplishments

Learning Automation Related

- Developed initial approaches for clustering days based on en route convective impacts and the location and cause of Ground Delay Programs
- Analyzed and ranked historical routing options used in conjunction with the en route clusters
- Exploring refined reroute clustering approaches to help define the “national plan”
- Prototype system developed for visualizing clustering and Digital TMI results

Related Data Mining Work

Developed models for predicting if Ground Delay Program and Miles-in-Trail restrictions are required given weather and traffic observations

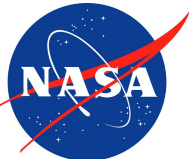


Evaluator Concept Connection

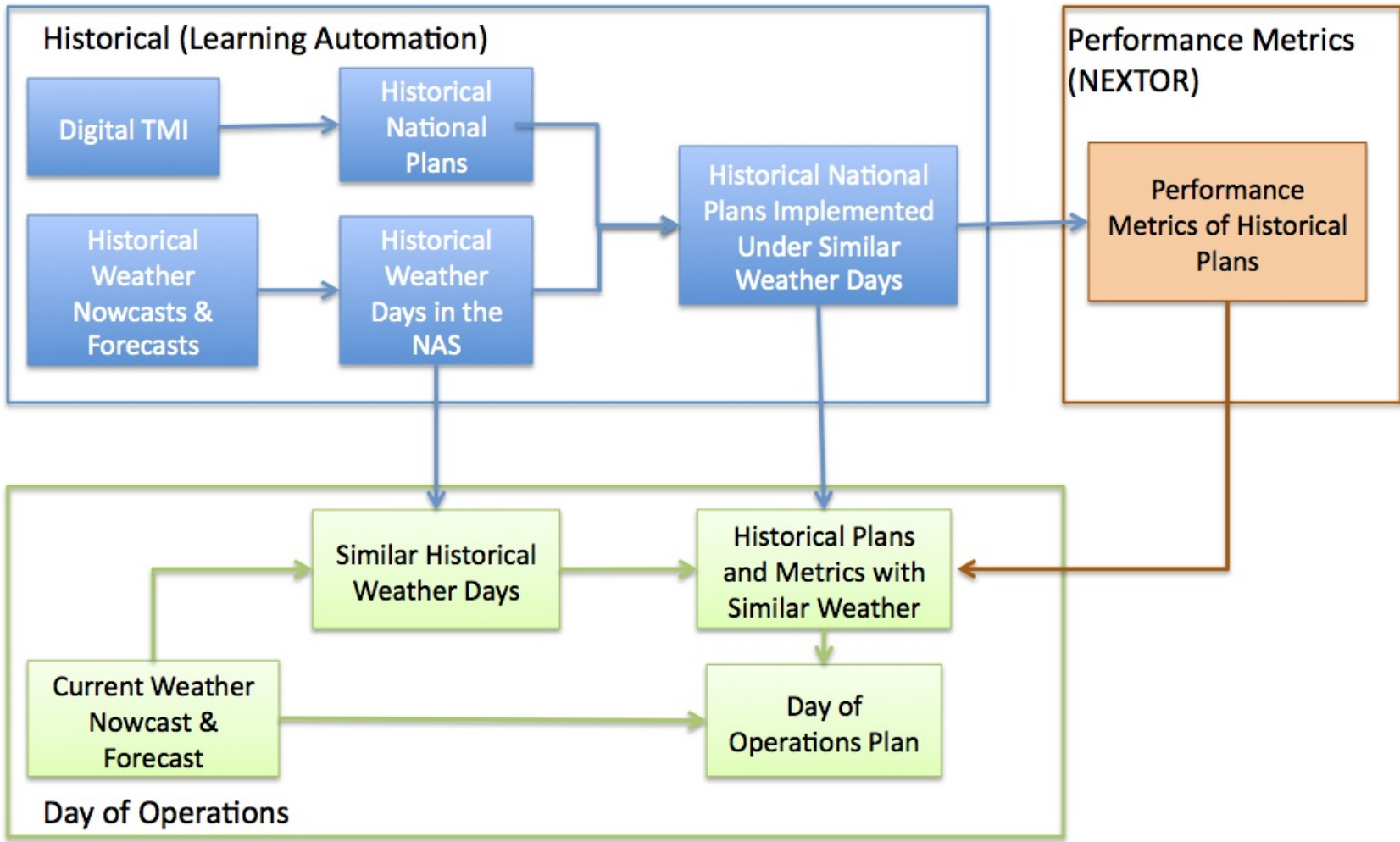
Clustering days based on historical convective weather and the location and cause of Ground Delay Programs

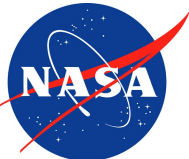
“... the Evaluator makes use of its learning automation capabilities to incorporate lessons learned from earlier interventions, their project impact and the actual results experienced. The experiences used to to automatically inform future response strategies – or the prioritization of the options against one another on the list of candidate responses.”

