

ZIP Code 411: Decoding SASHELP.ZIPCODE

and Other SAS® Maps Online Mysteries

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ABSTRACT

SAS® provides a very useful file called SASHELP.ZIPCODE. This file is relatively unknown and under-utilized. This paper explores current and potential uses of the file, as well as how to update the file on a quarterly basis by accessing SAS MAPS ONLINE. The authors also provide a walk-through of several programming projects that they have recently conducted. Data and programming resources provided by SAS and other sources are highlighted.

INTRODUCTION

SAS MAPS ONLINE is the source of many helpful SAS provided files, including SASHELP.ZIPCODE. This paper will describe the SASHELP.ZIPCODE file, detail how to acquire and update the file, explore some of the many potential uses of the file, and briefly explore some other files, programs and helpful links available on the SAS MAPS ONLINE page.

WHAT IS SASHELP.ZIPCODE?

The SASHELP.ZIPCODE file is a SAS data set containing ZIPCODE level information for the United States including ZIPCODE centroids (x, y coordinates), Area Codes, city names, FIPS codes, and more. The file is indexed on ZIPCODE to facilitate processing, and is updated on a regular basis by SAS. It is provided in transport format so that installations with dissimilar releases of SAS and operating systems can make use of the file. The source of the zip code data in the file is <http://www.zipcodedownload.com/>, which is a subscription service that users can purchase. It is available for free to licensed SAS users as a SAS data set through SAS MAPS Online.

A content listing of a recent (OCT09) file is provided below. SAS periodically adds variables to the file to aid users. SAS 9.2 ships with the latest versions of the SASHELP.ZIPCODE file, SASHELP.MAPFMTS file, and all SAS-provided maps.

Contents of SASHELP.ZIPCODE file				
Variables in Creation Order				
#	Variable	Type	Len	Format Label
1	ZIP	Num	8	Z5. The 5-digit ZIP Code
2	Y	Num	8	11.6 Latitude (degrees) of the center (centroid) of ZIP Code.
3	X	Num	8	11.6 Longitude (degrees) of the center (centroid) of ZIP Code.
4	ZIP_CLASS	Char	1	ZIP Code Classification: P=PO Box U=Unique zip used for large orgs/businesses/bldgs Blank=Standard/non-unique
5	CITY	Char	35	Name of city/org
6	STATE	Num	8	Two-digit number (FIPS code) for state/territory
7	STATECODE	Char	2	Two-letter abbrev. for state name.
8	STATENAME	Char	25	Full name of state/territory
9	COUNTY	Num	8	FIPS county code.
10	COUNTYNM	Char	25	Name of county/parish.
11	MSA	Num	8	Metro Statistical Area code by common pop-pre 2003; no MSA for rural
12	AREACODE	Num	8	Single Area Code for ZIP Code.
13	AREACODES	Char	12	Multiple Area Codes for ZIP Code.
14	TIMEZONE	Char	9	Time Zone for ZIP Code.
15	GMTOFFSET	Num	8	Diff (hrs) between GMT and time zone for ZIP Code
16	DST	Char	1	ZIP Code obeys Daylight Savings: Y=Yes N=No
17	PONAME	Char	35	USPS Post Office Name: same as City
18	ALIAS_CITY	Char	300	Alternate names of city separated by

For users with SAS version 9 and above, the SASHELP.ZIPCODE file is located in your SASHELP folder, and may be accessed by using SASHELP as the library reference, just as you would access SAS map data sets by using MAPS as the library reference. For PC-SAS installations, the SASHELP folder is usually located at: C:\Program Files\SAS\SASFoundation\9.2\core\sasHELP. Updated versions of SASHELP.ZIPCODE and SAS map data sets may also be obtained from SAS MAPS ONLINE for versions 8 and above.

