Local Climate Analysis Tool (LCAT) in Support of Weather and Climate Extremes

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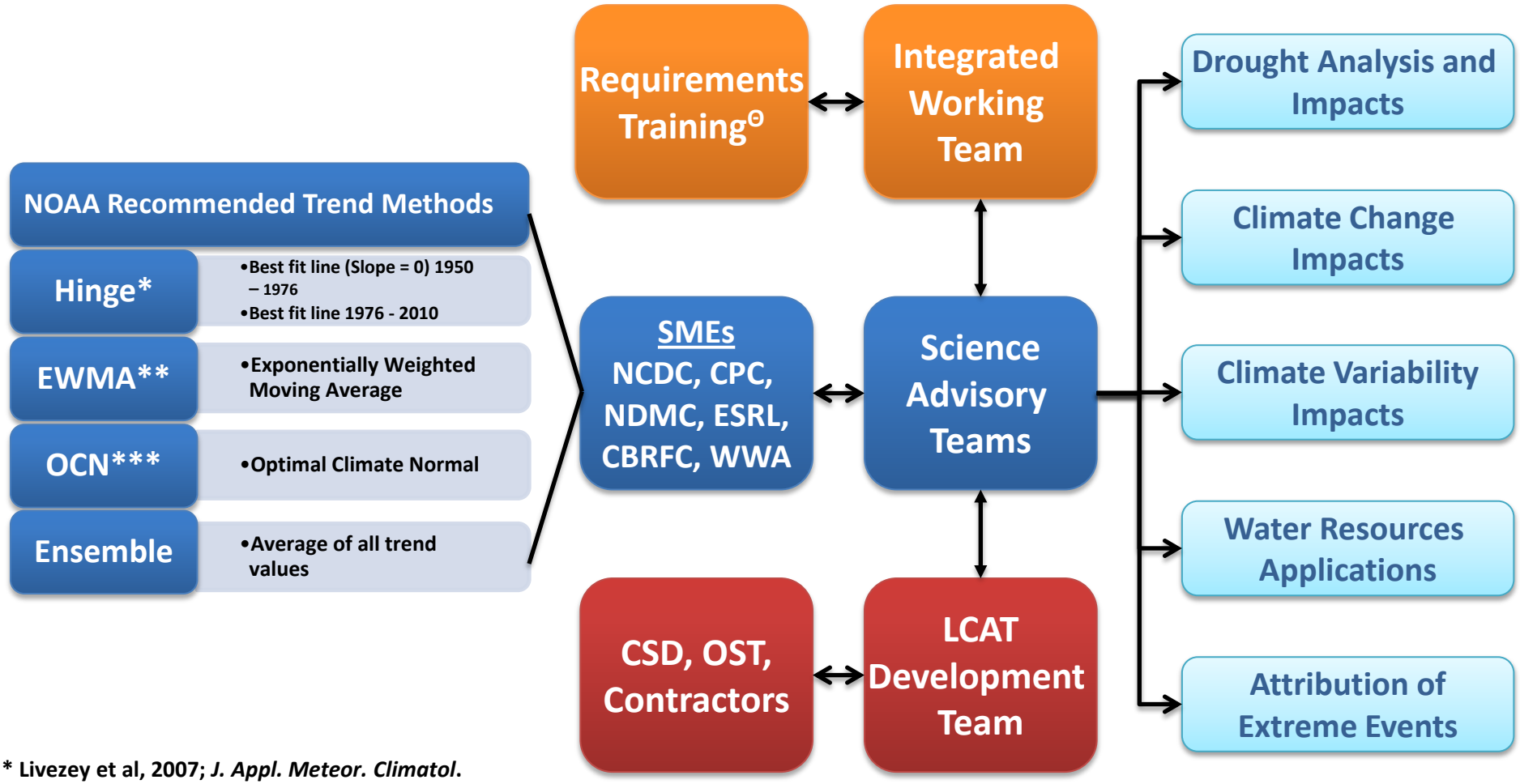
Local Climate Analysis Tool (LCAT)

- Developed to support NWS field offices
- Online interactive tool
- For regional and local climate studies
- State-of-the-art station data
- Best practices for climate analysis
- Applications for assessing climate impacts on severe weather

- Variables beyond average temp and total precip, including extreme events
- Reduce field office time spent on responding to customers' climate questions
- Provides critical links for forecasters on climate drivers for weather and water events

