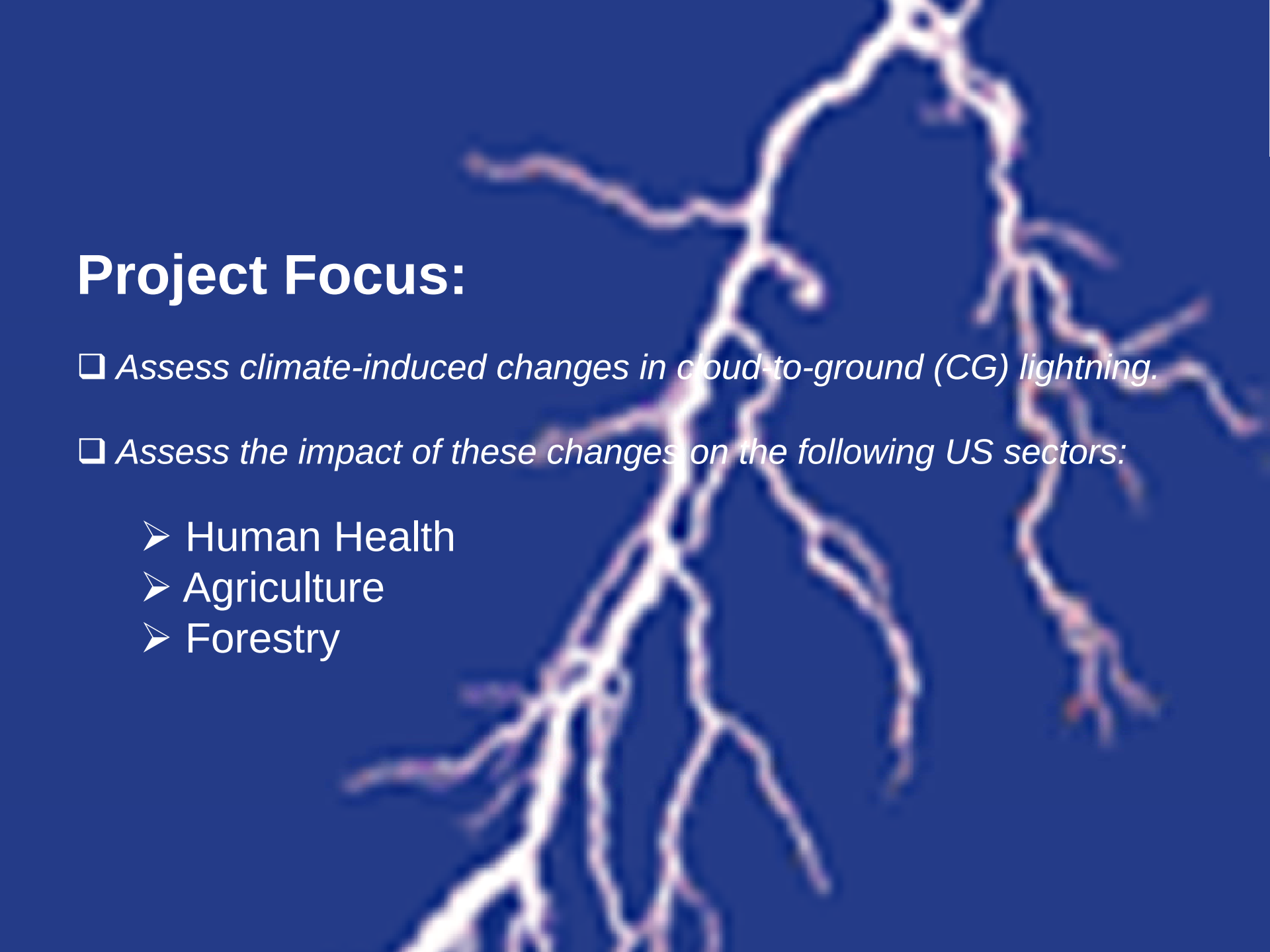
Assessing Global Change Impact on the US using National Lightning Data