SOME POTENTIAL USES OF SASHELP.ZIPCODE

Don't be intimidated by the fact that the data set is maintained by the SAS MAPS ONLINE staff! The file can be and is used by SAS for more than mapping. The SASHELP.ZIPCODE FILE can be used to enable SAS-written functions, calculate distances between zip codes, to annotate SAS/GRAPH maps with information in the file, to develop user-defined formats, and much, much more. If you do not have a current ZIPCODE file in your SASHELP subdirectory, these uses are not possible!

SASHELP.ZIPCODE IS THE BASIS OF ZIP GEOGRAPHIC FUNCTIONS

9.1 SAS-written functions utilizing the SASHELP.ZIPCODE file include ZIPCITY, ZIPSTATE, ZIPNAME, ZIPNAMEL and ZIPFIPS. For example, the ZIPCITY function takes ZIPCODE as its argument and returns a proper case city name and a two character postal state abbreviation.

ZIPCITY('02138') returns 'Cambridge, MA'

ZIPSTATE('02138') returns 'MA'

ZIPNAME('02138') returns 'MASSACHUSETTS'

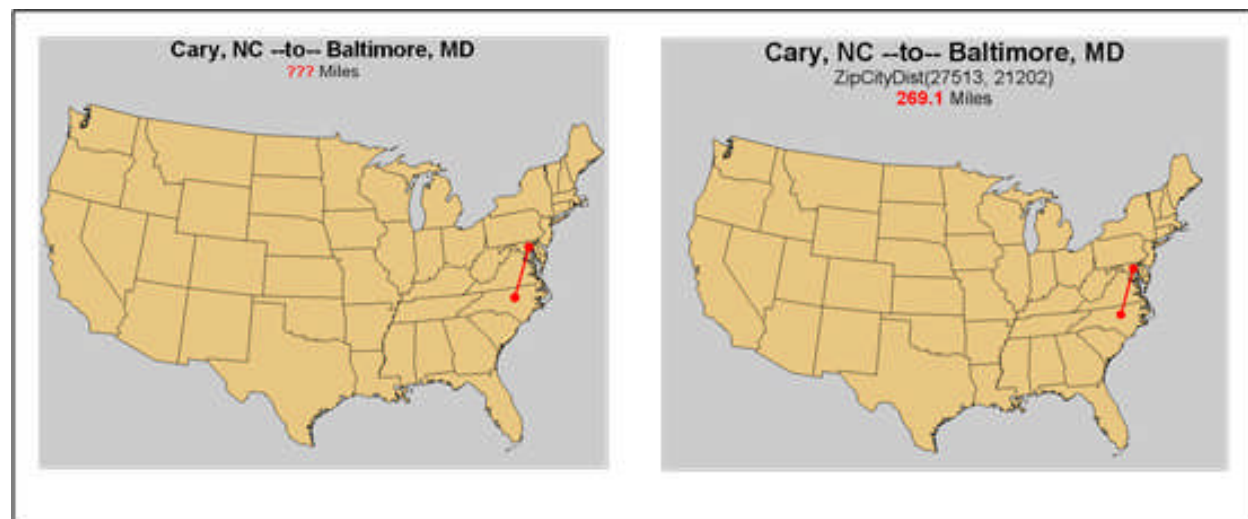
ZIPNAMEL('02138') returns 'Massachusetts'

ZIPFIPS('02138') returns 25 (FIPS state code for Massachusetts)

The SASHELP.ZIPCODE file can also be used to calculate distances between Zip Code centroids in 8.2 and 9.1. support.sas.com has provided an example of this use at <http://support.sas.com/techsup/unotes/SN/005/005325.html>.

```
/* calculate the distance between zip code centroids */

%macro geodist(lat1, long1, lat2, long2);
%let pi180=0.0174532925199433;
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;
```



In 9.2, SAS builds on this functionality by adding new functions and procedures. In 9.1, SAS did not provide any functions to calculate distance between longitude and latitude pairs, but this changes with the addition of the