LCAT Essentials



* Livezey et al, 2007; *J. Appl. Meteor. Climatol.*

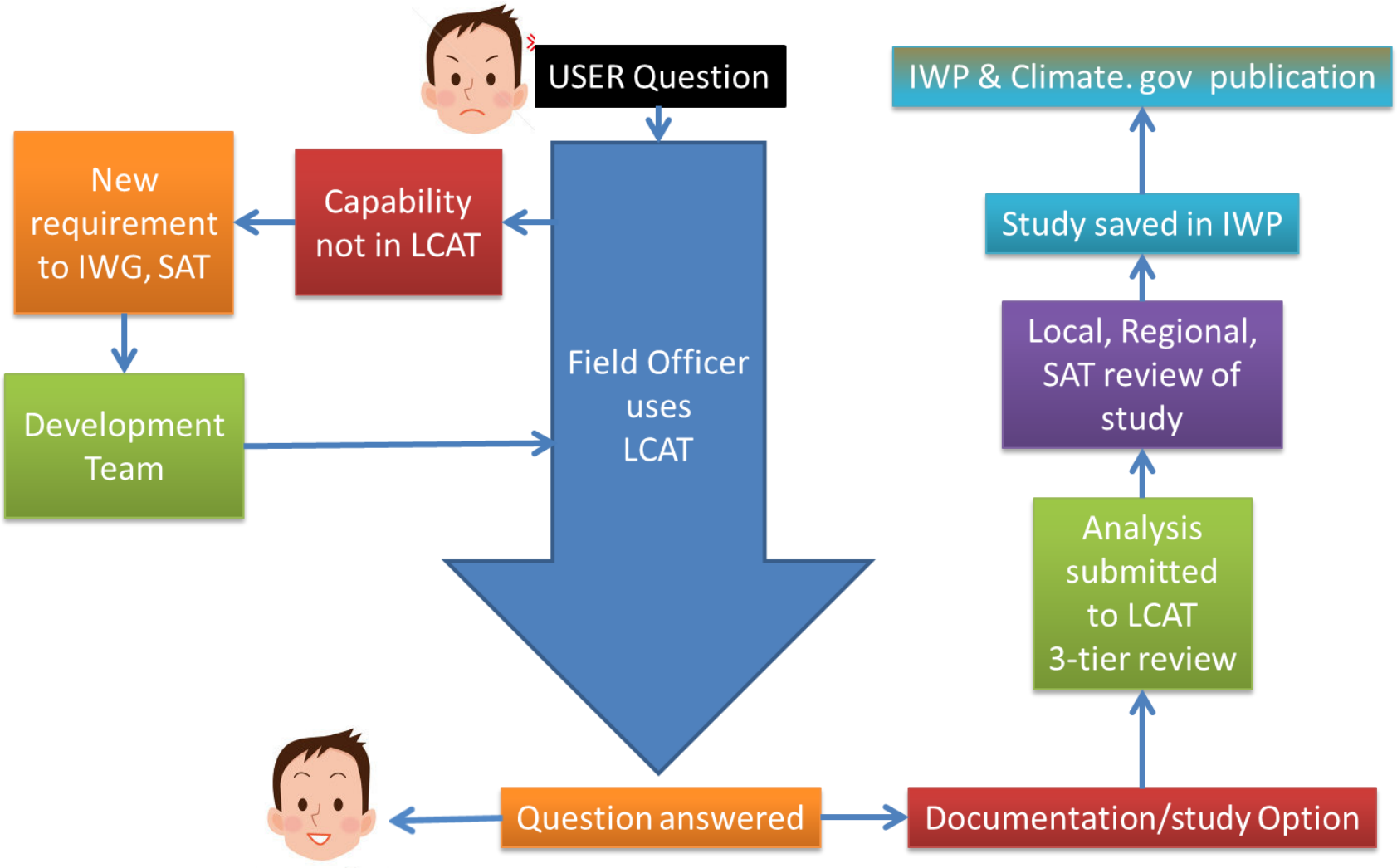
** *NIST/SEMATECH e--Handbook of Statistical Methods. 2012*

*** Huang et al, *1996; J. Climate*

⊖ Requirements pulled from NWS field, RCSDs, stakeholders

LCAT Essentials

Peer review and coordination process



How does LCAT work?

