

# Acid Deposition Response to the 1995 Clean Air Act Amendment

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# Outline

- Objectives
- Background
- Tools we used
- Examples
- Future work
- Conclusion



# Objectives

- Demonstrate the use of ArcGIS to display evidence of acid deposition response to the 1995 Clean Air Act Amendment
- Provide useful tools and examples for scientists



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# NAtChem/Precipitation Chemistry Database and Analysis Facility

- Operated by MSC of Environment Canada
- Purpose to enhance atmospheric research
  - Research chemical nature of the atmosphere
  - atmospheric processes
  - spatial and temporal patterns
  - source receptor relationships
  - Long range transport of air pollutants
- Database consists of 7 regional-scale monitoring networks in North America

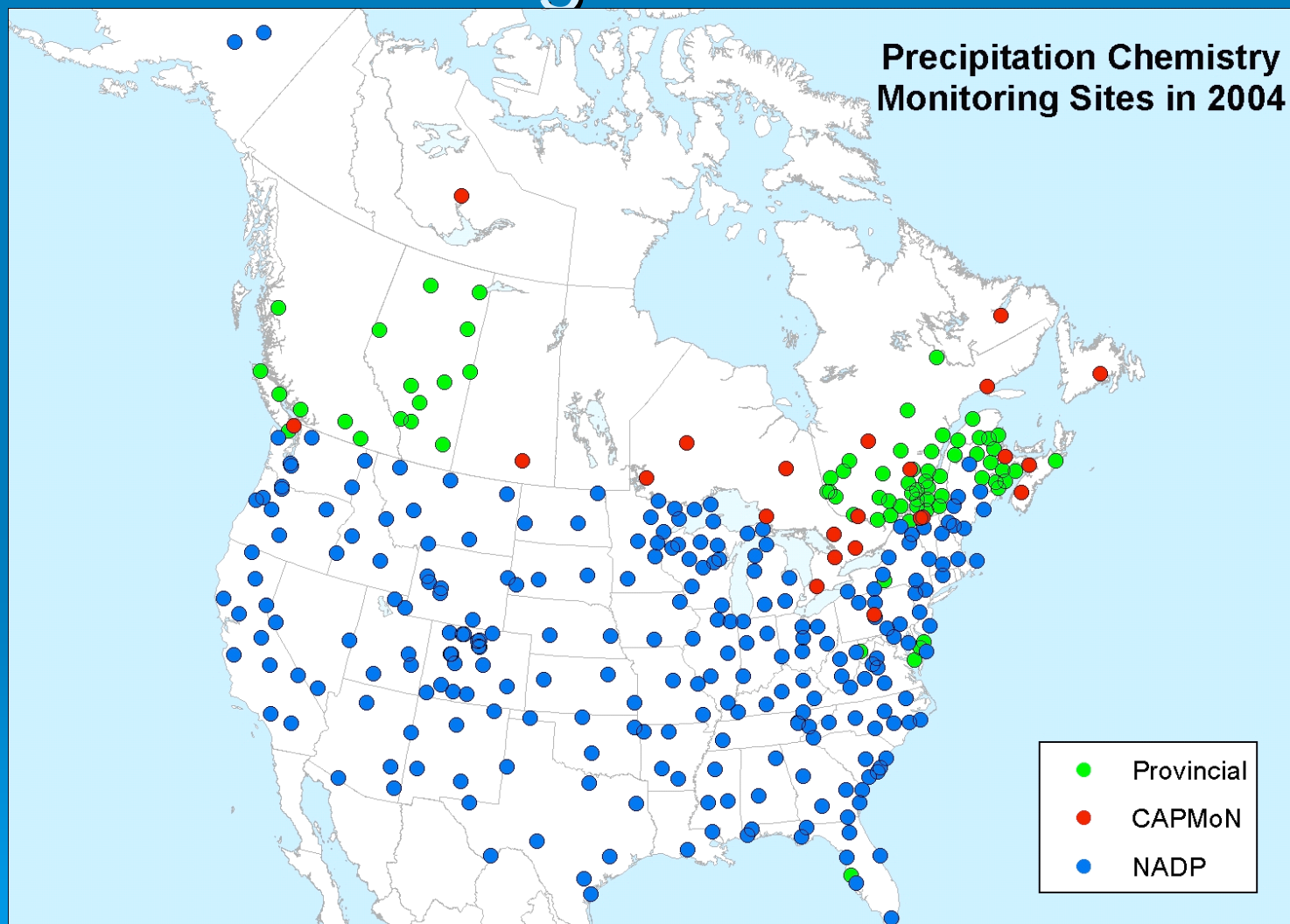


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# NAtChem/Precipitation Chemistry Monitoring Sites in 2004



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Changes of SO<sub>2</sub> emissions and  
nss-SO<sub>4</sub><sup>=</sup> wet deposition  
in the 5 years before and after  
the implementation of  
the Clean Air Act Amendment  
(CAAA)

Phase 1 reductions in 1995.

