An Introduction to PROC SGMAP

Presenter

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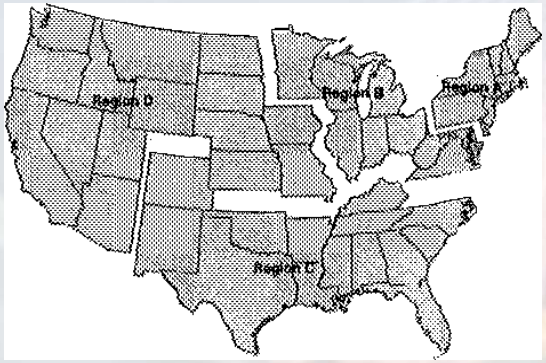
Louise Hadden has been using and loving SAS since the days of punch cards and computers the size of a tiny house. She spends most of her time in support of health policy analytics at Abt Associates Inc. and loves a good SAS reporting challenge. She is an ardent life long learner and reads voraciously, loves photography and volunteers at the MSPCA Boston Adoption Center walking, training and photographing dogs.

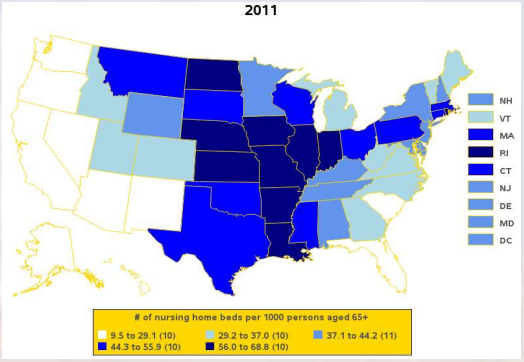
An Introduction to PROC SGMAP: Ushering in a New Era of Mapping with BASE SAS

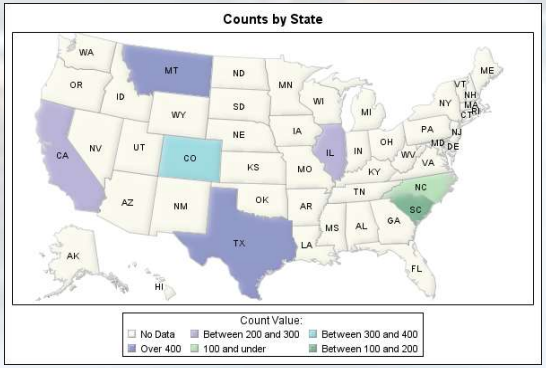
Presented to BASUG, April 2018

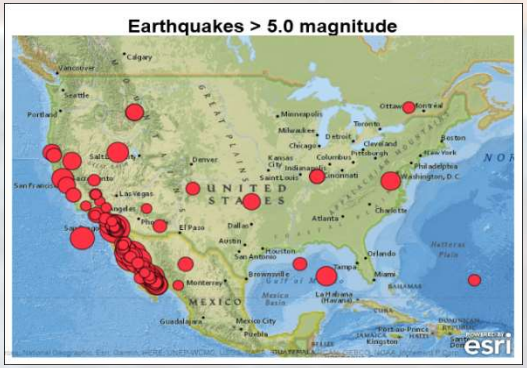
Introduction

Mapping with SAS









Introduction

Resources for Mapping with PROC SGMAP

Creation of maps with BASE SAS® software

- Mapping resources
- Mapping concepts
- Procedures –Base SAS polygon plots in PROC SGPLOT, Base SAS PROC SGMAP
- Examples

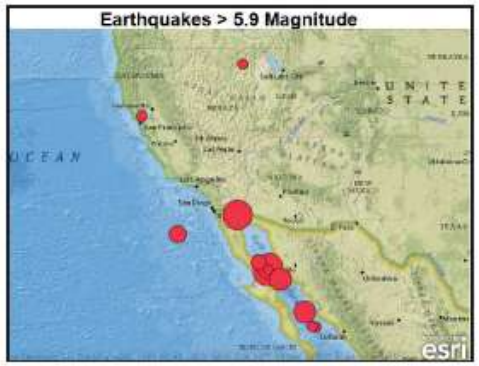
Mapping Basics

Resources – PROC SGMAP Tip Sheet

rocedure Tip Sheet

SGMap: Bubbles on Esri Map

```
data work.major_quakes;
  set sashelp.quakes(where=(magnitude>5.9));
run;
proc sgmap plotdata=work.major_quakes;
  esrimap
url='http://services.arcgisonline.com/arcgis/
rest/services/NatGeo World Map';
  title h=2 'Earthquakes > 5.9 Magnitude';
  bubble x=longitude y=latitude
    size=magnitude /
    fillattrs=(color=cxff3344);
run;
```



PROC SGMAP Notes

- Map features are drawn in the order of the statements. A CHOROMAP, ESRIMAP or OPENSTREETMAP statement should precede BUBBLE, SCATTER and TEXT statements
- Map polygons drawn with CHOROMAP can be overlaid on Open Street Map and Esri background maps. Submit the CHOROMAP statement second to draw it on top.
- The CHOROMAP statement always uses the variables named X and Y in the map data set to draw the map polygons.
- All plot and map data locations ***must*** be in the same coordinate system.
- Both OPENSTREETMAP and ESRIMAP ***require*** unprojected latitude/longitude point locations in the plot data set. The map is sized to contain all the point data.
- If the SAS/GRAPH MAPSGFK library is not installed at your site, you can download the older MAPS library from SAS Maps Online. The MAPDATA= option and CHOROMAP can draw polygon maps with those.
- The MAPIMPORT procedure can import shapefiles for use with MAPDATA= and CHOROMAP to draw polygonal maps.