LCAT uses principles of Artificial Intelligence to connect humans with computing capability to apply data and scientific techniques

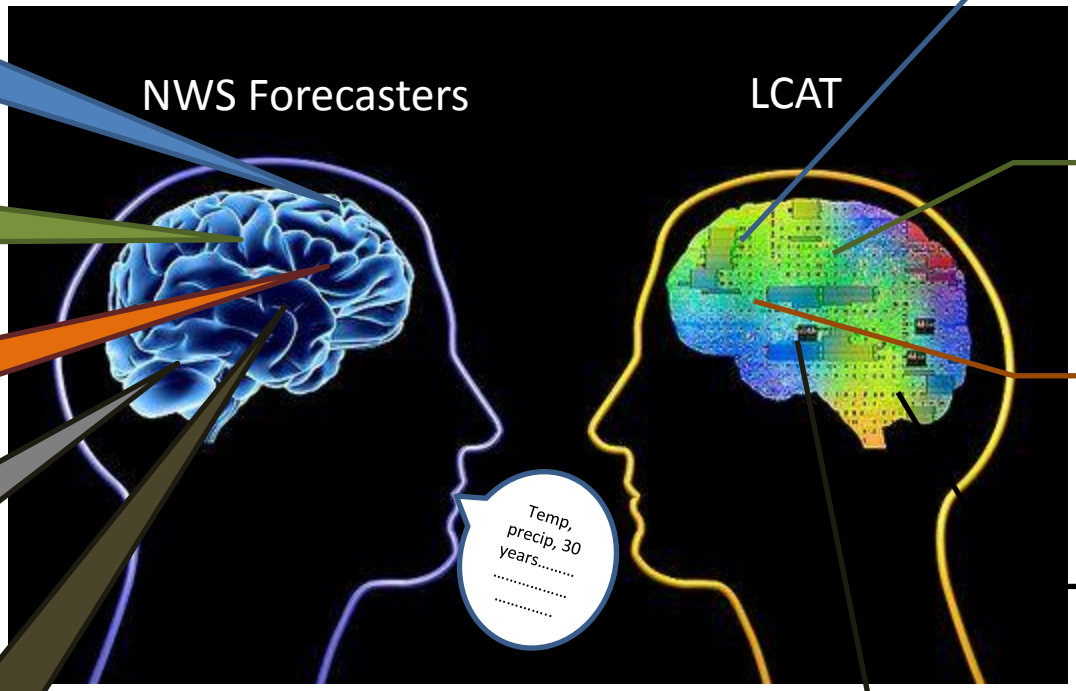
How is the temperature in my town changing?

Should we expect floods during La Nina events?

How severe is the drought in my region this year?

Which climate model performs best in my region?

What are the projections for climate in my region?



Data: Homogenized station maximum temperature
Analysis: best practices for trend; rate of change
Output: statistics, plots, metadata

Data: Homogenized precipitation and river flow
Analysis: composites, risk assessment
Output: statistics, plots, metadata

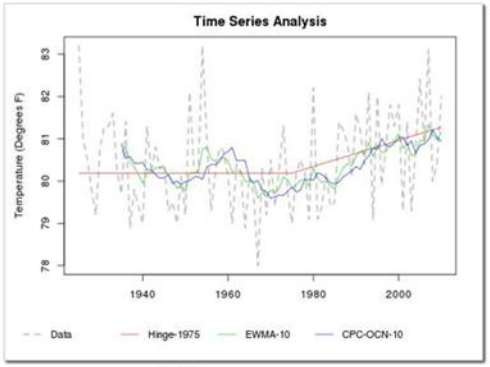
Data: Drought indices
Analysis: time series analysis
Output: statistics, plots, metadata

Data: Reanalysis and GCM fields
Analysis: downscaling, sensitivity tests
Output: statistics, plots, metadata

Data: GCM outputs
Analysis: downscaling
Output: statistics, plots, metadata

LCAT Output

Climate Change Impacts



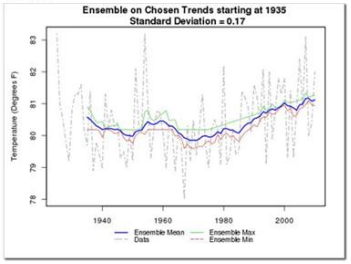
Data Statistics

Mean:	80.42 Degrees F
Median:	80.30 Degrees F
Mode:	80.20 Degrees F
Standard Deviation:	1.083

Trend Performance

Root Mean Square Error

Hinge with anchor at 1975:	1.02
Exponentially Weighted Moving Average (Alpha=10):	0.88
CPC Optimal Climate Normal (10-Year Moving Average):	1.06



Ensemble Performance

Ensemble Standard Deviation 0.17

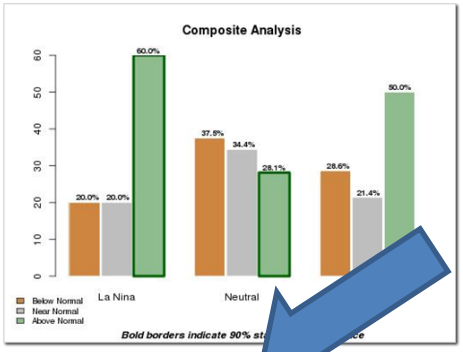
Rate of Change

Annual Rate of Change	0.010 Degrees F per year
Decadal Rate of Change	0.1 Degrees F per decade
Climatological Rate of Change	0.3 Degrees F per 30-year period