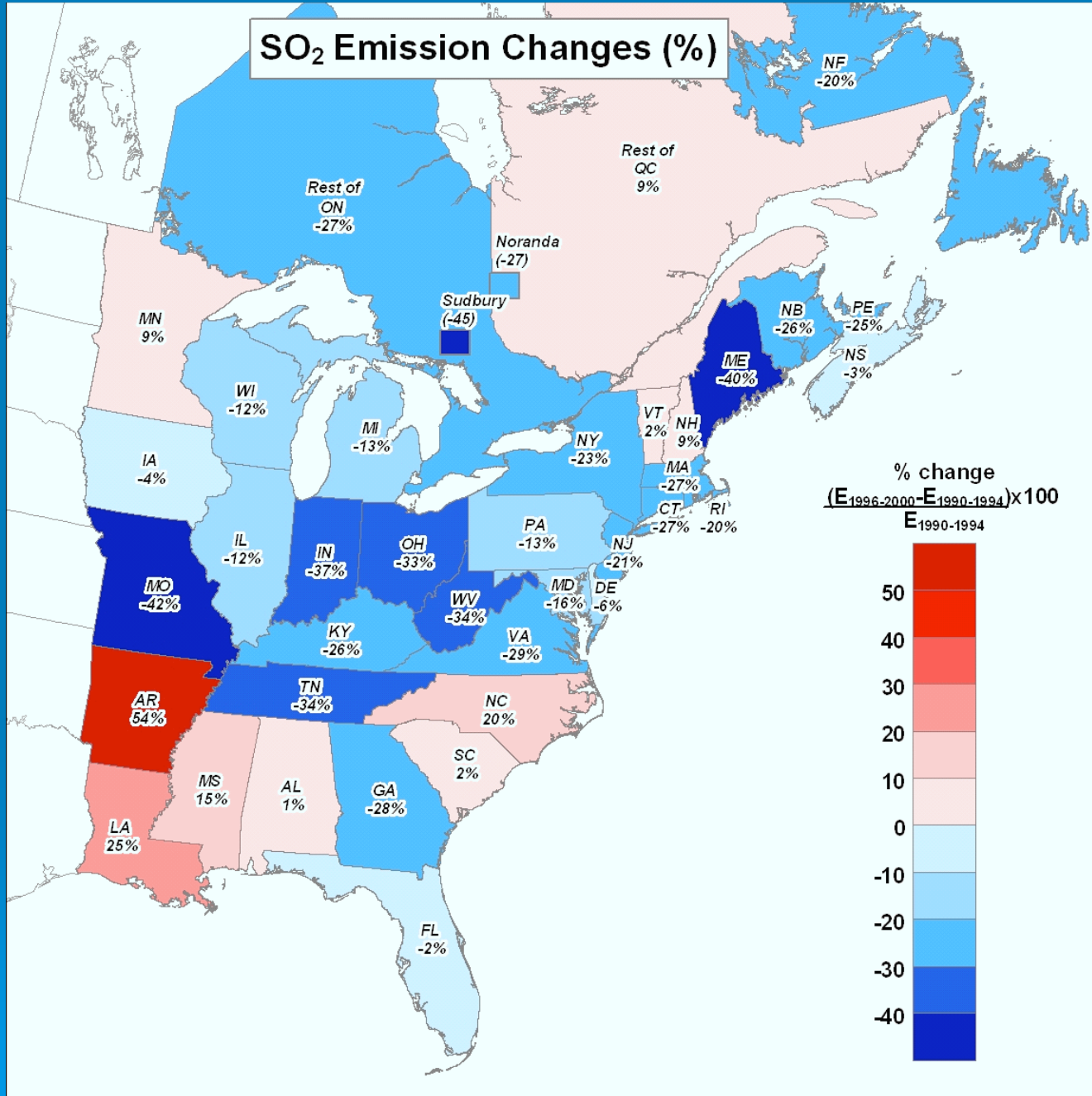


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# SO<sub>2</sub> Emission Changes (%)



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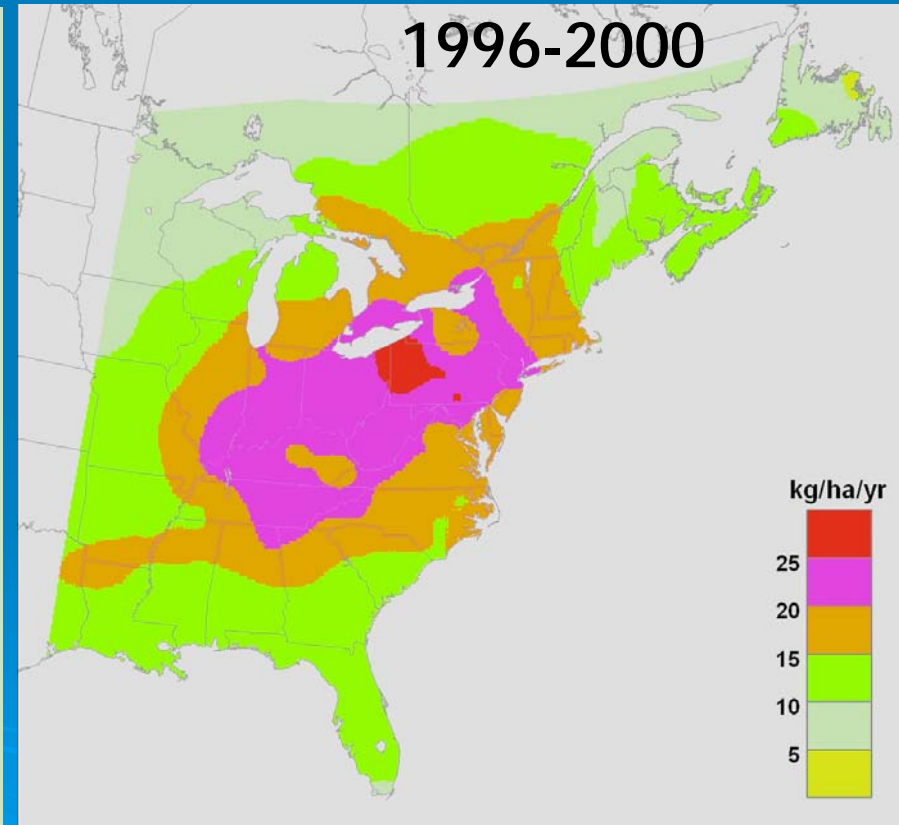
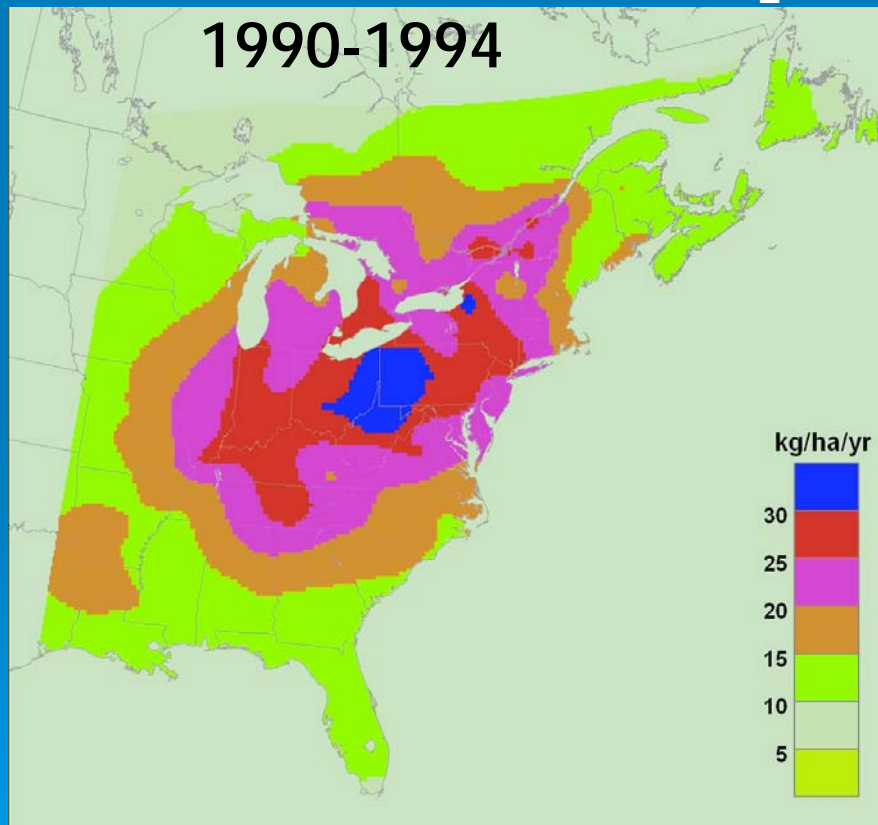
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# 5-Year Mean Pattern Changes to non-seasalt-SO<sub>4</sub><sup>=</sup> Wet Deposition