Project Update
National Climate Assessment
February 24, 2012

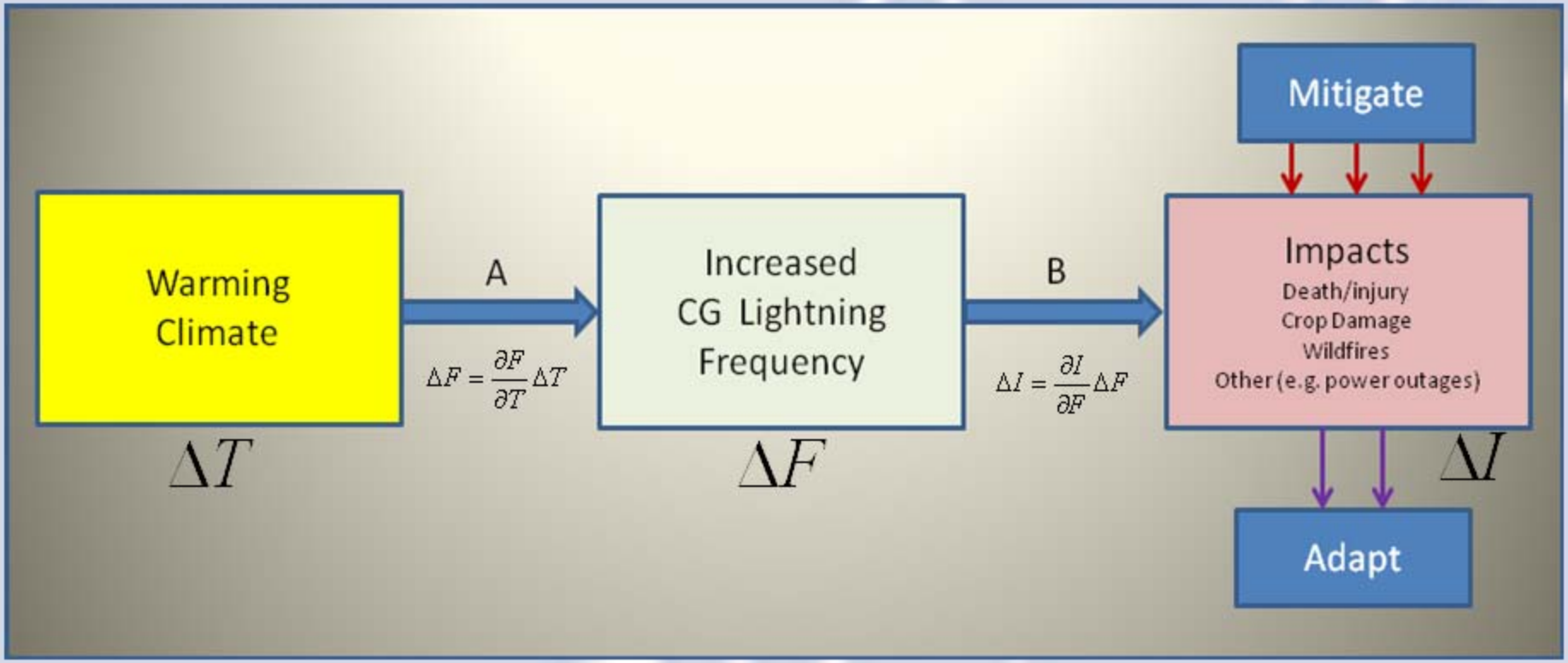
William Koshak and Richard Blakeslee
Earth Science Office, NASA Marshall Space Flight Center, Huntsville, AL, USA