Climate Variability Impacts

Data Statistics

Mean:	5.94 Inches
Median:	5.8 Inches
Mode:	6.3 Inches
Standard Deviation:	1.391
Climatological Mean:	5.92 Inches
Tercile Low:	5.1 Inches
Tercile High:	6.3 Inches
Below Events:	15
Neutral Events:	32
Above Events:	14
Total Events:	61

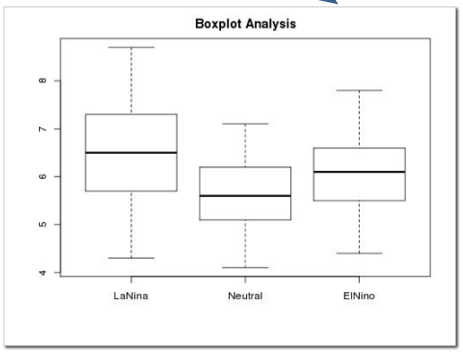


Composite Analysis Interpretation Statement

Anomaly

Lower Category Anomaly:	0.57 Inches
Middle Category Anomaly:	-0.29 Inches
Upper Category Anomaly:	0.15 Inches

Anomaly Interpretation Statement



Boxplot Analysis Interpretation Statement

COOP Data: TALLAHASSEE WSO AP, FL
Variable: Average Temperature (degrees F)

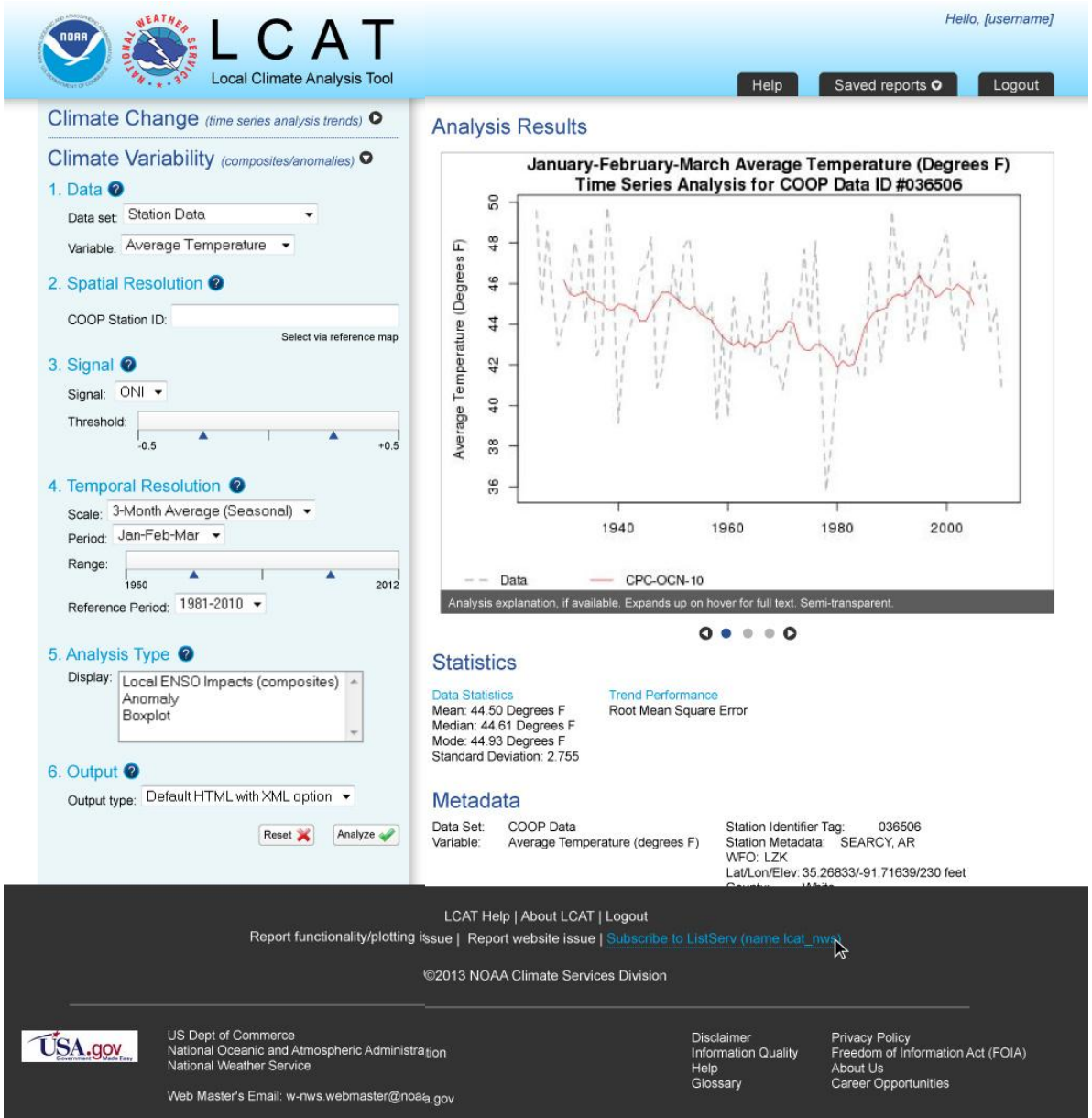
Climate Division Data: Florida Panhandle
Variable: Total Precipitation (inches)