- Analysis of reroutes used in conjunction with similar convective weather constraints
- Route clustering work (simplifies the list of candidate responses)

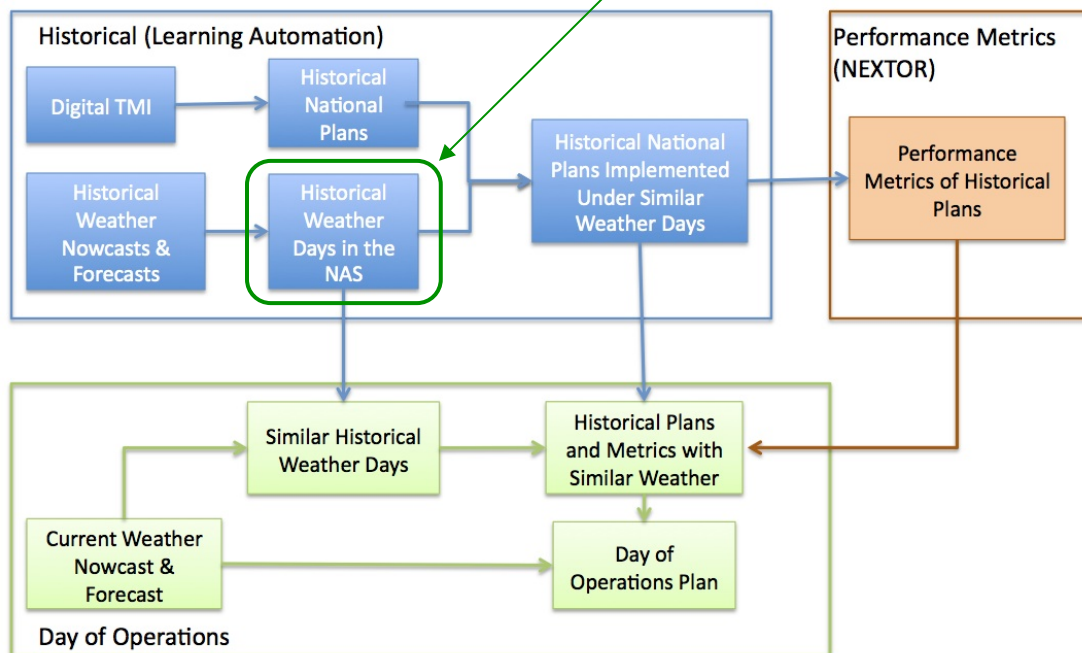


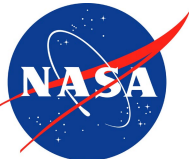
Approach



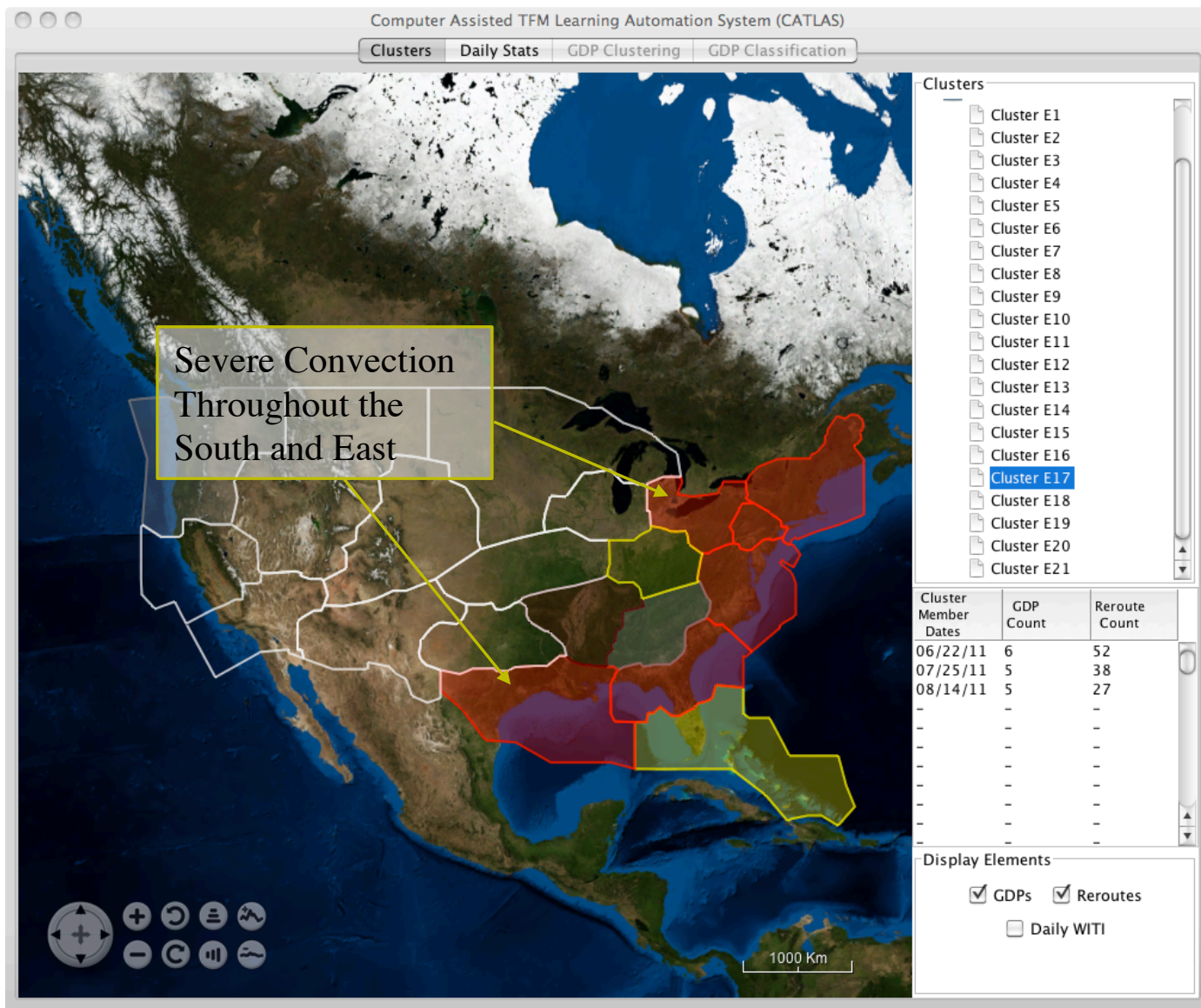


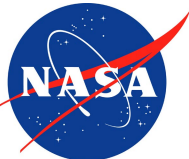
Historical Days in the NAS: an Airspace Perspective