5 Year Average  
SO<sub>2</sub> Emissions:

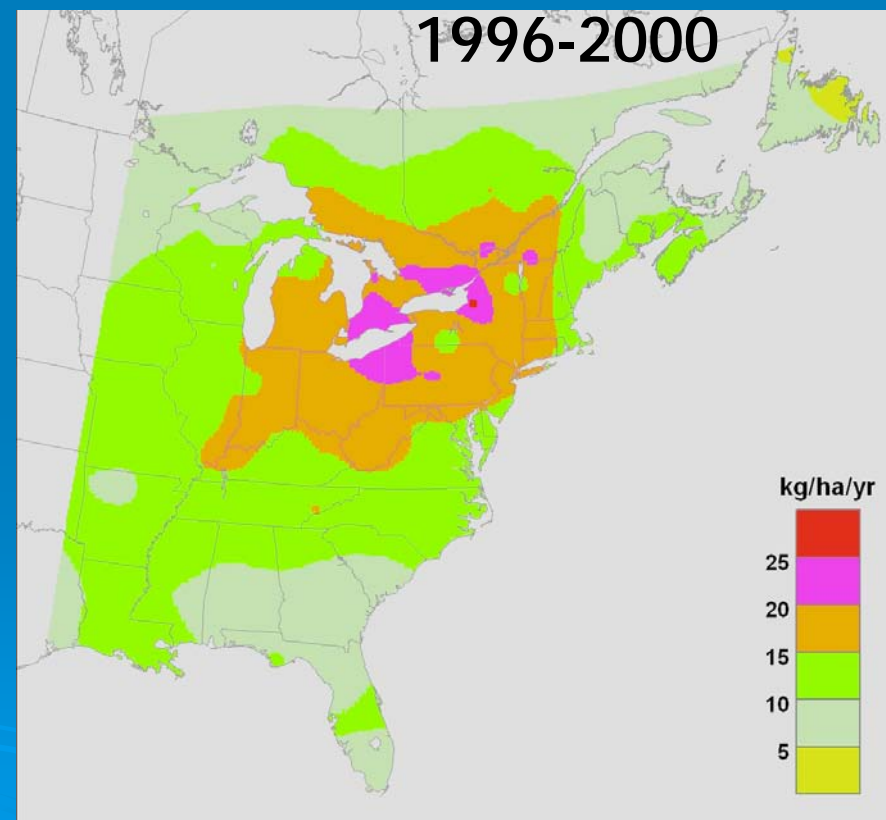
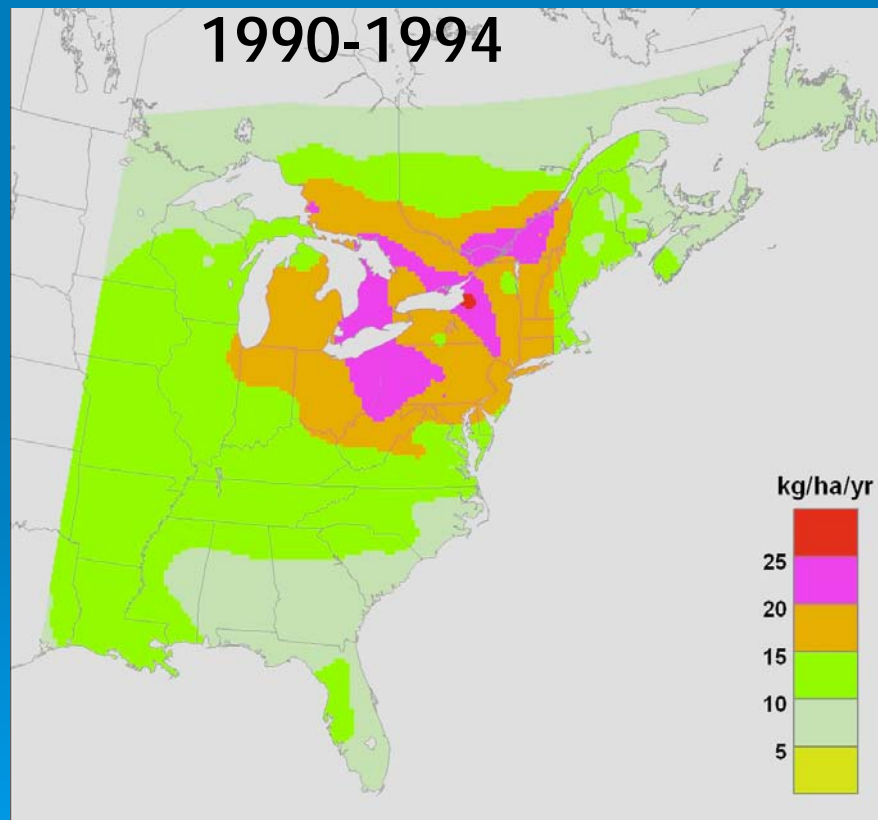
20 MT