Link to LCAT Developmental Site

LCAT Milestones

Activity	Date
Complete LCAT Documentation and Training Modules	**March 2013**
Operational Deployment: • Climate Variability Study (T/P data for station, CPC FR, NCDC CD) • Climate Change Study (ENSO, T/P data for station, CPC FR, NCDC CD, 20 NCEP R1 fields) • Correlation (20 NCEP R1 fields + 20 Climate Variability modes)	**March 2013**
Augmenting Datasets • ACIS – extremes data • NCDC Severe Weather • NOS sea level	**September 2013**
DOE Year 1 • User requirements • Global gridding • Reanalysis data	**August 2013**
DOE Year 2 • New computational analysis capabilities for DOE applications • Implement new web design • Access CMIP5 data	**August 2014**

LCAT New Operational Look and Feel

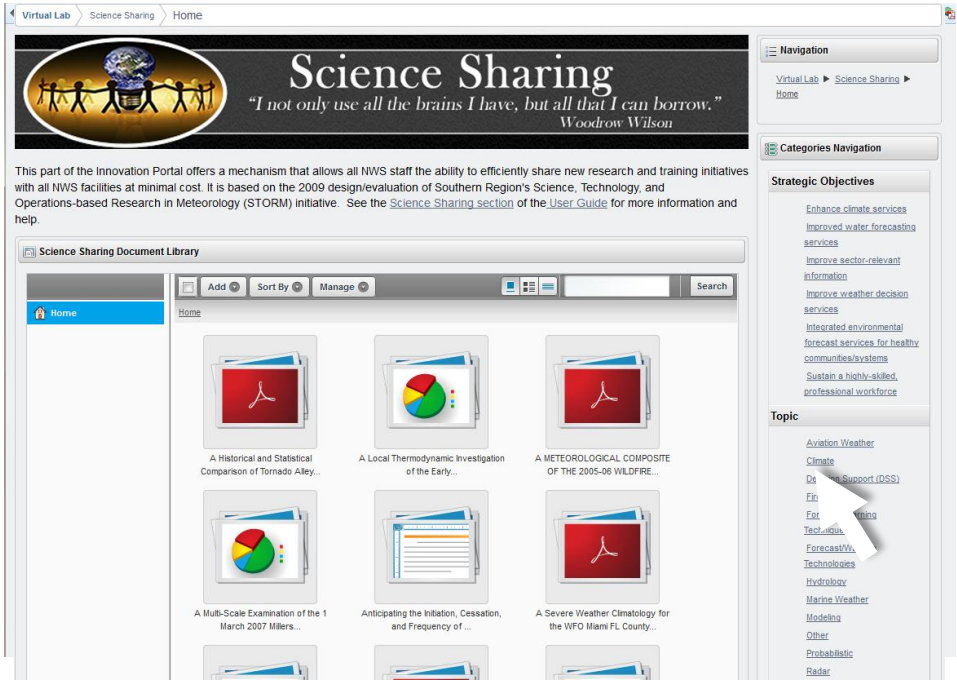


LCAT – Learn

- Total of 6.5 h of recorded training:
  - LCAT Utility
  - LCAT Data
  - LCAT Methods
  - LCAT Applications
- Online guidance
- Available in the end of March – April 2013
- Online Help buttons and Dynamic Interpretation will bridge the gaps
- We will rely on CSPMs and SOOs for ensuring proper training and utility of LCAT in operations