SAS 9

SGMAP Procedure Tip Sheet

This tip sheet is a quick reference guide for frequently used information on the SGMAP procedure introduced in SAS 9.4M5.

SGMAP is the latest addition to the SG procedures in Base and is available in the SAS University Edition.

The SGMAP procedure allows you to easily plot data onto a map. The base map can be polygons from a SAS map data set or a background map from Esri™ or OpenStreetMap® (OSM).

You can also overlay SAS map polygons onto an OSM or Esri background map. The polygons can be outlines or display response values.

Mapping Basics

Resources – SAS® Blog Posts and Social Media

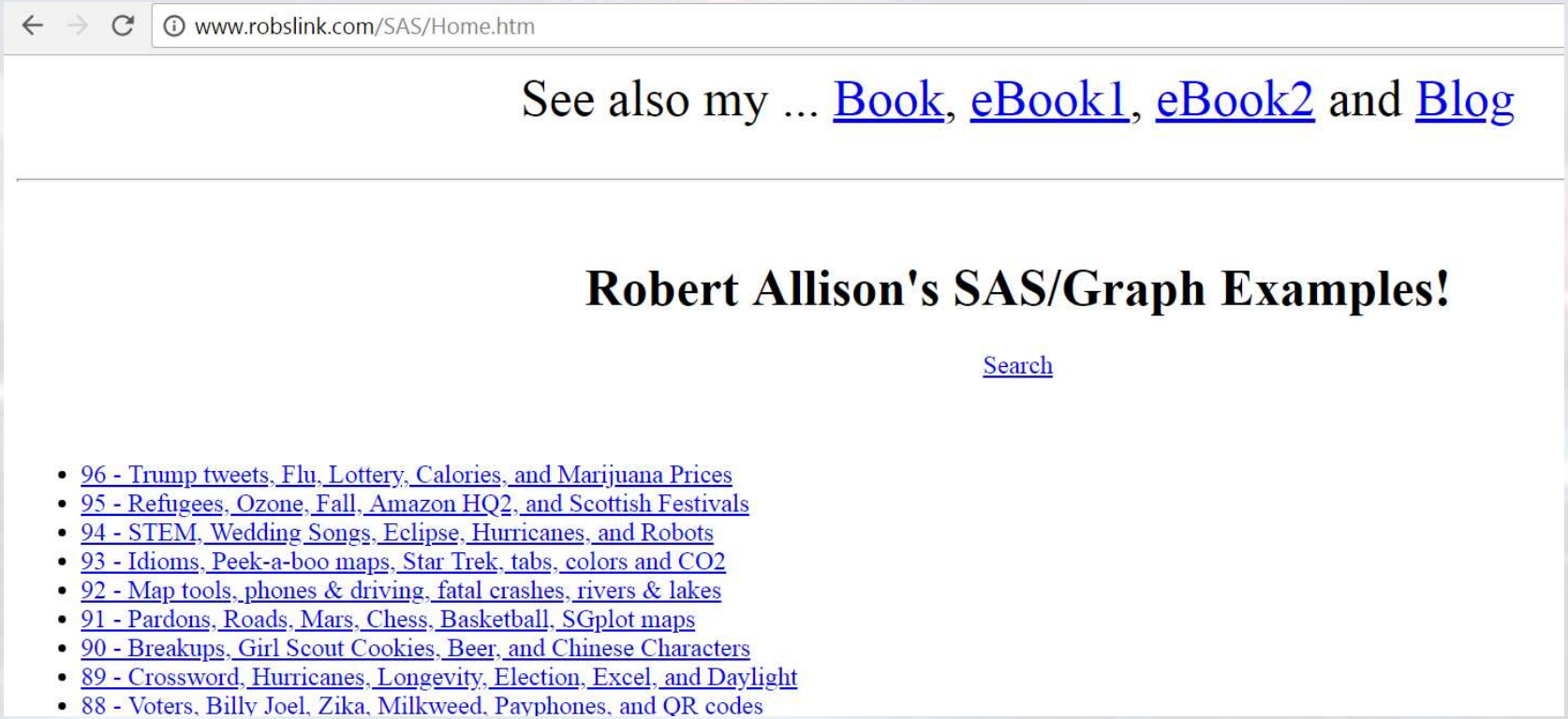
- Sanjay Matange's Blog Posts and Web Page
- Robert Allison's Blog Posts and Web Page
- SAS Communities
- LinkedIn
- Google
- Github
- Regional and Specialty Groups

Mapping Basics

Resources – SAS® Blog Posts and Social Media

Mapping Basics

Resources – SAS® Blog Posts and Social Media



Mapping Basics

Resources – SAS® Blog Posts and Social Media

Author

Robert Allison

The Graph Guy!

Robert has worked at SAS for over 25 years, and is perhaps the foremost expert in creating custom background is in Computer Science, and he holds a BS, MS, and PhD from NC State University. He won a few graphic competitions, and has written a book (SAS/GRAPH: Beyond the Basics).