15 MT





# 5-Year Mean Pattern Changes to $\text{NO}_3^-$ Wet Deposition

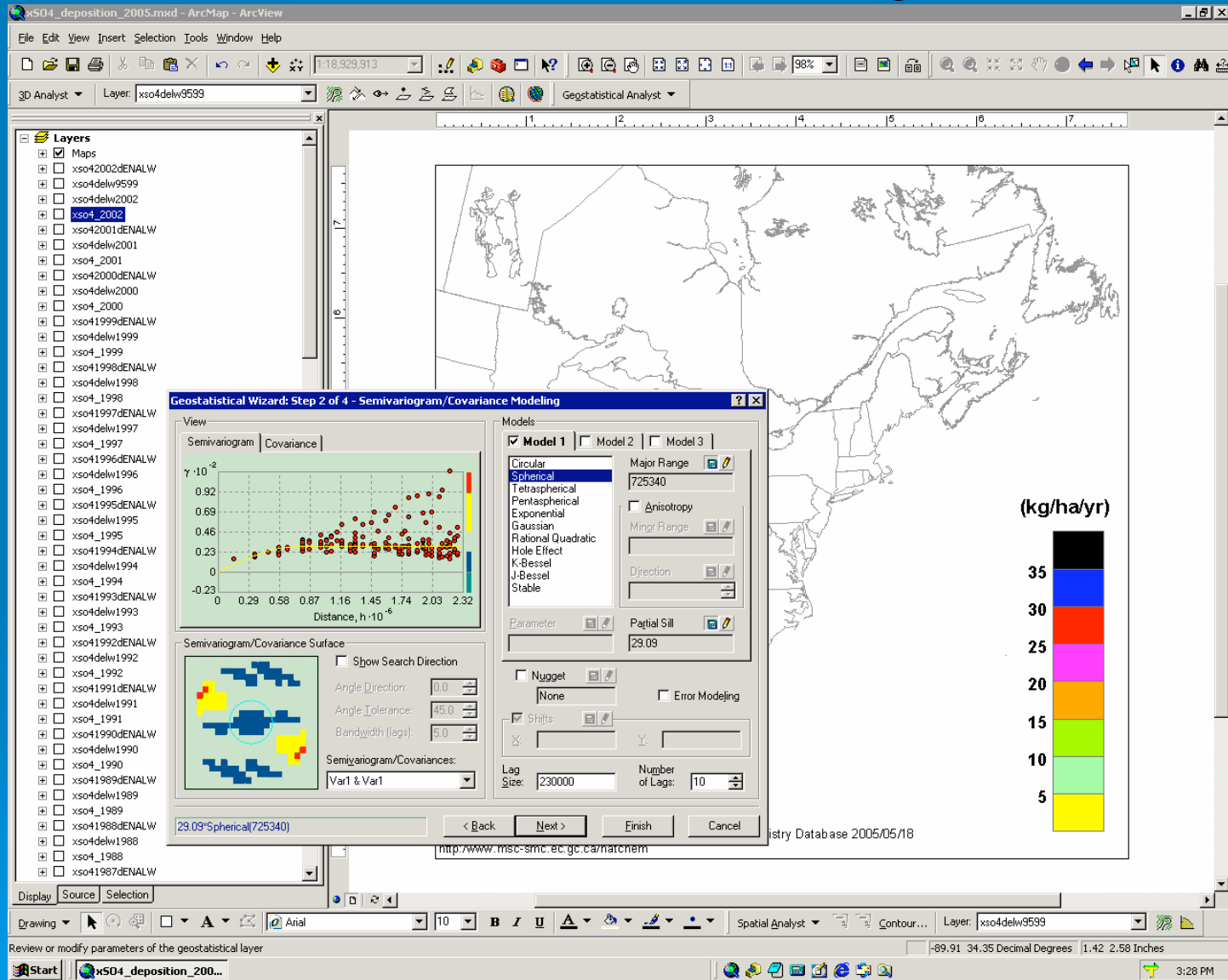


# What did we need to get here?

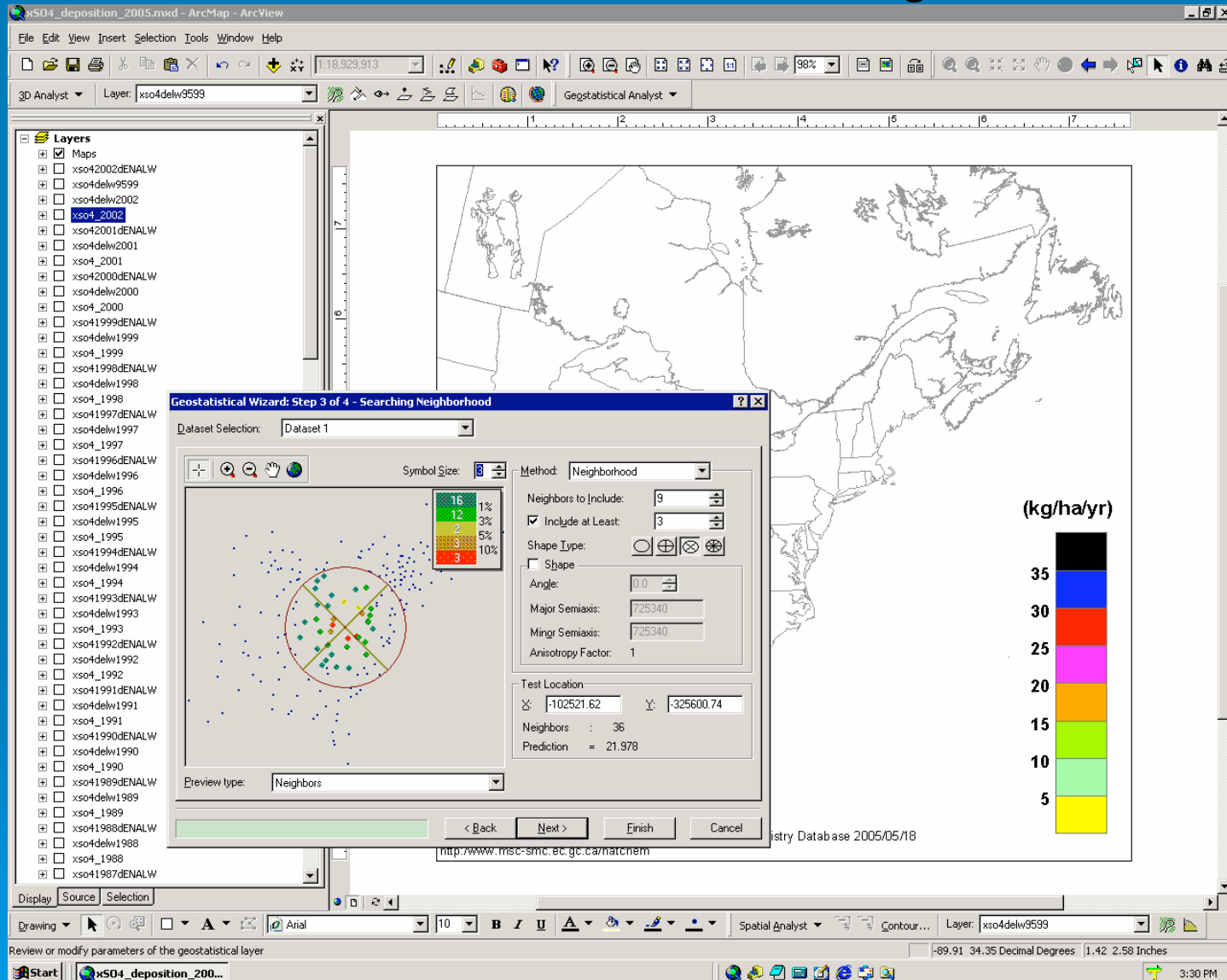
- Annual average monitoring site data on a map for each year between 1980 – 2002
  - 22 parameters measured
  - One project per parameter (MXD file)
- Geostatistical Analyst to interpolate the data to raster grid layers
  - Ordinary Kriging using Spherical Model
  - Export predicted surface to grid
  - Apply spatial ref. using *CopySpatialReference*
  - A lot of time to estimate each layer ~25 minutes