LCAT – Share

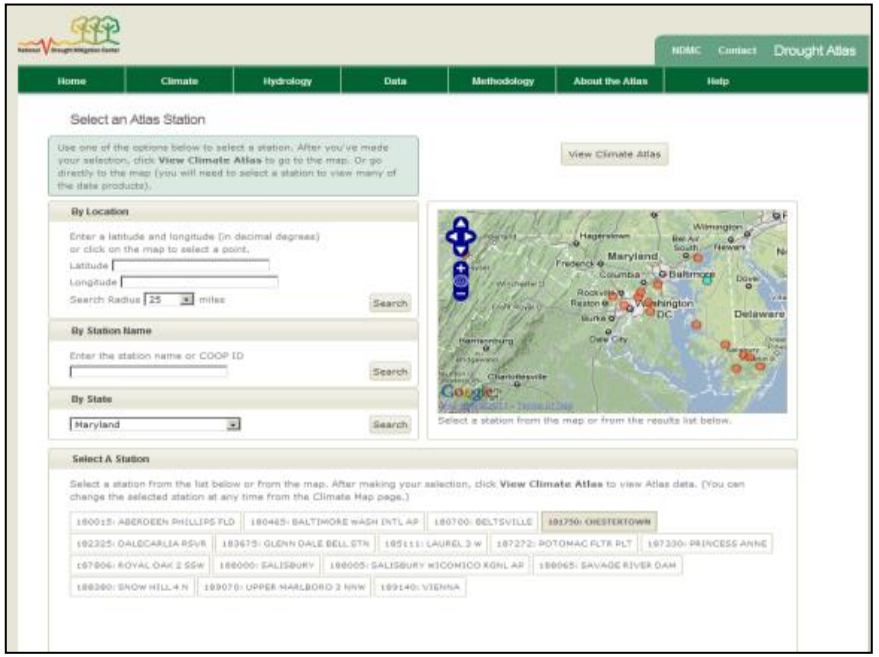
- LCAT will leverage MDL Innovation Web Portal (IWP, OSIP project 11-002), a common, virtual, dynamic, interactive environment for field developers, meteorologists, other NOAA/NWS personnel, and partners to collaborate, share information, validate needs, exchange innovative ideas, concepts, research/science and technology information



- https://nws.weather.gov/innovate/

- Advantage:
  - Merging Climate Studies into the suite of NWS innovations
  - Use of existing capabilities
  - Located at the same operational server, and
  - Search for climate across broader data

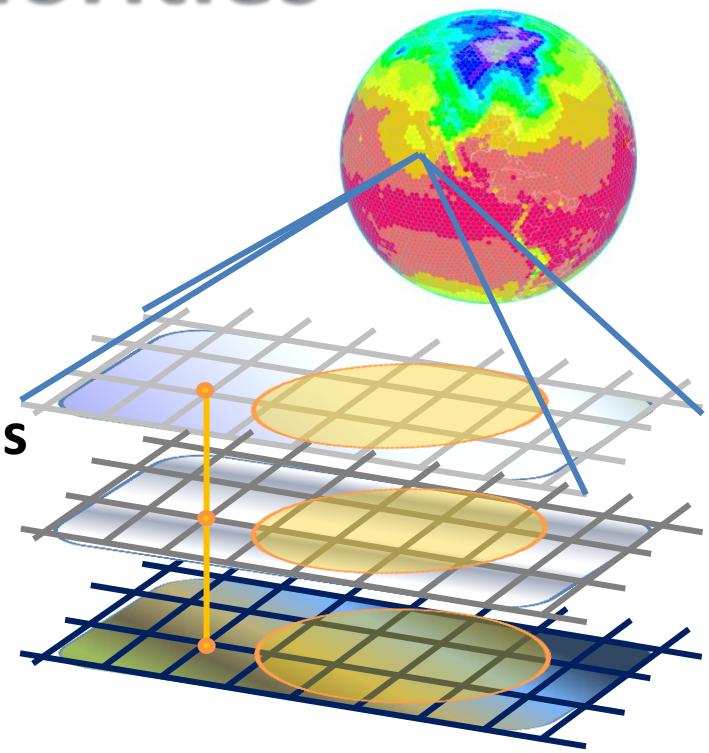
Water Resources Applications and Drought Studies



LCAT capabilities developed in partnership with

- NIDIS
- National Drought Mitigation Center (NDMC)
- NWS Office of Hydrological Development (OHD)