ZIPCITYDIST() and GEODIST() functions in 9.2. ZIPCITYDIST() calculates the number of miles between 2 US Zip Codes. GEODIST() allows the user to specify 2 sets of longitude and latitude coordinates, and calculates the distance between the pairs. You can specify the units for the results, such as miles or kilometers. ZIPCITYDIST() only works on US Zip Codes, while GEODIST() can be used for coordinates anywhere around the globe. The example above shows the use of both new functions.

```
%let zip1=27513;
%let zip2=21202;

/* latitude and longitude coordinates */

proc sql;
create table zip1 as select * from sashelp.zipcode where zip=&zip1;
create table zip2 as select * from sashelp.zipcode where zip=&zip2;
select x into :long1 from zip1;
select y into :lat1 from zip1;
select x into :long2 from zip2;
select y into :lat2 from zip2;
quit; run;

%let city1=%sysfunc(zipcity(&zip1));
%let city2=%sysfunc(zipcity(&zip2));

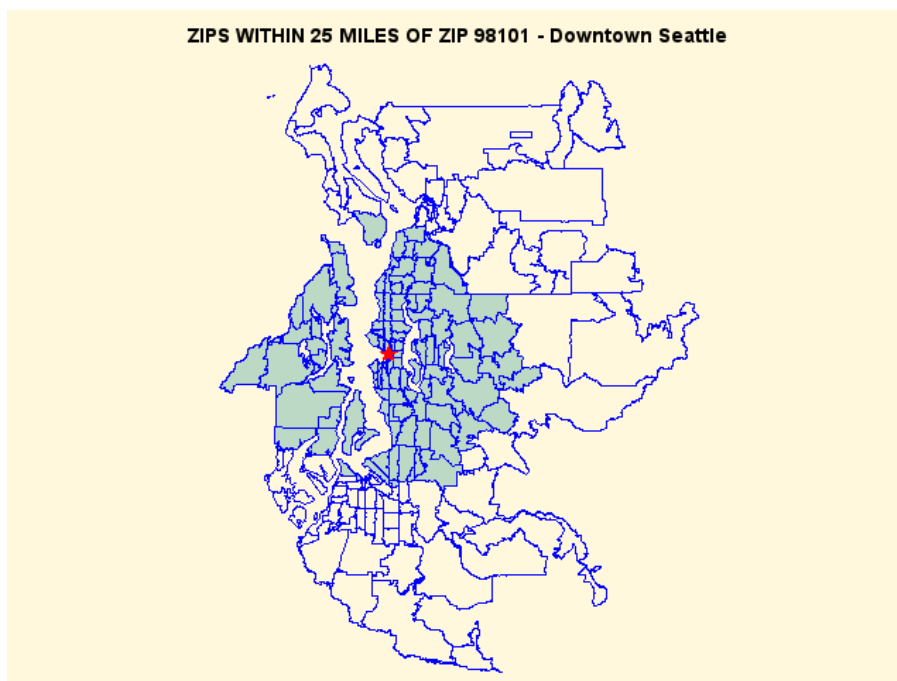
/* two new 9.2 functions */

%let zipdist=%sysfunc(zipcitydistance(&zip1,&zip2));

%let geodist=%sysfunc(geodist(&lat1, &long1, &lat2, &long2, 'M'),comma10.5);
```