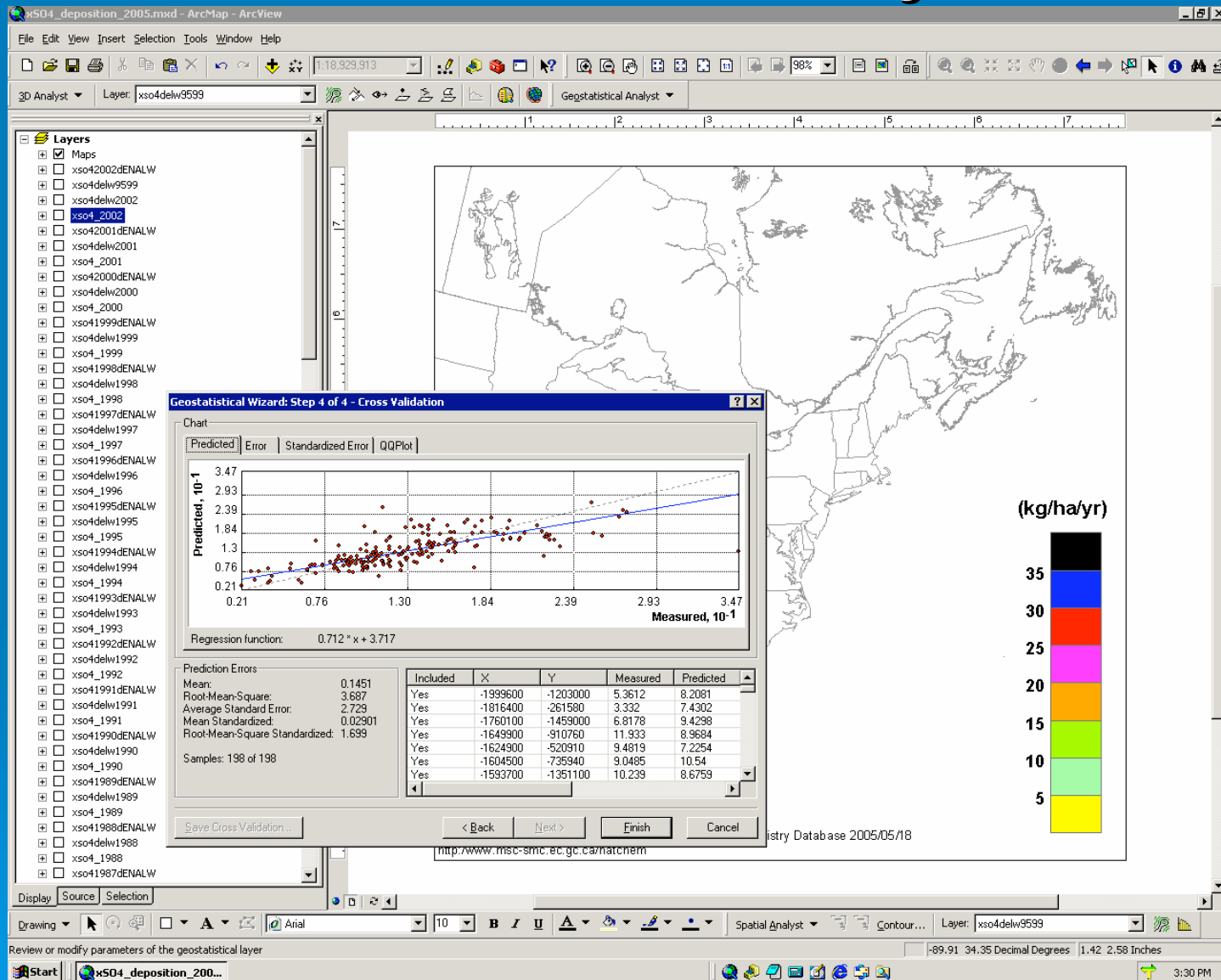
# Geostatistical Analyst



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# Geostatistical Analyst

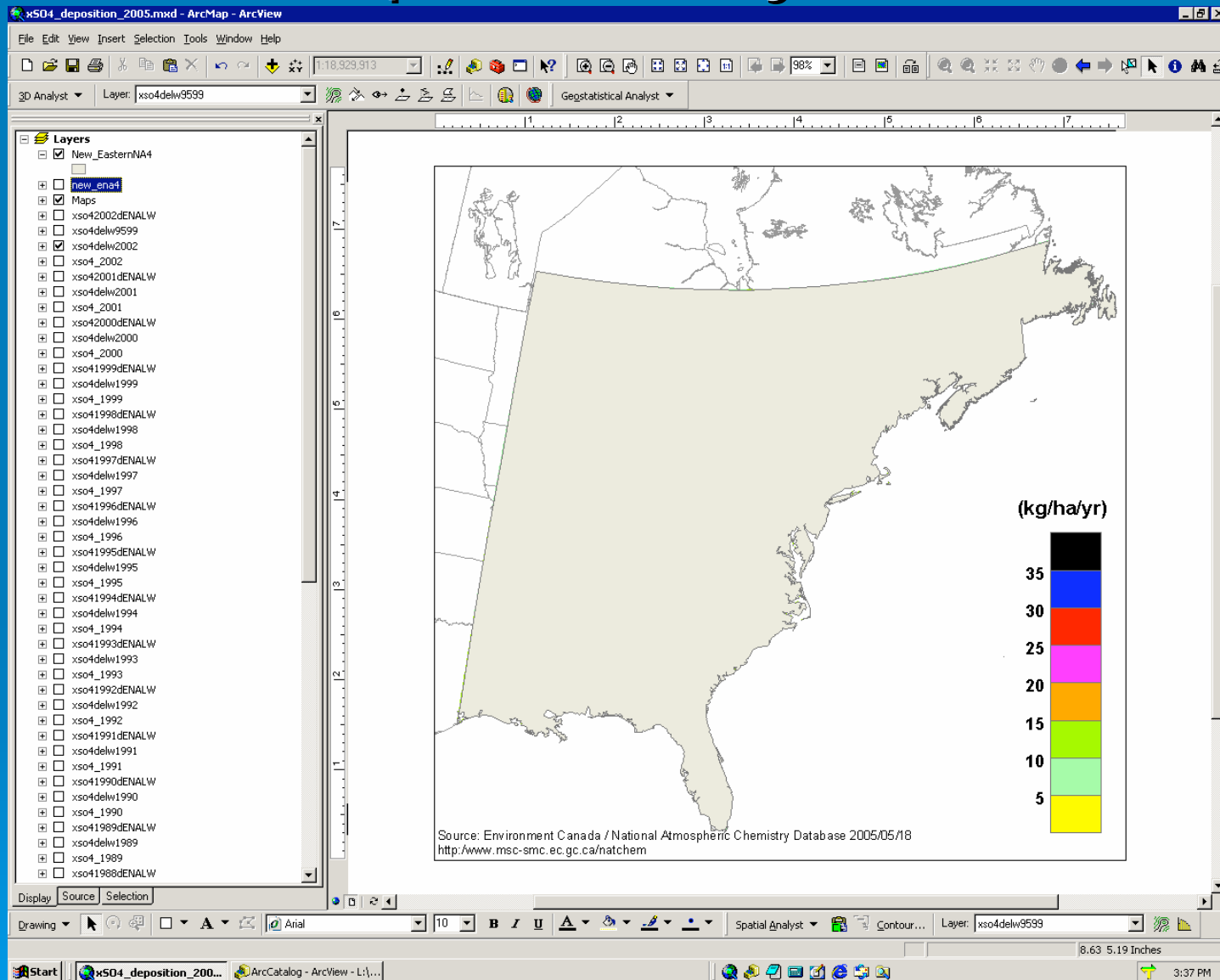


# ...What did we need to get here?

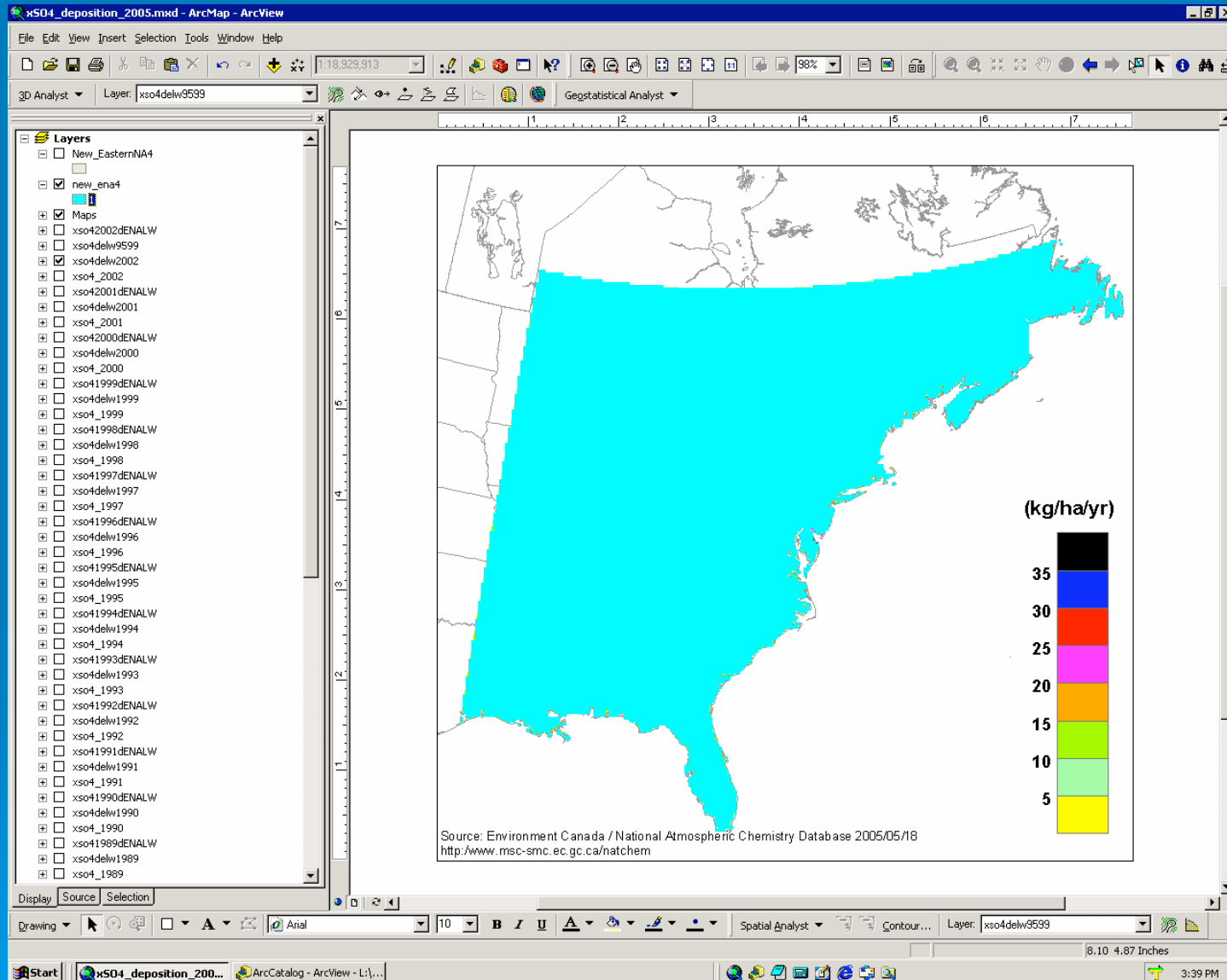
- Creation of a cookie-cutter raster
  - Eastern North America
  - Convert a shapefile to a grid layer (values=1)
- Spatial Analyst raster calculator to trim the raster grid layers
  - This was done using VBA scripts *RasterMathOps*
  - Also created contour lines of the new rasters
  - Assigned layer names using tables