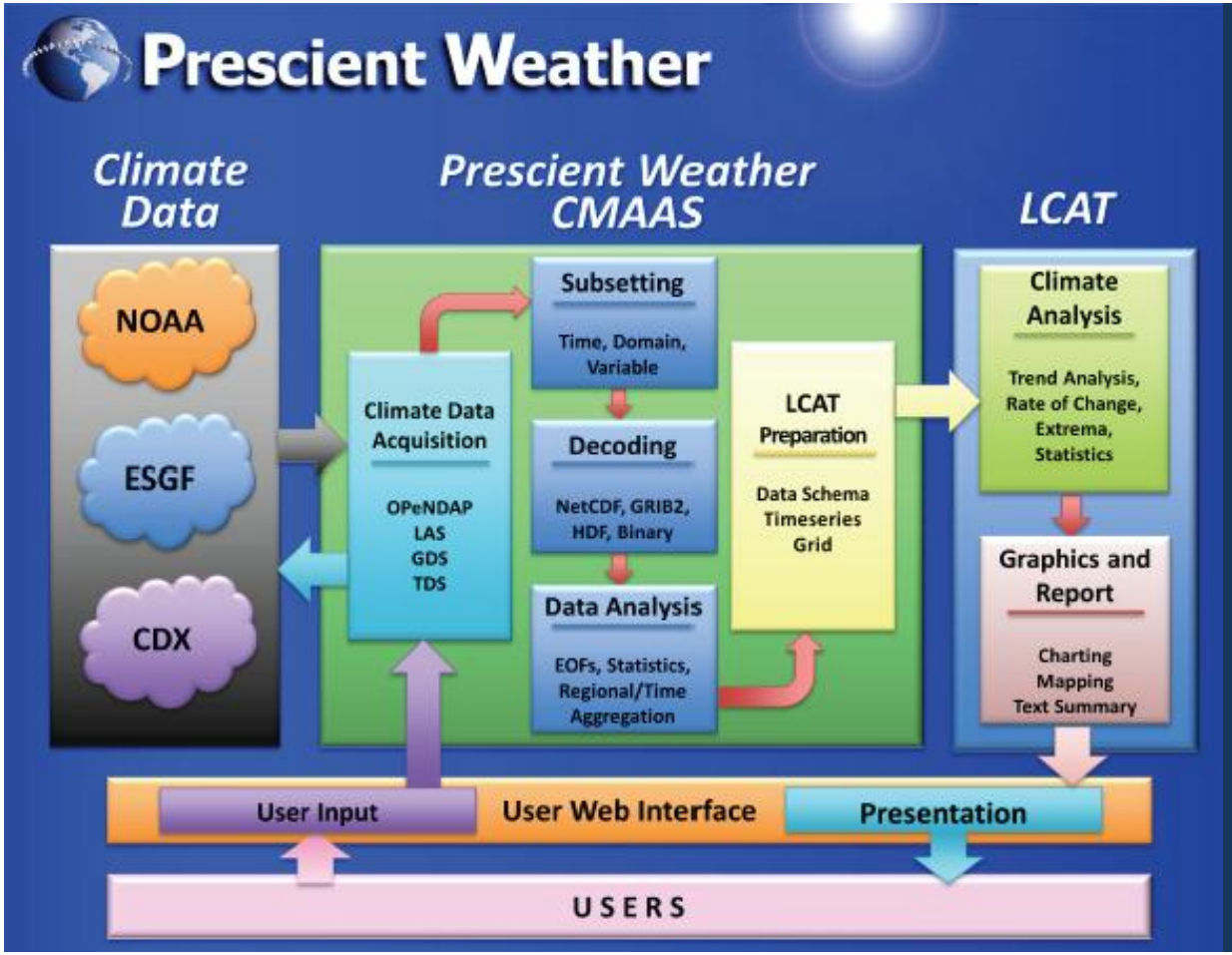
LCAT – Shift of Priorities



- DOE Project – with relevance to NOAA
  - Reanalysis data – CFSR
    - Grid point data
    - Averaging over a region
  - Model data at grid points and regions
    - CMIP / IPCC models – AR5
    - What's next?
      - CFSv2, FIM
      - 7 models of the NMME
- New LCAT Application
  - Validation/evaluation of climate model output/performance by region
  - Analysis of regional trends in climate models
  - Spatial correlations of climate phenomena
  - Extracting climate signals from model data

LCAT – Shift of Priorities

To enhance the availability and application of DOE environmental information resources for research and research management in DOE and in the broader scientific community.