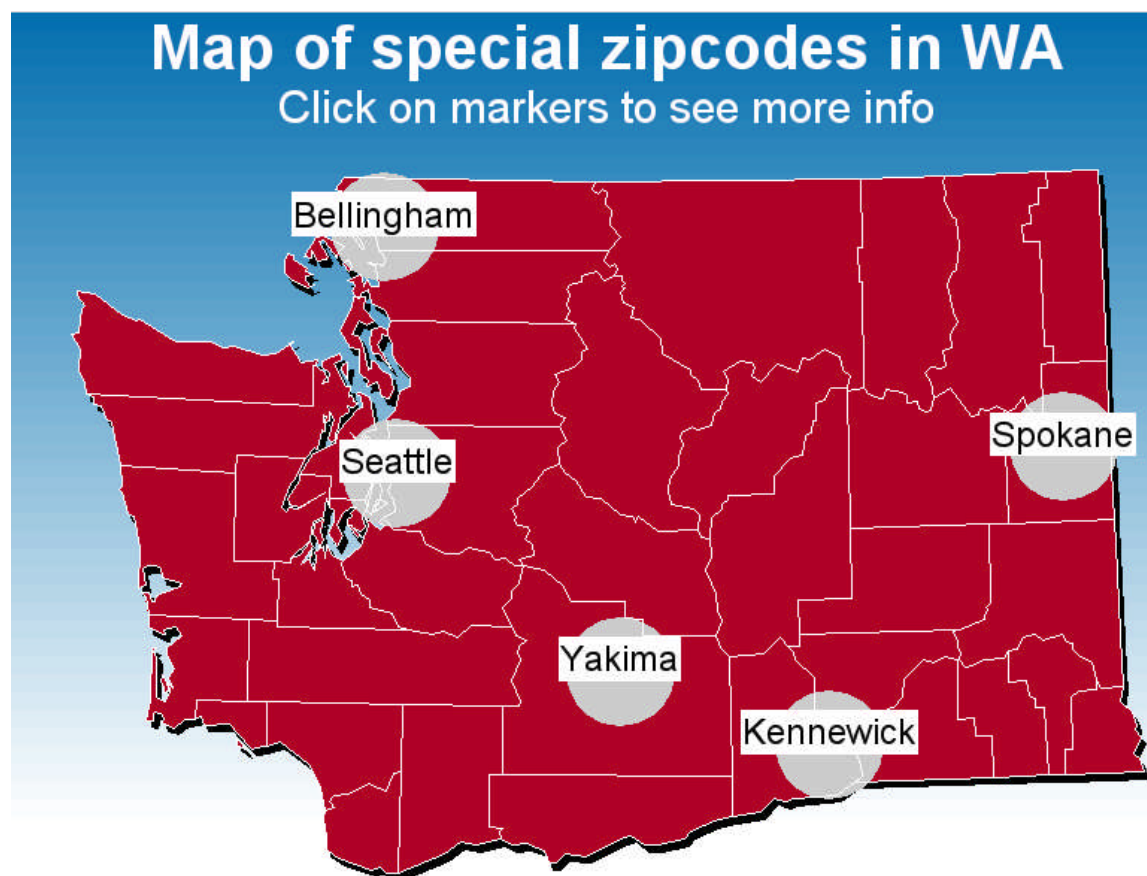
ZIPs WITHIN 25 MILES

The ZIPCITYDISC() function can be used in conjunction with PROC GMAP, PROC MAPIMPORT, Annotate and the SASHELP.ZIPCODE file to highlight zip codes within 25 miles (or the distance of your choice) from a central point (zip code.) The red star indicates the central zip code centroid. Such maps could be used to graphically demonstrate sales penetration in target areas, map out sales regions or delivery areas, etc. The program to create this map is located in a zip file on the paper's sascommunity.org page.



HIGHLIGHT SPECIAL ZIPS

Mike Zdeb and Robert Allison presented a similar sample (for the state of Pennsylvania) at a Hands-On Workshop at SUGI 30. PROC GMAP is used in combination with the Annotate facility to create a map of Washington with: fake transparent effects; 'shadows' behind the map; a gradient shaded background. The example starts with a fairly basic map, a county map, with Annotate markers and labels, based on longitude/latitude coordinates from SASHELP.ZIPCODE. Then, the all of the 'extras' listed above are added. The program to create this map is located in a zip file on the paper's sascommunity.org page.