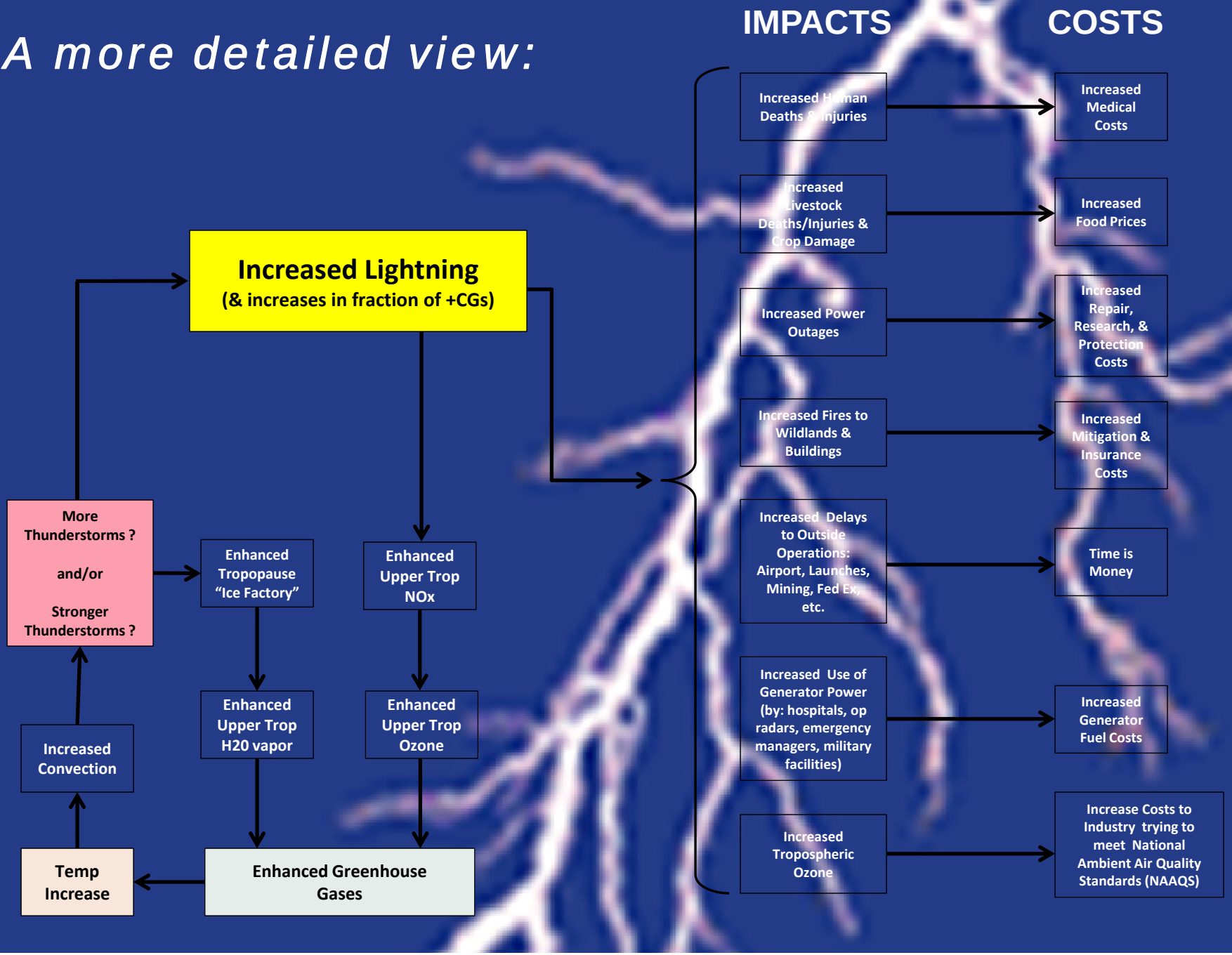
Project Focus:

- *Assess climate-induced changes in cloud-to-ground (CG) lightning.*
- *Assess the impact of these changes on the following US sectors:*
  - Human Health
  - Agriculture
  - Forestry

A warming climate scenario would give …

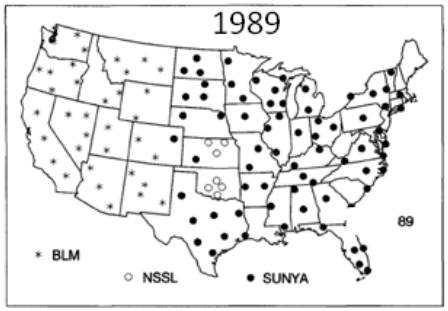


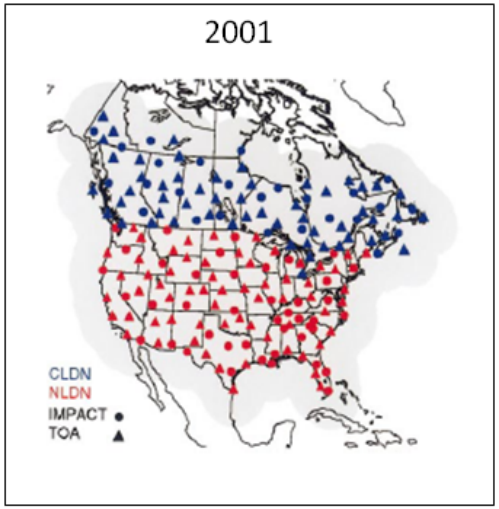
A more detailed view:

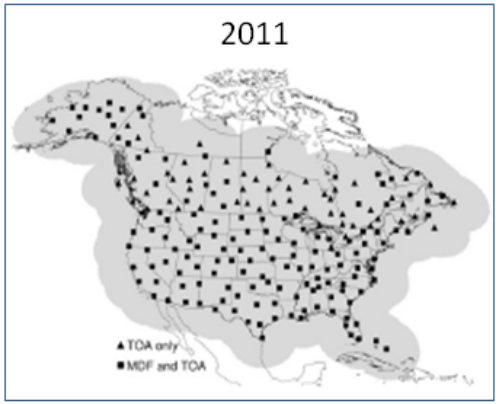


Important to Note

- 2000 Assessment Report did not even mention lightning
- 2009 Assessment Report only briefly mentioned lightning
  - pie chart on page 89 regarding hazard-related deaths
  - plot on page 105 regarding insurance claims
- No career lightning researchers involved in these previous assessments
- National lightning network not really ready to make good assessments







[adapted from Orville (1991, Fig. 2), Orville et al. (2002, Fig. 1), and Orville et al. (2011, Fig.1); ©American Meteorological Society. Reprinted with permission.]

Accomplishments

- **Developed a Lightning Software Analysis Tool (LSAT)**
  - written in IDL programming language
  - ingests, calculates, and visualizes national CG lightning data
  - now serves as a new "sustaining assessment" tool

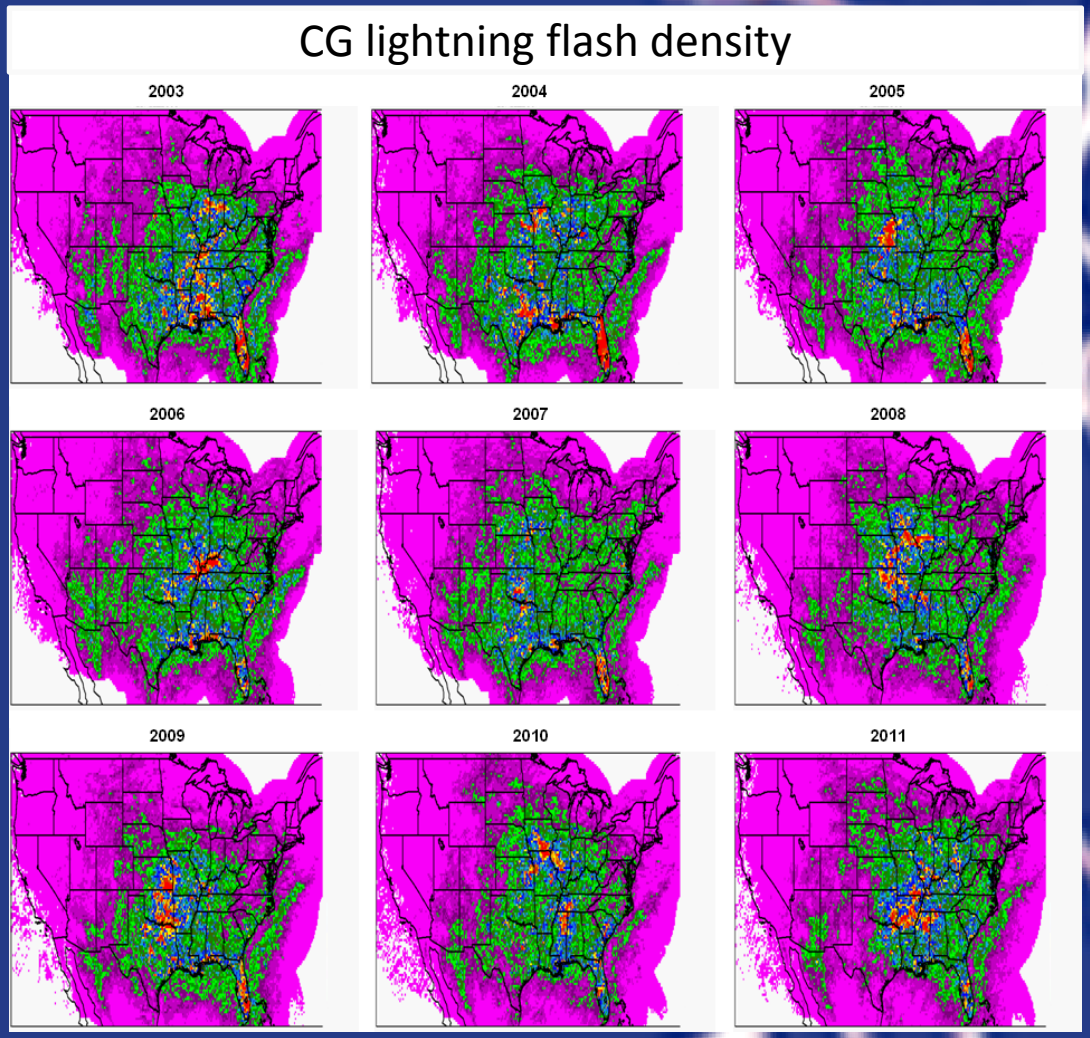
- **Applied LSAT to analyze CG lightning over a region slightly larger than CONUS during the period 2003-2011.**