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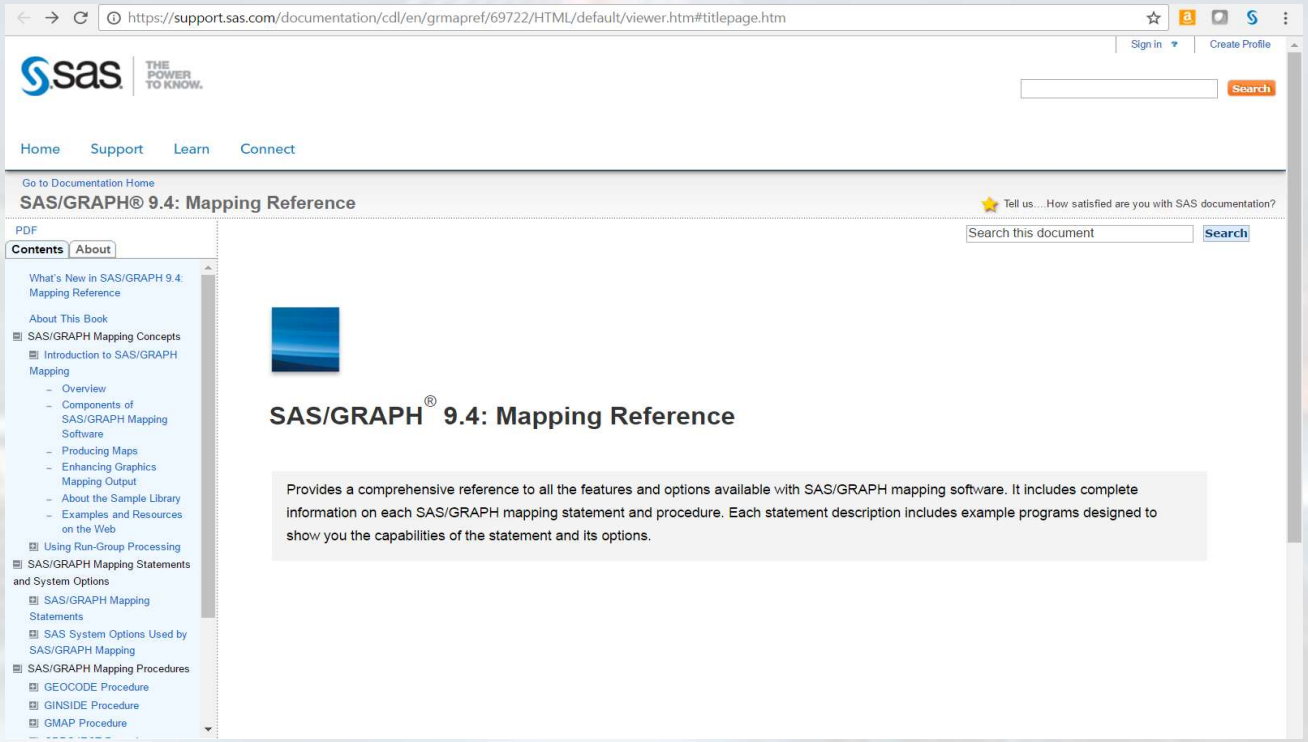
Mapping Basics

Resources – SAS Software

- Map Data Sets provided by SAS
  - Traditional Map Data Sets
    - LIBNAME MAPS (MAPSSAS);
  - GfK Map Data Sets
    - LIBNAME MAPS (MAPSGFK);
  - SASHelp Data Sets
    - SASHELP.ZIPCODE, etc.
  - External Map Data Sets SAS can access (ESRI shapefiles, OpenStreetMap, etc.)

Mapping Basics

Resources – SAS Doc



Mapping Basics

Resources – SAS software

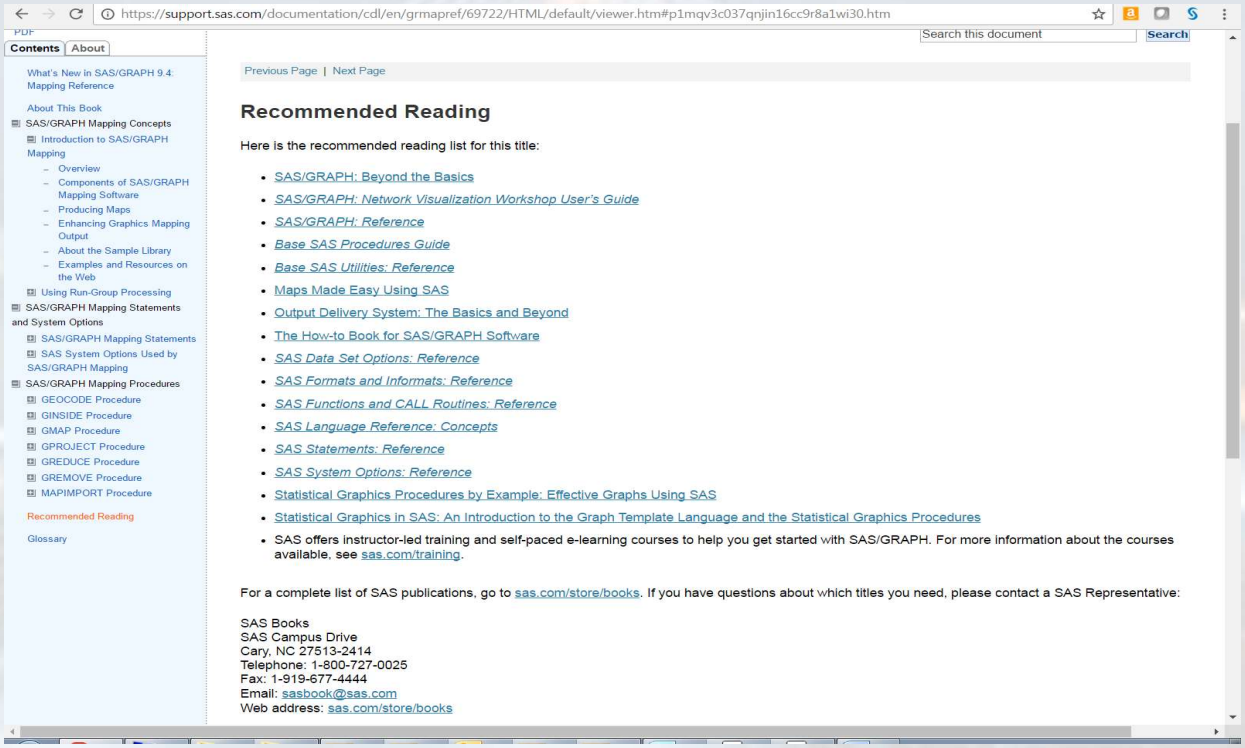
- SAS documentation (support.sas.com)