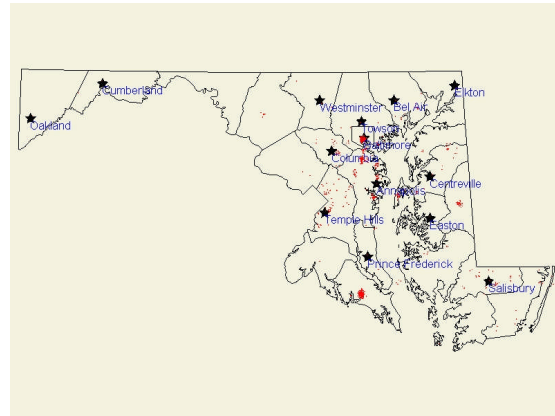
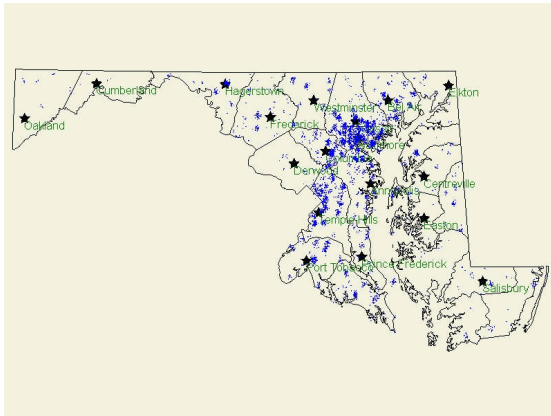


DOT DENSITY

An author's company is conducting a study involving counseling of Medicare enrollees. The project director wished to graphically display the location of beneficiaries by zip code separately from counseling locations to convey the disparity between where clusters of beneficiaries lived versus where clusters of beneficiaries were counseled. The mapping project involved using the zip code centroids provided in SASHELP.ZIPCODE in conjunction with a "dot density" mapping program supplied on the support.sas.com website written by Darrell Massengill to annotate county maps of various states. The program to create this map is located in a zip file on the paper's sascommunity.org page.

This type of map would be ideal to show sales penetration, sales, etc. The annotation (dots) can be color-coded and sized to match response data. The "dot density" effect is achieved by randomly distributing multiple records per zip code centroid with small adjustments.

Counseling Locations in Maryland



An author's company is conducting a study of beneficiaries in Medicare's Part D program. In order to sample participants for focus groups in selected communities, the project director wished to graphically present poverty rates on zip code level maps for given communities. The project involved obtaining FREE zip code level poverty data from Census 2000 data via Data Ferrett, another well-kept secret (<http://dataferrett.census.gov/>). FREE zip code ESRI shapefiles were obtained from the Bureau of the Census Cartographic Boundary Files web page (<http://www.census.gov/geo/www/cog/z52000.html>). SAS's PROC MAPIMPORT was used to import the zip code boundary maps for selected communities. Poverty data from Data Ferrett were collected for the same communities and combined with the SASHELP.ZIPCODE file to obtain zip code centroids. The poverty data were used to annotate zip codes in the various communities with poverty rates.

Map of the County of San Diego showing the distribution of the 2000 Census population by age group. The map is divided into 15 numbered regions, each with a corresponding percentage of the total population. The regions and their percentages are:

- 23604-10.1%
- 23607-37.7%
- 23605-12.6%
- 23601-10.2%
- 23606-8.8%
- 23602-8.7%
- 23608-10.0%
- 23603-5.8%

The project team was then able to select zip codes with predominantly low incomes close to the focus group facility for sampling. This type of map could be used to inform locations of residential, industrial and commercial developments, as well as target sales, etc. The program to create this map is located in a zip file on the paper's sascommunity.org page.

USER-DEFINED FORMATS

The variables in the SASHELP.ZIPCODE file can also be used to create user-defined formats. Potential user-written formats include: conversion of zip code to MSA code (and by extension, urban/rural status); conversion of zip code to FIPS county code; conversion of zip code to county name; conversion of zip code to latitude and longitude; conversion of zip code to telephone area codes; conversion of zip code to daylight savings time flag; and conversion of zip code to time zones.

Liz Simon of SAS MAPS ONLINE has also constructed a zip code utility file which includes CBSA and SSA State and County Codes. This file will be available shortly on the SAS MAPS ONLINE site, and will allow users to construct user-written formats to link zip codes to CBSA and SSA State and County. Some sample programs illustrating current uses of the file will also be provided on the SAS MAPS ONLINE site.