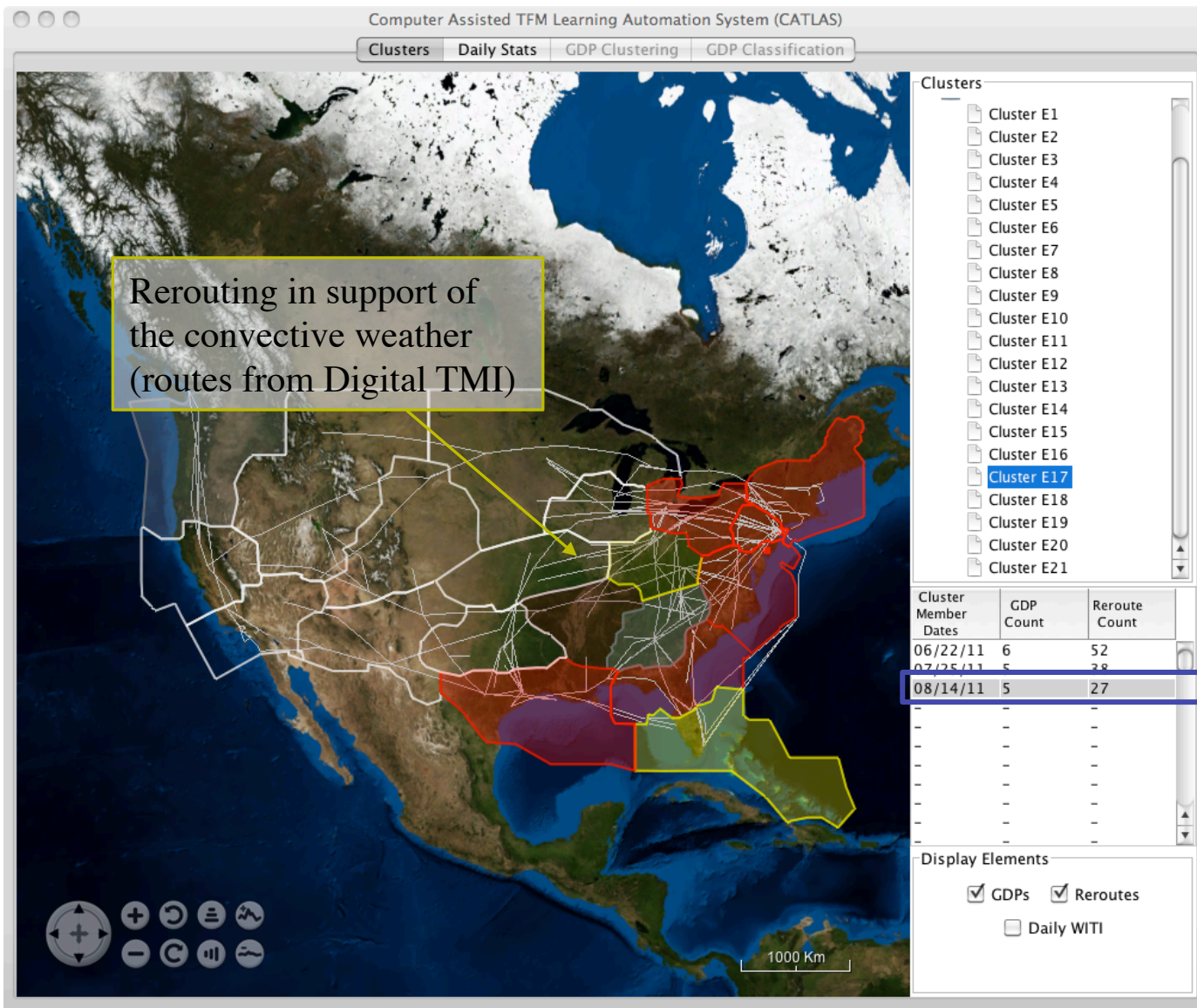


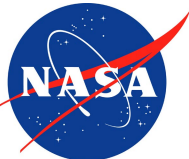
National-level En route Clustering: Cluster 17, 3 days



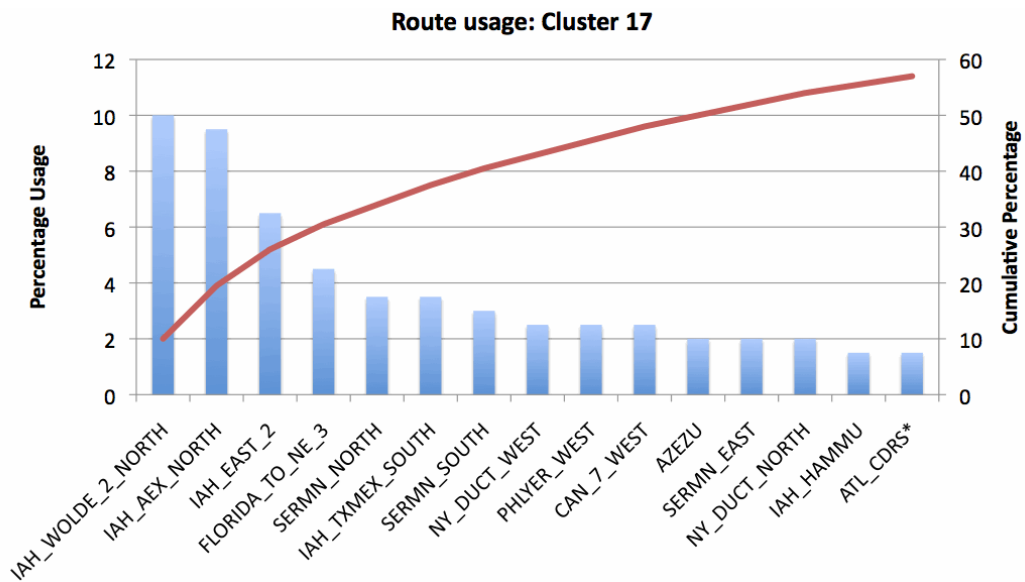
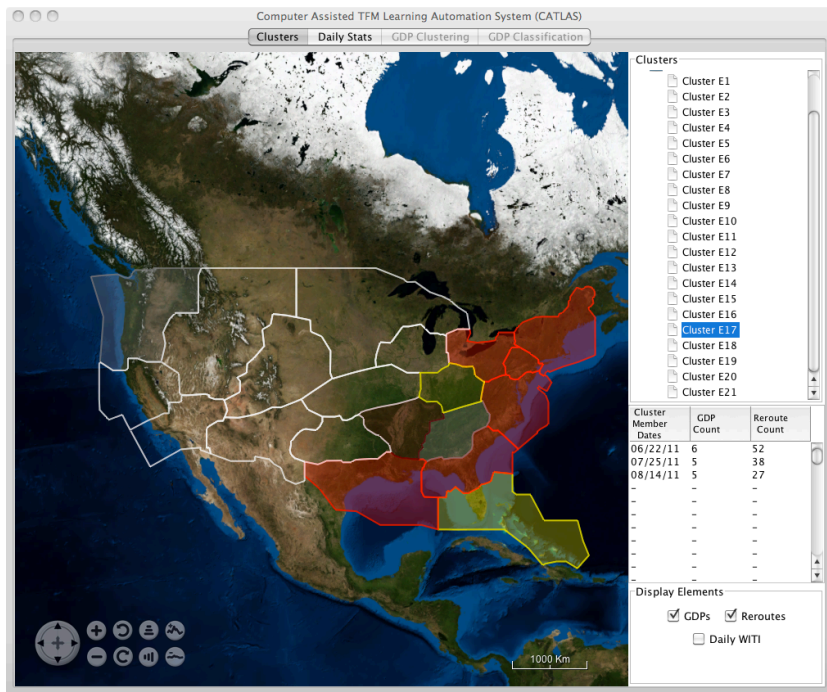