  https://support.sas.com/documentation/cdl/en/grmapref/69722/HTML/default/titlepage.htm (HTML) and https://support.sas.com/documentation/cdl/en/grmapref/69722/PDF/default/grmapref.pdf (PDF)

- SAS Maps Online
  - Your primary resource for SAS map data sets and other important information
- SAS Tip Sheets

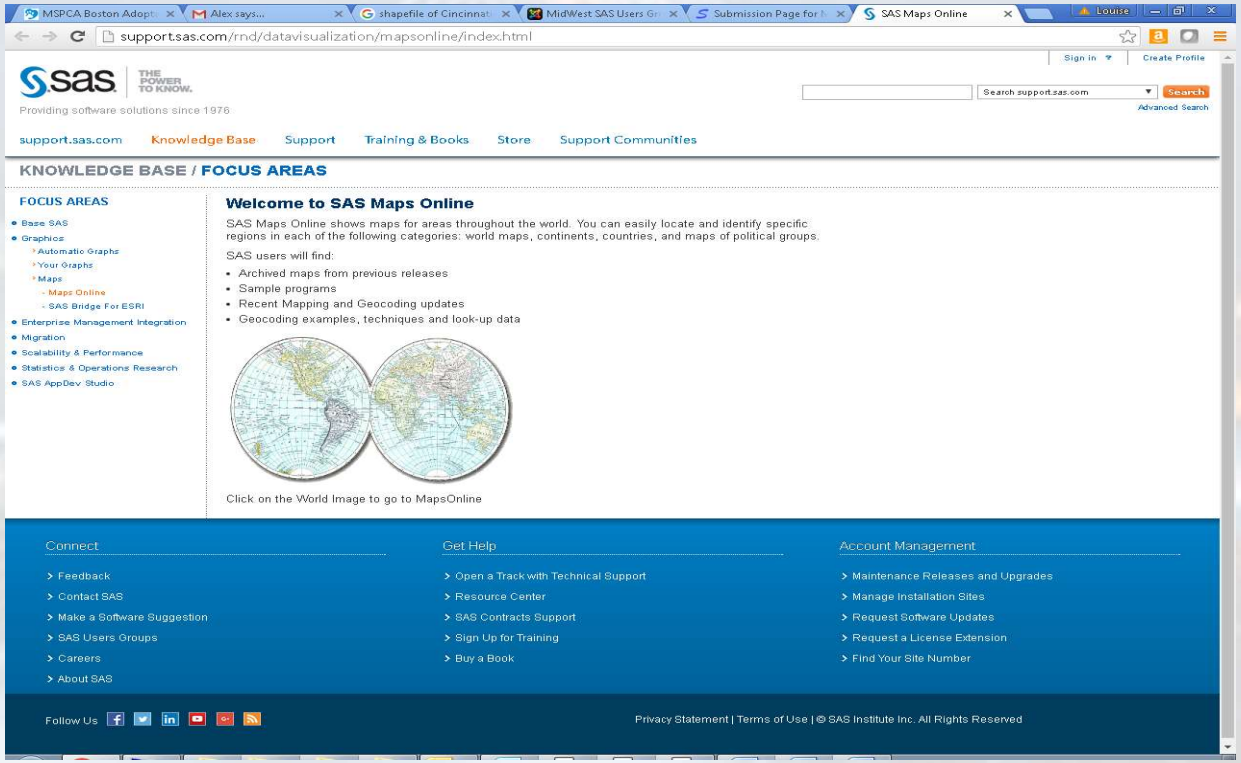
Mapping Basics

Resources – Recommended Reading



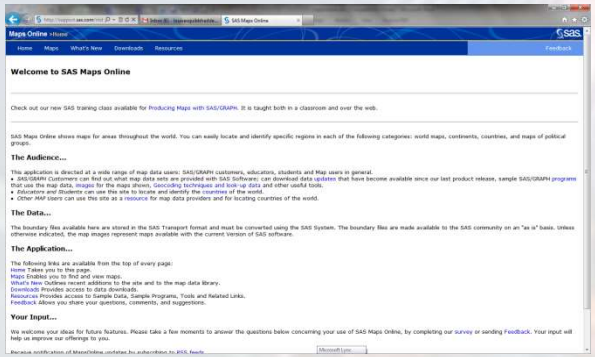
Mapping Basics

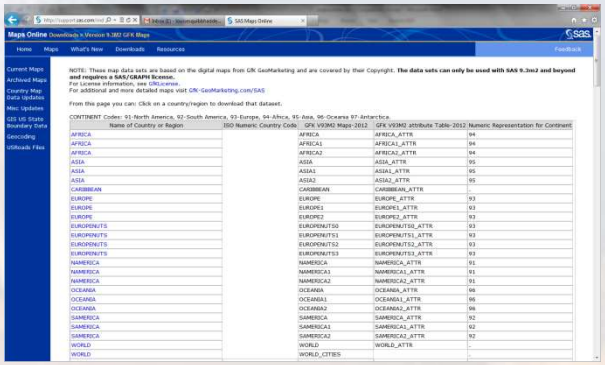
Resources – SAS MAPS Online

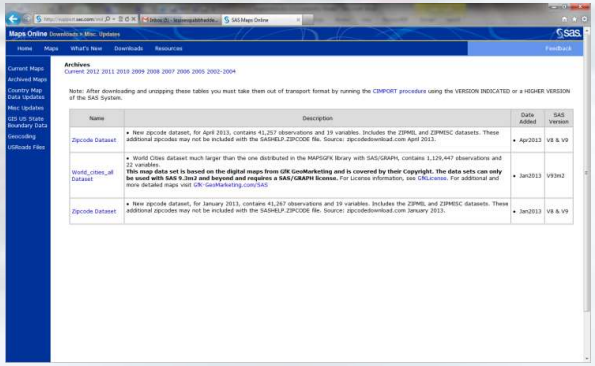


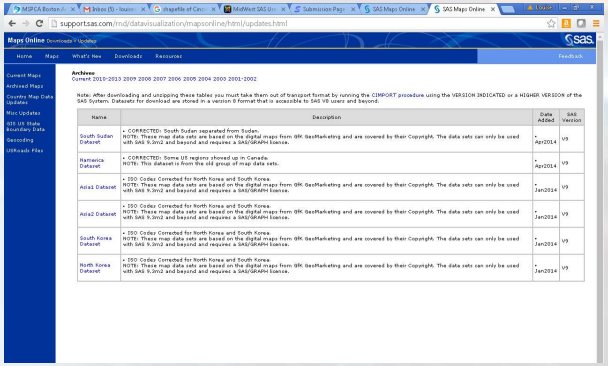
Mapping Basics

Resources – SAS MAPS Online









Mapping Basics

Resources – SAS® Software

- Macros, Functions and Formats, Oh My
  - Macros: %sganno, %centroid, %geodist
  - Geographic Functions: ZIPCITY, ZIPSTATE, ZIPNAME, ZIPNAMEL, ZIPFIPS, ZIPCITYDIST() and GEODIST()
  - SASHELP.MAPFMTS

Mapping Basics

Resources – Mapping Macros

- %sganno
  - %sgimage
  - %centroid
- %geodist

Mapping Basics