Example:

```

Data zip2msa (rename=(zipcode=start msacode=label));
  Set sashelp.zipcode end=last;
  Msacode=put(msa,z4.);
  Zipcode=put(zip,z5.);
  Retain fmtname '$zip2msa' type 'c' hlo=' ';
  If last then hlo='h';
Run;

Proc format library=library cntlin=zip2msa;
Run;

Data x;
  Length msacode $ 4;
  Zipcode='02138';
  Msacode=put(zipcode,$zip2msa.);
Run;

Proc print data=x;
Run;

```

Result:

Obs	msacode	Zipcode
1	1120	02138

IF YOU ARE SOLD ON SASHELP.ZIPCODE, HERE'S WHERE TO GO: SAS MAPS ONLINE

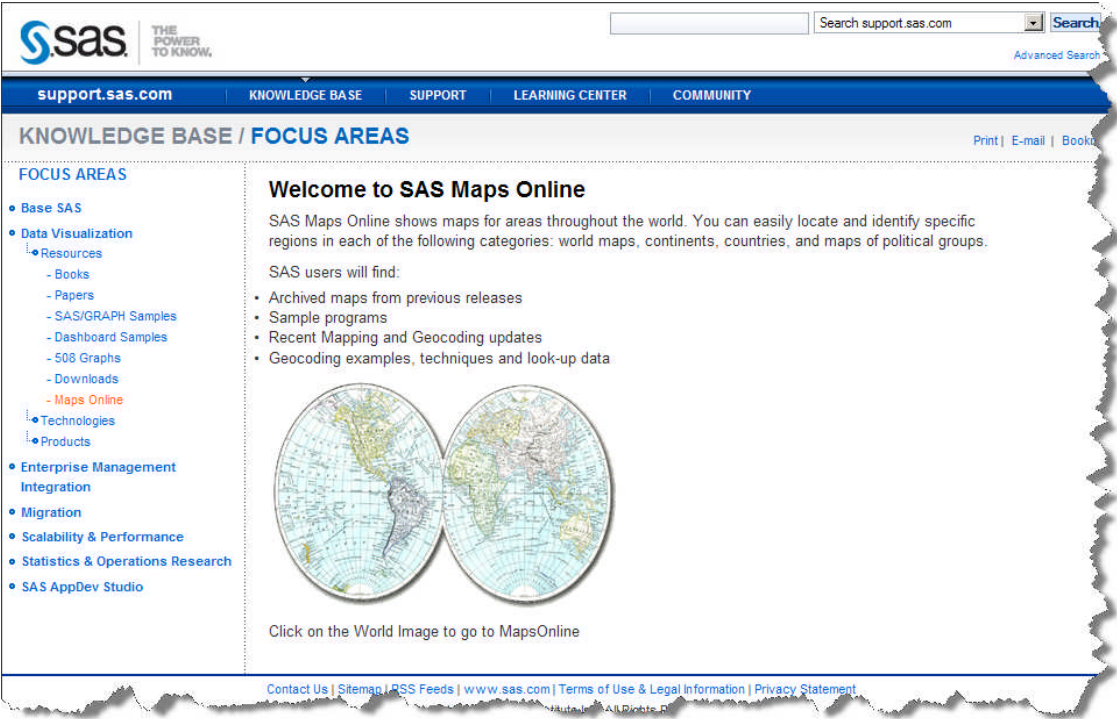
SAS MAPS ONLINE is a SAS-provided web page with a number of useful tools regarding mapping, including map data sets and updates, related data sets (such as SASHELP.ZIPCODE and WORLDCTS), and sample programs. SAS MAPS ONLINE archives older map data sets and versions of SASHELP.ZIPCODE so that users can match their response data appropriately. The files do change over time so it is important to visit SAS MAPS ONLINE on a regular basis to download newer versions of files, or, you may wish to download an older file which matches the timing of your response data. Or maybe you'd just like to see the cool new samples that are available.

You can subscribe to an RSS feed so that you will be notified of updates.