National-level En route Clustering: Cluster 17, 3 days



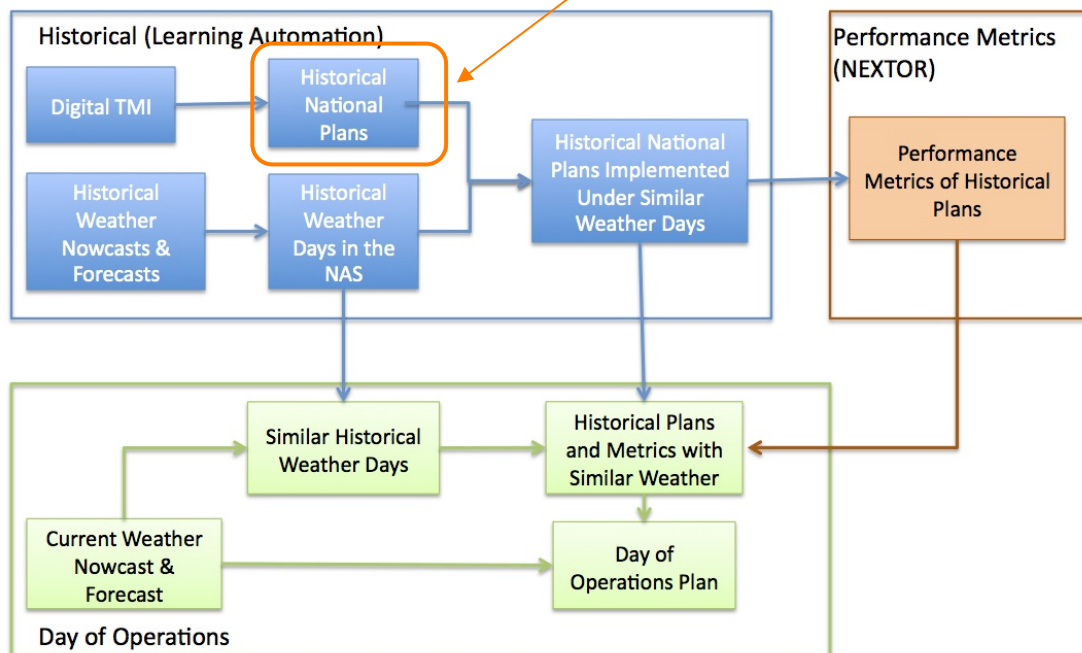


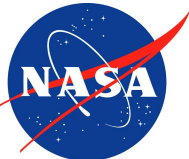
National-level En route Clustering: Cluster 17, 3 days





Historical Days in the NAS: an Airport Perspective





National-level Airport Clustering: Cluster 2, 32 days

Computer Assisted TFM Learning Automation System (CATLAS)

Clusters Daily Stats GDP Clustering GDP Classification



- Clusters
- NAS Clusters
 - Terminal Clusters
 - Cluster T0
 - Cluster T1
 - Cluster T2
 - Cluster T3
 - Cluster T4
 - Cluster T5
 - Cluster T6
 - Cluster T7
 - Cluster T8
 - Cluster T9
 - Cluster T10
 - Cluster T11
 - Cluster T12
 - Cluster T13

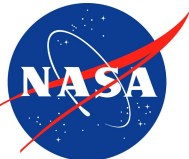
Cluster Member Dates	GDP Count	Reroute Count
05/12/11	4	29
01/13/11	2	6
06/08/11	1	10
04/19/11	8	36
02/24/11	2	15
09/14/11	1	10
09/13/11	2	7
08/12/11	1	20