Resources – Mapping Macros

```
/* calculate the distance between two zip code centroids */
%macro geodist(lat1,long1,lat2,long2);
   %let pi180=0.01745329251994333;
   7921.6623*arsin(sqrt((sin((&pi180*&lat2-
   &pi180*&lat1)/2))**2+
   cos(&pi180*&lat1)*cos(&pi180*&lat2)*
   (sin((&pi180*&long2-&pi180*&long1)/2))**2));
%mend;
```

Mapping Basics

Resources – Geographic Functions

- ZIPCITY('02138') returns 'Cambridge, MA'
- ZIPSTATE('02138') returns 'MA'
- ZIPNAME('02138') returns 'MASSACHUSETTS'
- ZIPNAMEL('02138') returns 'Massachusetts'
- ZIPFIPS('02138') returns 25 (FIPS state code for Massachusetts)

Mapping Basics

Selected SAS® procedures related to mapping

- Some BASE SAS procedures that create a map
  - PROC GMAP – SAS/GRAPH
  - PROC SGPLOT with a POLYGON statement – BASE SAS
  - PROC SGMAP – BASE SAS
- Other selected important graphics procedures
  - PROC MAPIMPORT, PROC GREDUCE*, PROC GREMOVE*, PROC GPROJECT*
- Important geography-related procedures
  - PROC GEOCODE, PROC GINSIDE**, PROC GREPLAY***