# Spatial Analyst

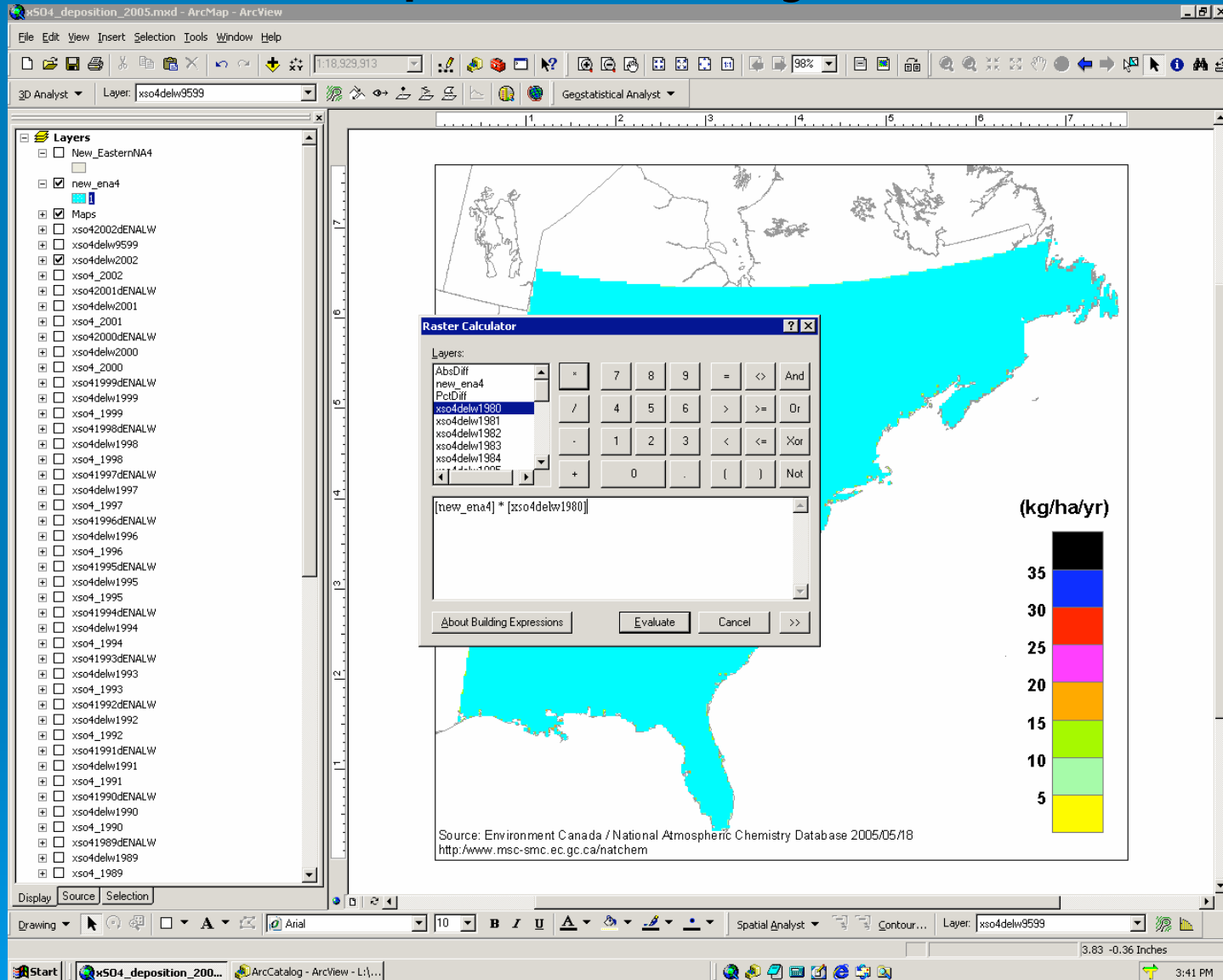


# Spatial Analyst





# Spatial Analyst

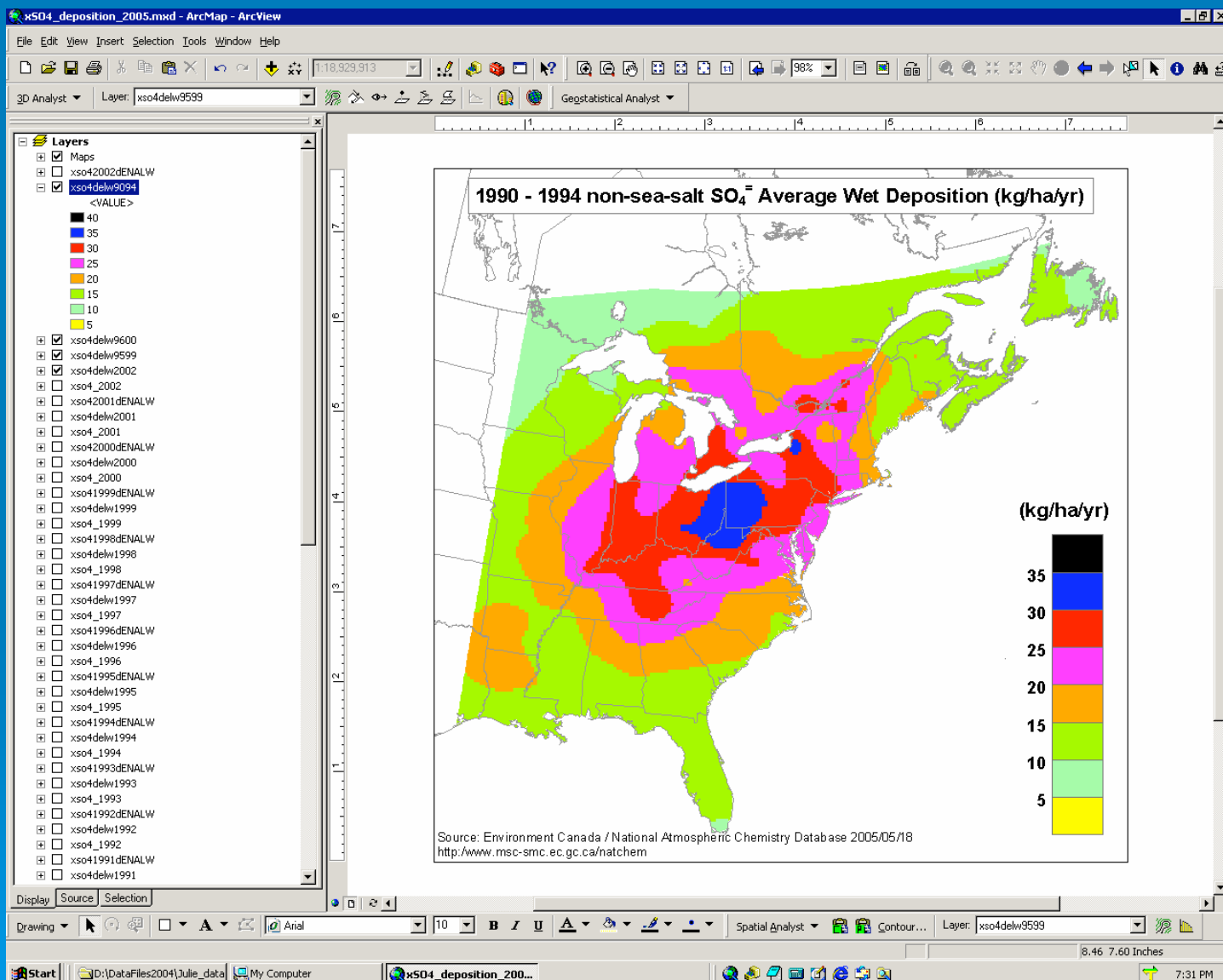


# What else did we do to get here?

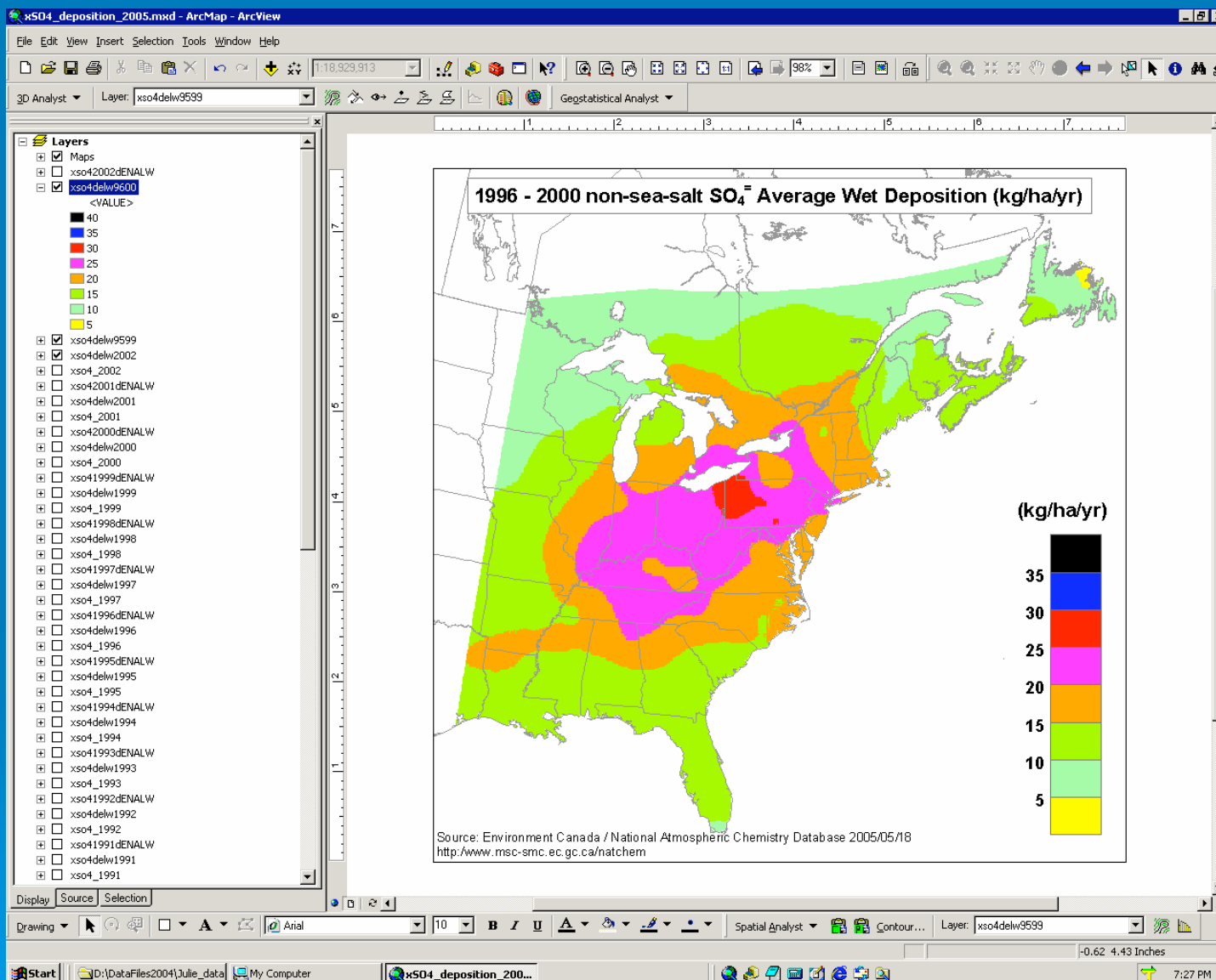
- Add rasters to data frame and apply Raster Symbology using VBA scripts *CopyRasSym* and *PasteRasSym*
- Export the images to PDF or JPEG files using VBA scripts *PDFExporter* or *JpegExporter*
  - Apply titles and footnotes to images
  - Select layers for each image file
  - Assign output file names
- Calculate regional grid statistics using VBA script *RasterStatistics*



# Results



# Results



# Future Work

- Implementation of the SAS Bridge to ESRI
- Complete the analysis for additional years
- Continue the collaborations with other monitoring networks including NADP (USA)



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# Conclusion

- ArcGIS is an essential and powerful air quality data analysis tool
  - Spatial analysis
  - Statistical analysis
  - Spatial distribution / mapping