Display Elements

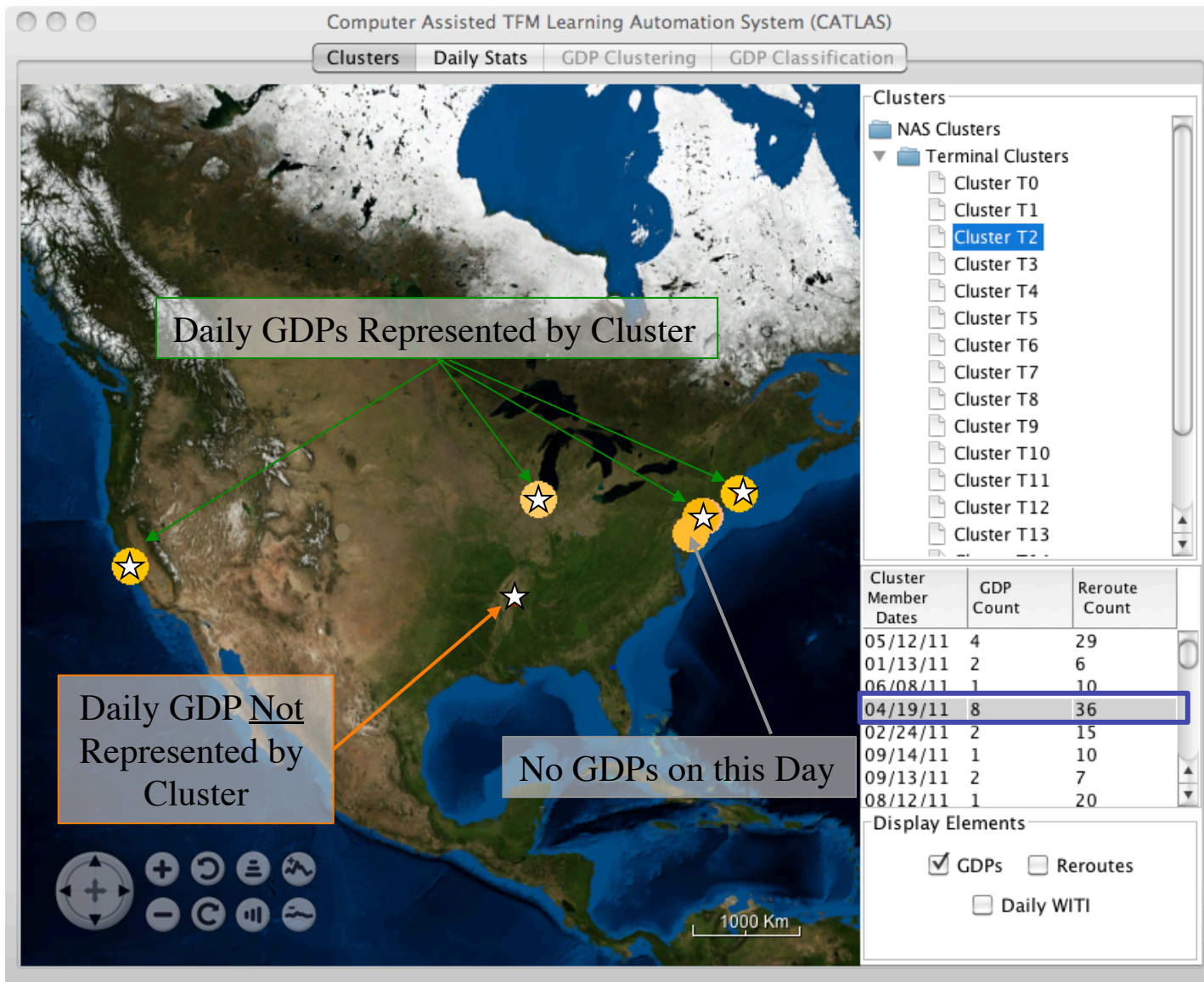
GDPs Reroutes

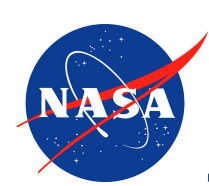
Daily WITI

Low Ceiling GDPs at SFO/PHL/BOS/ORD/LGA

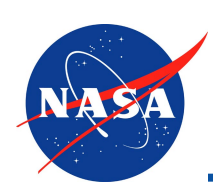


National-level Airport Clustering: Cluster 2, 32 days

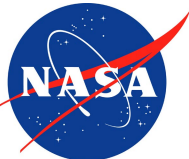