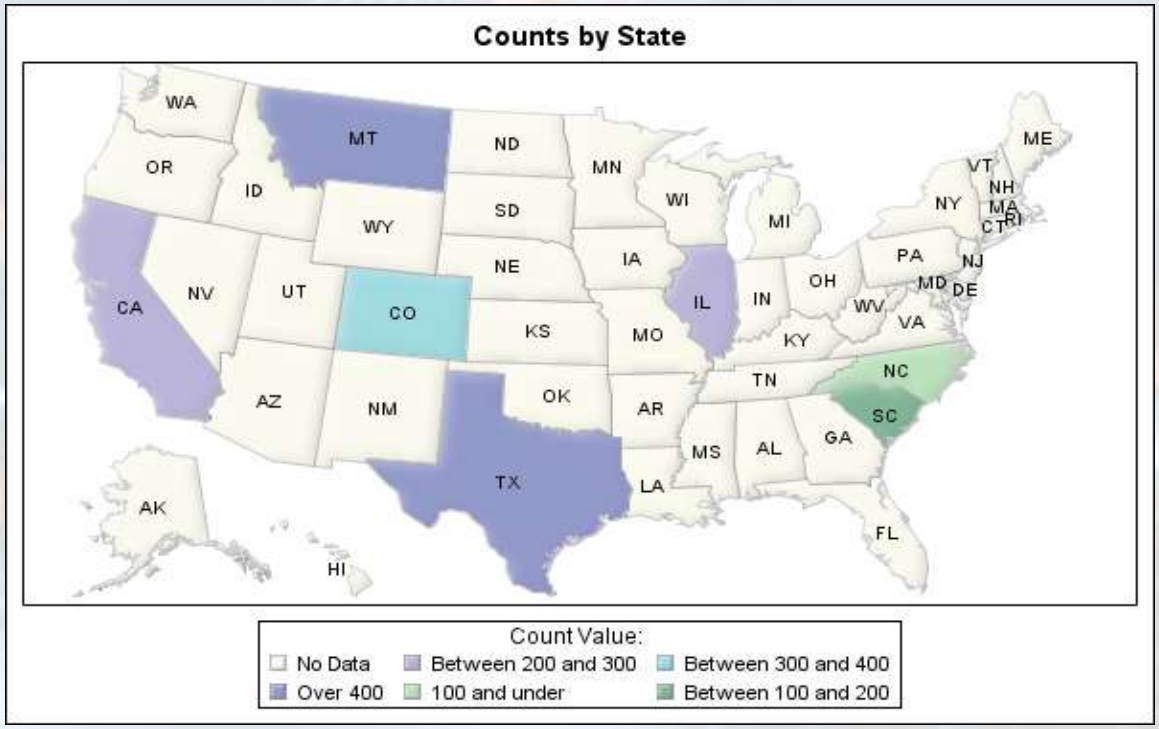
Mapping Basics

Mapping Concepts for Creating Maps with Base SAS

- Map data sets
- Outputting maps
  - Devices, ODS and style templates
- Annotation
- Graphics editing (GTL)

Examples

PROC SGPLOT with a Polygon Statement



Examples

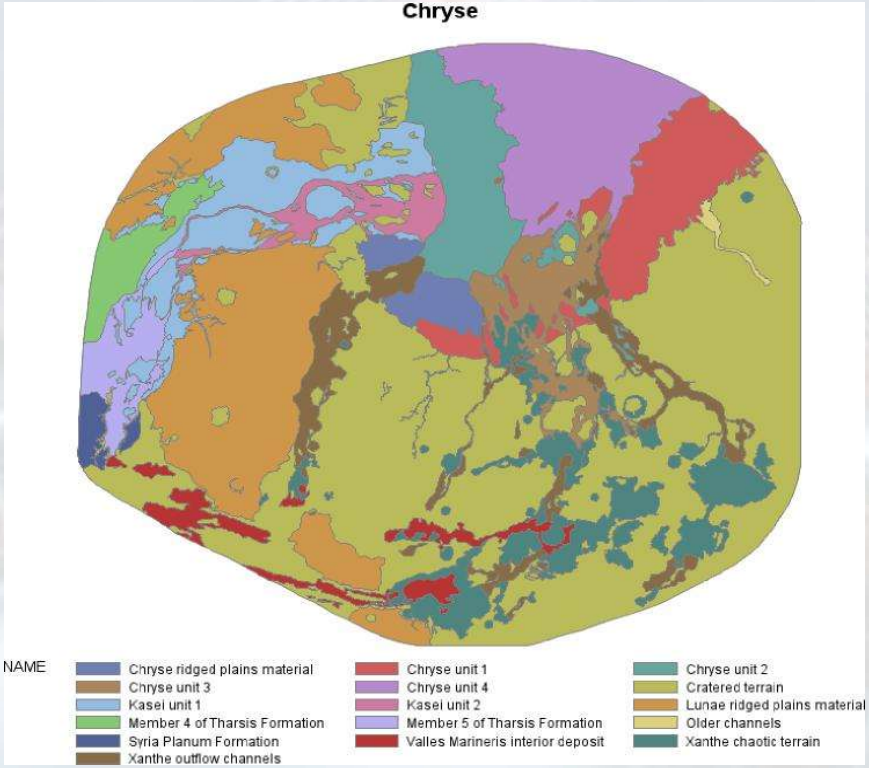
PROC MAPIMPORT

Basic syntax for PROC MAPIMPORT:

```
PROC MAPIMPORT
      OUT=map-data-set
      DATAFILE='path-to-shapefile '
      <CONTENTS>
      <CREATE_ID_> ;
      <SELECT> 'field-identifier(s)';
      <EXCLUDE> 'field-identifier(s)';
RUN;
```

Examples

PROC MAPIMPORT



Examples

SASHELP.ZIPCODE

- The SASHELP.ZIPCODE file is a SAS data set containing ZIPCODE level information for the United States
- The file is indexed on ZIPCODE to facilitate processing
- The source of the zip code data in the file is http://www.zipcodedownload.com/
- Updates are free to licensed SAS users as a SAS transport file through SAS MAPS Online.