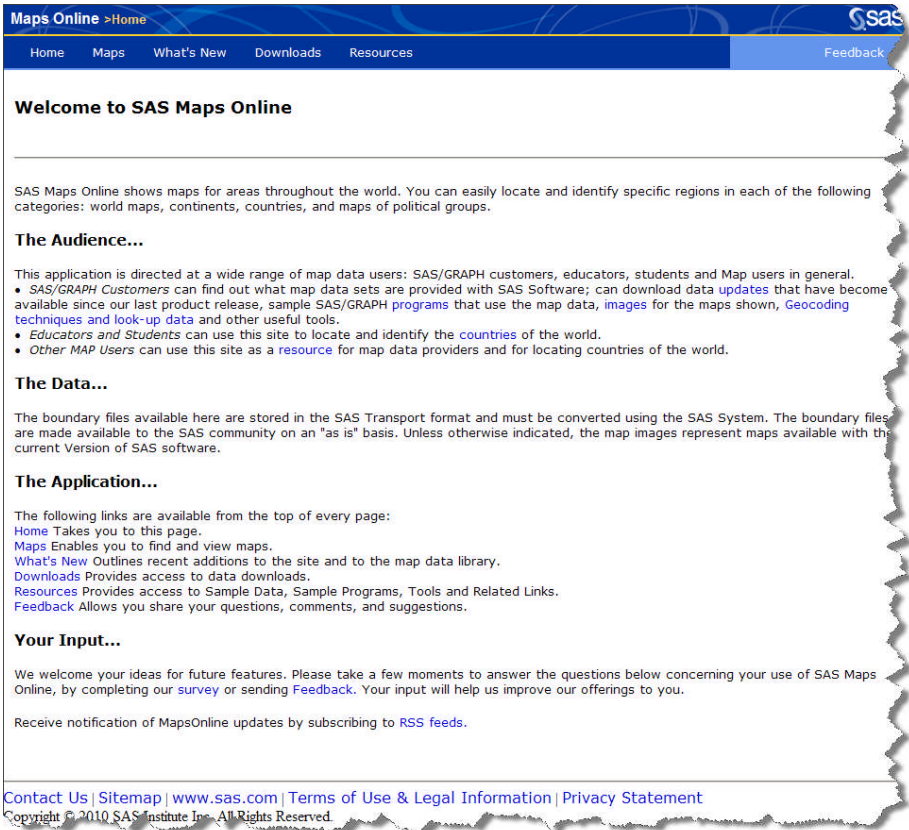
SAS MAPS ONLINE is located on the support.sas.com page, at:
<http://support.sas.com/rnd/datavisualization/mapsonline/>.

NAVIGATING SAS MAPS ONLINE

Clicking on the link above leads you to the SAS MAPS ONLINE home page, seen below. Clicking on the map of the world will lead to numerous SAS treasures. This paper will primarily deal with downloads and sample programs, but other aspects of the site are well-worth exploring.



Note the link to subscribe to RSS feeds below. This is highly recommended so that you will be aware of updates to the site (in particular, when a new version of the SASHELP.ZIPCODE file is available!)



HOW TO GET OR UPDATE YOUR COPY OF SASHELP.ZIPCODE

To obtain a new (or older) version of SASHELP.ZIPCODE, navigate to Downloads -> Misc. Updates and click on the Zipcode Dataset link. Note the availability of archives, which allows the user to choose data sets to match their response data. Liz Simon of SAS has also provided a sample program (available in the accompanying zip file in the Proceedings) which allows users to CIMPORT the data set(s) for your platform and version of SAS and update an existing SASHELP.ZIPCODE file. This program is designed for users running Version 8 and up. You will need administrator rights to update the SASHELP.ZIPCODE file, or will need to ask your SAS administrator to update the file for you. You are free to install in a directory of your choice that you have write access to and reference the file from there. This file is NOT automatically updated with the SAS Hotfixes. The zip file that contains the updated SASHELP.ZIPCODE transport file also contains some programs to add some additional SAS datasets that come in the Transport file. These datasets contain military zip code and alias information.