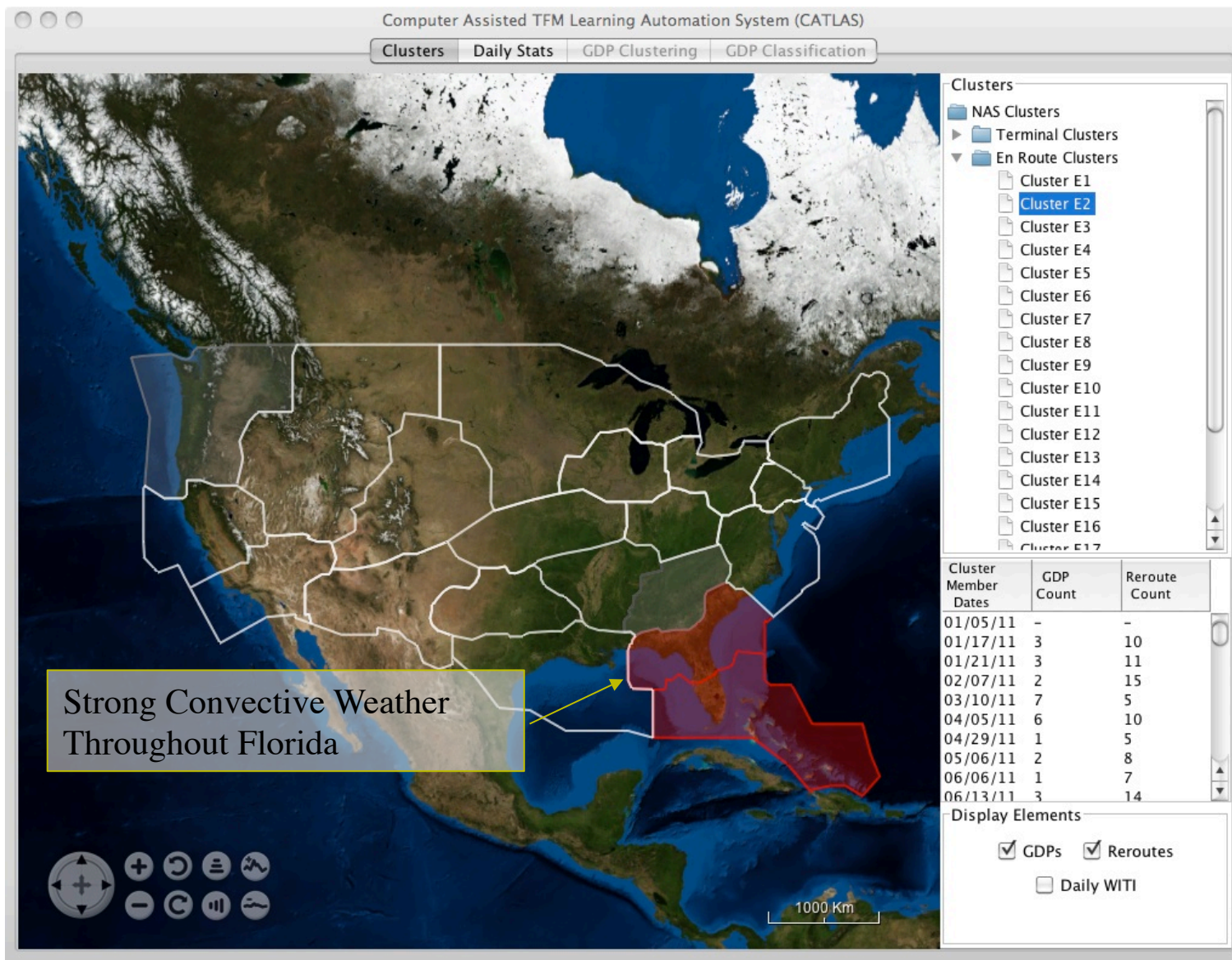
- Develop techniques to identify airport-level days in the NAS using weather observations and forecasts
- Extend airspace-level days in the NAS work to consider weather forecasts
- Explore techniques for describing the “national plans”
- Begin coordination with NEXTOR regarding performance metrics