Examples

Zip Code Processing using SASHELP.ZIPCODE

```
DATA zip2msa (RENAME=(zipcode=start msacode=label));
    RETAIN fmtname '$zip2msa' type 'c' hlo=' ';
    SET sashelp.zipcode END=last;
    Msacode=PUT(msa,z4.);
    Zipcode=PUT(zip,z5.);
    IF last THEN hlo='h';
RUN;
PROC FORMAT LIBRARY=library CNTLIN=zip2msa;
RUN;
```

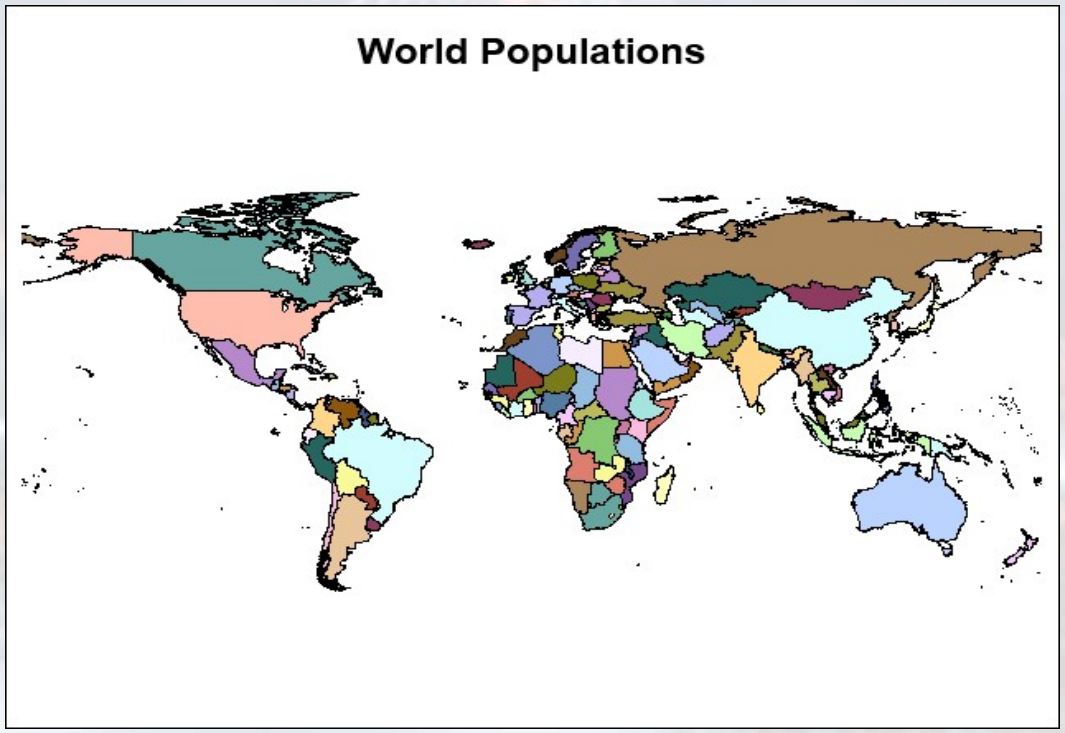
Examples

PROC SGMAP #1

```
PROC SGMAP MAPDATA=maps.world
MAPRESPDATA=sashelp.demographics;
   CHOROMAP popUrban / MAPID=id ID=id;
RUN;
```