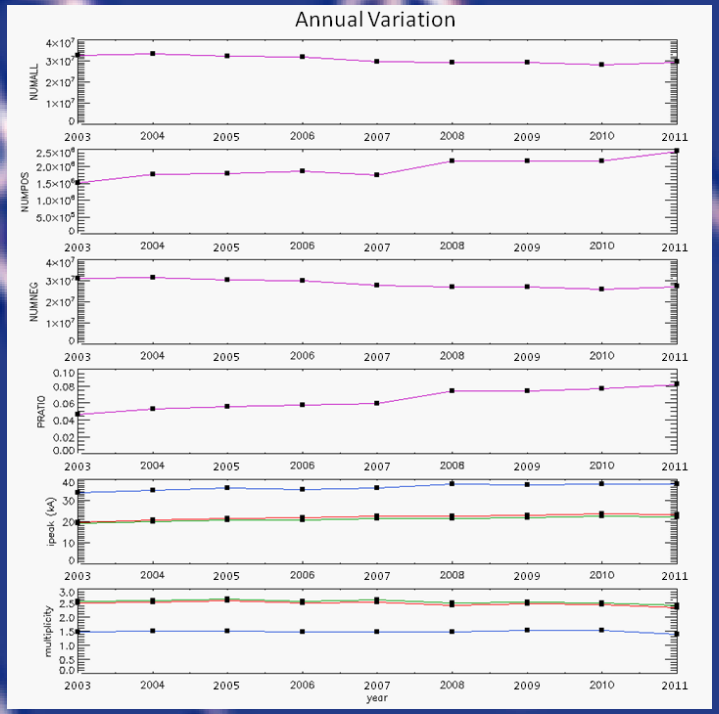
- **Used NOAA *Storm Data*, and National Interagency Fire Center (NIFC) data to obtain associated death/injury, crop damage, wildfire stats.**

- **Compared average values (2003-2006) with average values (2007-2010):**
  - ✓CG lightning frequency dropped by 10.7%
  - ✓Fatalities dropped by 13.5%
  - ✓Injuries dropped by 31.2%
  - ✓Crop damage dropped by 61.25%
  - ✓# wildfires dropped by 23.6%
  - ✓Wildfire burn acreage dropped by 8.3%
  - ✓Multiplicity dropped by 2.4%
  - ✓Peak current increased by 9.9%

- **Number of +CG (and +CG fraction) monotonically trended upward in 2003-2011**

Sample of LSAT output





Accomplishments (cont.)

- **Synthesized literature on lightning/climate relations & compared w/LSAT.**
- **Completed a conservative risk-based assessment of lightning-caused impacts to our analysis region assuming a 1 degree C (wet-bulb) global (land mass) temp change:**

Human Health:	
Fatalities:	13.98 deaths per 1°C
Injuries:	87.47 injuries per 1°C
Agriculture:	
Crop Damage:	$49,348 per 1°C
Forestry:	
Wildland Fires (Number):	4091.0 wildfires per 1°C
Wildland Fires (Acres):	936,997.6 acres per 1°C

- **Completed a 30 page Technical Input report to summarize findings.**
- **Submitted Technical Input report on February 22, 2012.**