Backup

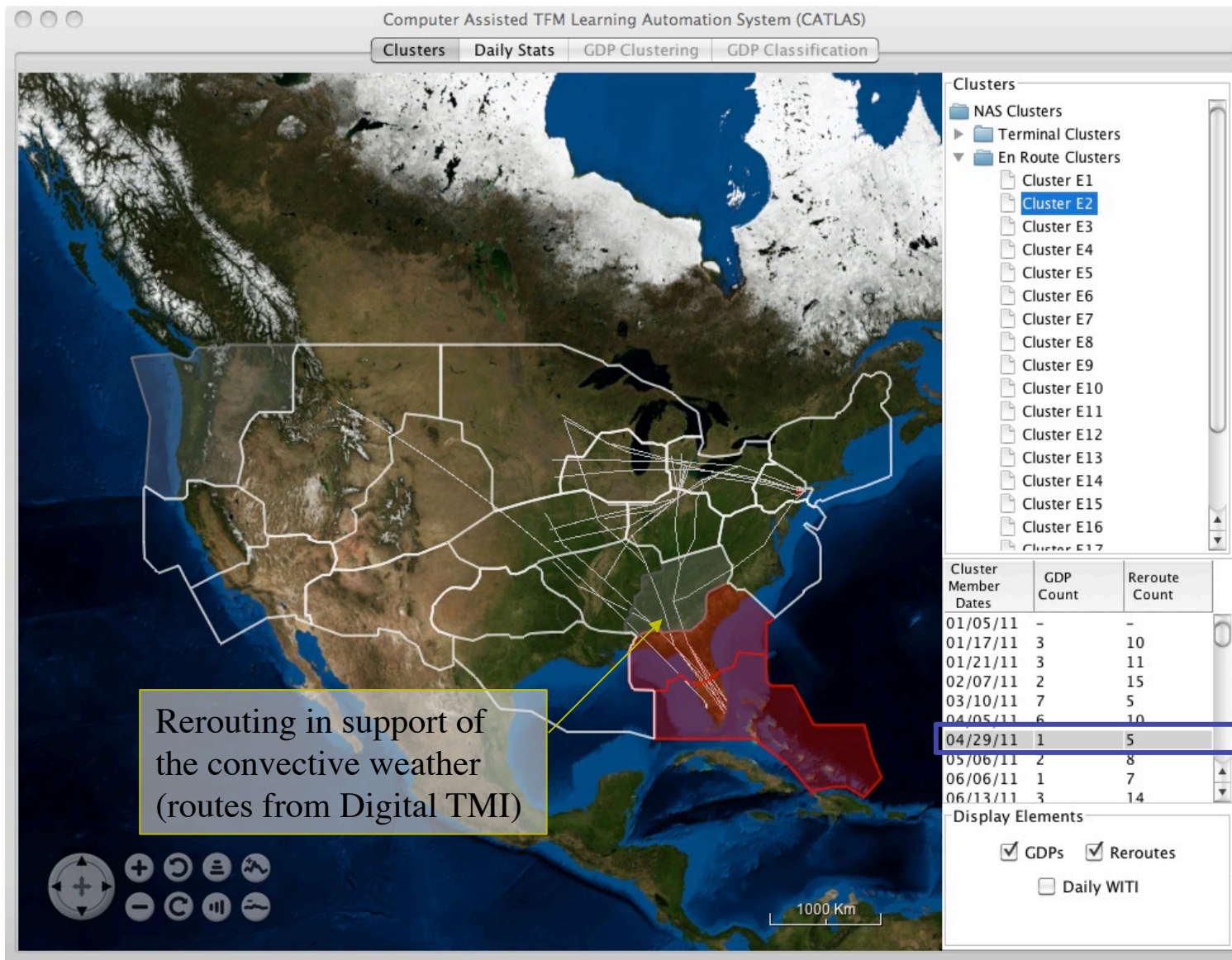


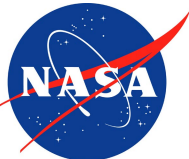
National-level Clustering: Cluster 2, 33 days



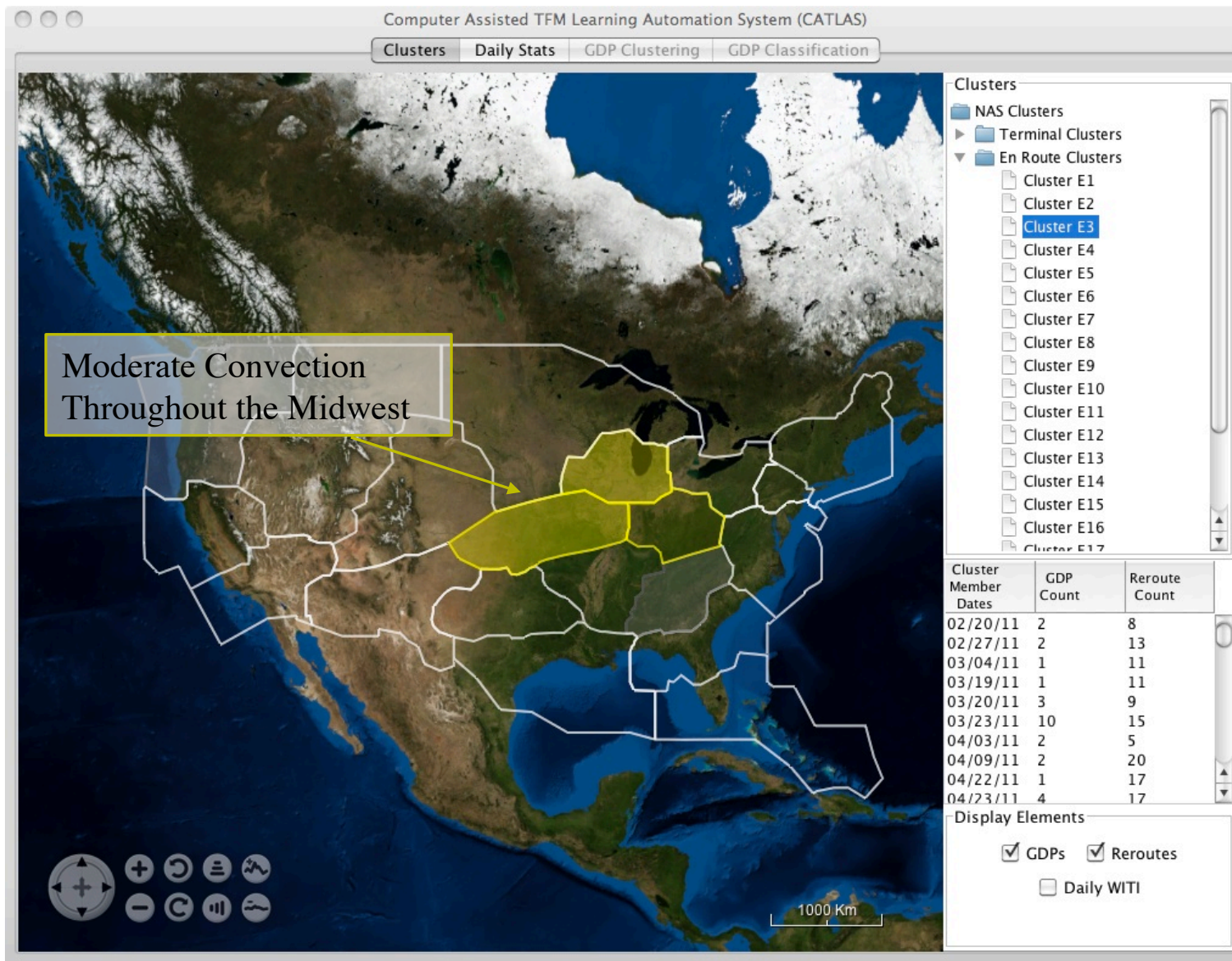


National-level Clustering: Cluster 2, 33 days





National-level Clustering: Cluster 3, 23 days





National-level Clustering: Cluster 3, 23 days