The project is supported for 1 year, expiration in September 2013, with potential of extension up to 3 years

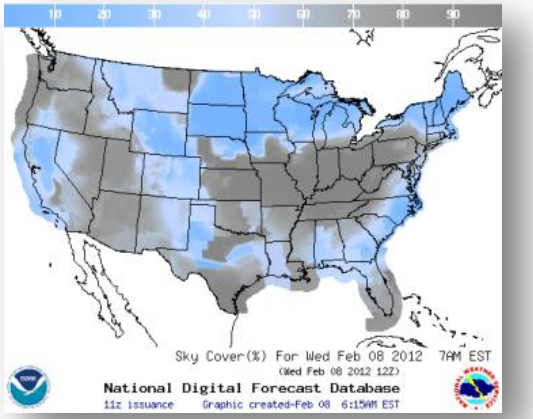
Support for:

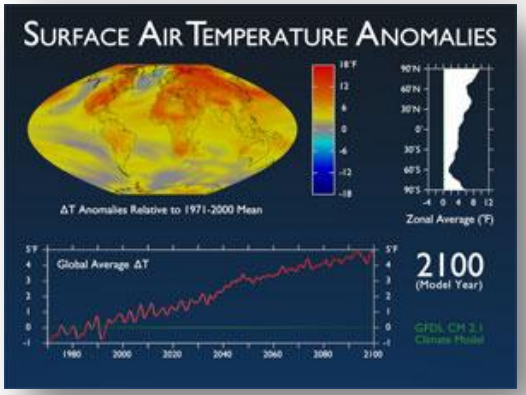
- Prescient Weather
- NWS Local Climate Specialist

NWS contribution: support for Web development for LCAT integration

LCAT Future

- **Data and analyses for energy industry support**
  - **What has been the maximum wind speed over the past 30 years?**
  - **What is the projection for the next 20-50 years?**
  - **What is the average daily cloud cover in a region during an El Niño winter?**
  - **What is the average radiation in the North East when the AO is in the negative phase?**

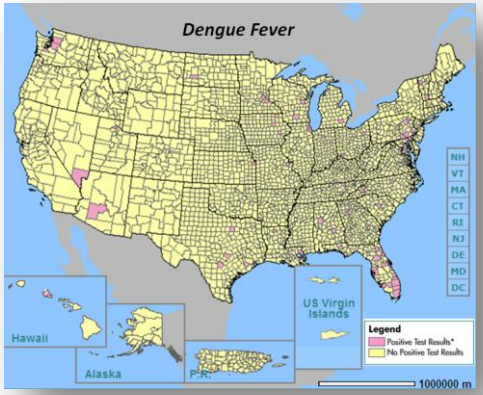




LCAT Future

- **Weather and Climate Extremes**
  - **Relative humidity, upper air, storminess, lightning, tornadoes, snow, radiation, large hail, high winds, lightning, winter storms, blizzards, tropical storms and hurricanes, flooding, dust storms, radiation, drought**
    - What is the frequency and return period of extreme precipitation?
    - What is hydrologic hazard distribution at a specific watershed?
    - What is the trend in snowfall in the Pacific NW?
    - What is the average speed of the midlatitude jet over Kansas during ENSO neutral years?
    - What is the probability of a greater than average number of hurricanes during a La Niña year?

- **Health Applications**
  - **Mortality, morbidity, vectors, pathogens, contaminants**
    - Is the local climatology favorable for spreading the Dengue Fever vector?
    - Will a spring drought increase the chance for spread of West Nile virus?
    - What is the trend in heat-related deaths in Chicago?
    - What is the relationship between severe precipitation events and the spread of contaminants?



LCAT Future

- **Coastal Inundation**
  - Incorporation of NOS sea level data and analysis techniques for correlations to regional and local climate variability and change
    - What are water level extremes during El Niño or La Niña events?
    - Are there seasonal extremes?
- **Marine Ecosystems**
  - Support for Healthy Oceans
  - *NOAA Habitat Blueprint: A framework to improve habitat for fisheries, marine life, and coastal communities*
    - Relating climate variables with relevant data sets
      - Fisheries
      - Habitats
      - Iconic species
    - Climate change impacts to the ocean
      - Sea level
      - Acidification
    - Warming Water level (tides, etc.) and climate signals for coastal regions

Final Thoughts

- **LCAT is a unique, revolutionary tool for data analysis**
- **Relieves user of burden of**
  - **Identifying which data is the most relevant and reliable**
  - **Identifying which analysis technique to use that is most appropriate and scientifically sound**
  - **Developing codes for data access and analysis techniques**
- **LCAT has application for priorities of both Weather-Ready Nation strategy and the Climate Goal objectives**
- **LCAT potential includes**
  - **Comprehensive environmental study of climate impacts at regional and local levels**
  - **National and global applications**
  - **Historical data out to climate projections**
- **Partnerships growing**
  - **State Climatologists – joint proposals for analysis of state climates**
  - **DOE support for accelerated LCAT development to meet their needs**
  - **Fisheries for stock analysis**
  - **Marine Sanctuaries for management of protected areas and climate adaptation planning**