Examples

PROC SGMAP #1



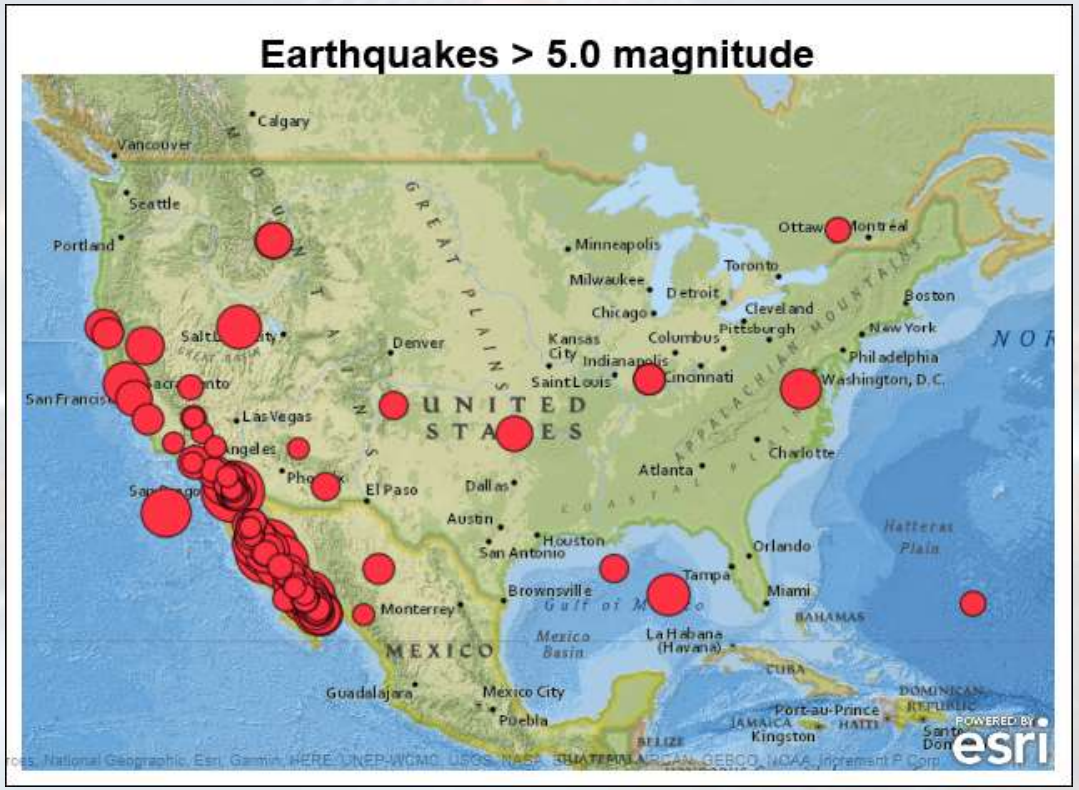
Examples

PROC SGMAP #2

```
DATA major_quakes;
   SET sashelp.quakes (WHERE=(magnitude>5.0));
RUN;
PROC SGMAP PLOTDATA=major_quakes;
     ESRIMAP URL='http://services.arcgisonline.com/
      arcgis/rest/services/NatGeo_World_Map';
TITLE H=2 'Earthquakes > 5.0 magnitude';
BUBBLE X=longitude Y=latitude SIZE=magnitude /
FILLATTRS=(COLOR=cxff3344);
RUN;
```

Examples

PROC SGMAP #2



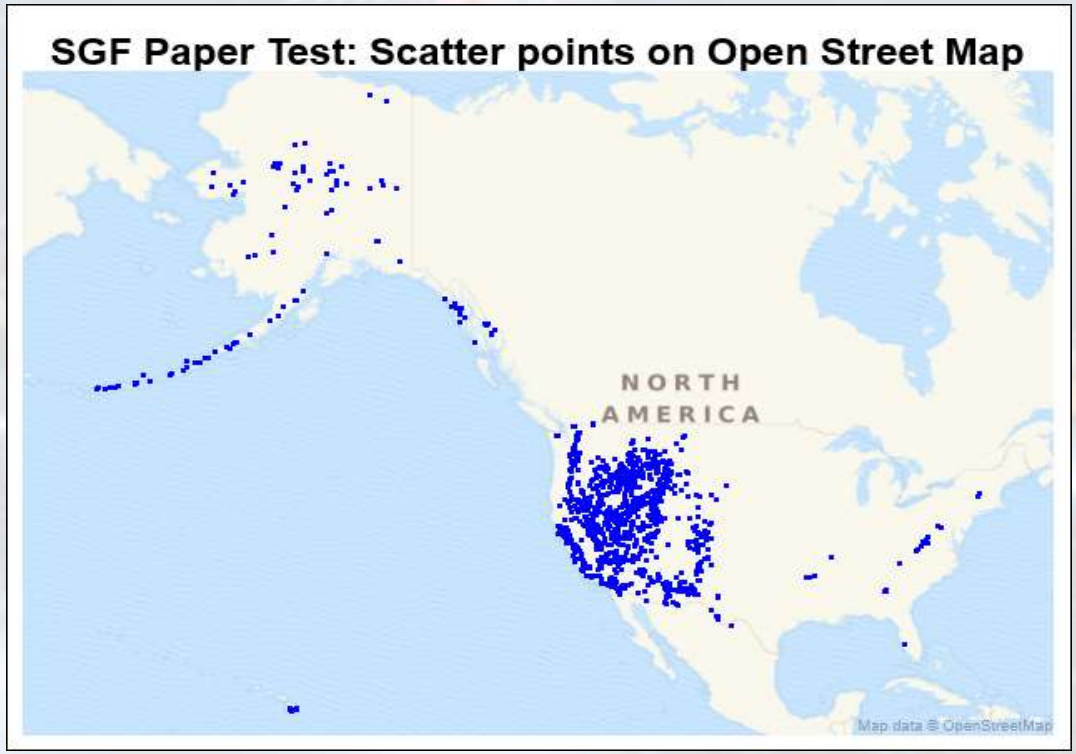
Examples

PROC SGMAP #3

```
PROC SGMAP PLOTDATA=sashelp.springs;
TITLE H=2 'SGF Paper Test: Scatter points on Open Street Map';
   OPENSTREETMAP;
   SCATTER X=longitude Y=latitude /
   MARKERATTRS=(COLOR=blue SIZE=3
   SYMBOL=circlefilled);
RUN;
```

Examples

PROC SGMAP #3



Conclusion

SAS has always been at the forefront of data visualization, from the days of SAS/GIS, ESRI bridge to SAS, SAS/GRAPH, and now with the SG procedures, SAS Visual Analytics, and SAS Viya. I feel privileged to have taken this journey with co-authors and my mentors. SAS has provided programmers with a vast array of tools to make beautiful maps – and those tools continue to evolve. I hope some of the examples in this paper inspire others to explore the unlocked potential of PROC SGMAP along with me.

Acknowledgements

- The author wishes to acknowledge Darrell Massengill (retired), Liz Simon and Robert Allison of SAS who work tirelessly to improve and facilitate the use of SAS/GRAPH and mapping with SAS and maintain the SAS MAPS ONLINE site; Ed Odom, Dan Heath, and Sanjay Matange who are ushering in a new era of mapping with base SAS and the SG procedures; Mike Zdeb and Barbara Okerson, extraordinary mapping gurus; and Rick Andrews of CMS.

Contact Information

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