Maps Online

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Country Map
Data Updates
Misc Updates
GIS US State
Boundary Data
Geocoding

Archives

Current200920082007200620052002-2004

Note: After downloading and unzipping these tables you must take them out of transport format by running the [CIMPORT procedure](#) using the VERSION INDICATED or a HIGHER VERSION of the SAS System.

Name	Description	Date Added	SAS Version
Zipcode Dataset	New zipcode dataset, for January 2010, contains 41,521 observations and 18 variables. Includes the ZIPMIL and ZIPMISC datasets. These additional zipcodes may not be included with the SASHELP.ZIPCODE file. Source: zipcodedownload.com January 2010.	Jan2010	V8 & V9

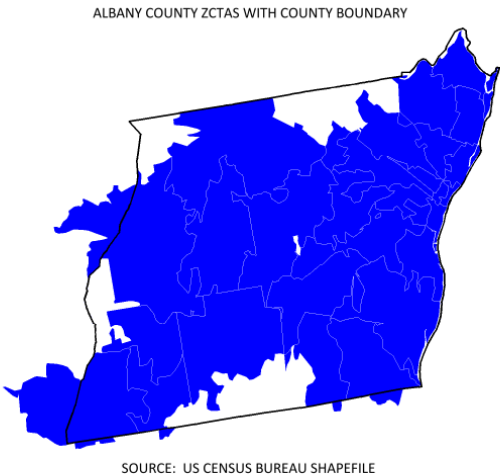
The zip file that contains the updated SASHELP.ZIPCODE transport file also contains some programs to add some additional SAS datasets that come in the Transport file. These datasets contain military zip code and alias information.

Name	Type	Modified	Size	Ratio	Packed	Path
zipcode_jan10.cpt	CPT File	1/28/2010 2:04 PM	6,441,600	78%	1,414,...	
zipmil_add.sas	SAS System ...	3/20/2008 10:54 AM	578	53%	271	
Readmecpt.txt	Text Document	11/29/2005 11:53 AM	531	41%	313	
ReadmeSAS.txt	Text Document	10/29/2002 3:50 PM	361	39%	221	
zipcode_alias.sas	SAS System ...	7/18/2007 10:56 AM	807	62%	307	
zipcode_jan10_v9.cpt	CPT File	2/2/2010 1:18 PM	6,441,600	78%	1,414,...	
ReadmeZip.rtf	Rich Text Fo...	2/2/2010 1:53 PM	33,879	78%	7,585	

UPDATE SASHELP.ZIPCODE FOR MULTI-COUNTY ZIPS

SAS MAPS ONLINE also provides code for those who want to create their own version of the SASHELP.ZIPCODE file with geographic data or update the file. The SASHELP.ZIPCODE file contains unique records for zip code, while zip codes may (for example) span counties and/or states, as shown in the example to the right.

In such cases, there is little information as to which part of a zip code area is predominant; however, this data is available on the web. Users may wish to update their copy of SASHELP.ZIPCODE to adjust for such instances.



The program to create this map is located in a zip file on the paper’s sascommunity.org page and is also included in this thread on SASCommunity.org: http://www.sascommunity.org/wiki/County_Validation_of_ZIP_Codes.

Updates to the SASHELP.ZIPCODE file occur on a quarterly basis. Occasionally a user may wish to perform more frequent updates. SAS provides code required to perform an update with a third party file and recommendations as to how to best accomplish this : <http://support.sas.com/community/newsletters/news/feature/2q2007/zipcode.html>.

REASONS FOR MAINTAINING AN UPDATED VERSION OF SASHELP.ZIPCODE

Zip Codes are occasionally reassigned by the US Postal Service, just to reinforce the need for maintaining an updated version of the SASHELP.ZIPCODE file. The two Wake County maps graphically demonstrate how Zip Code 27523 was used for the city of Eagle Rock (central Wake County, NC) a few years ago, and as of the writing of this paper, it is used for the city of Apex (in western Wake County, NC.)



As discussed above, SAS also uses SASHELP.ZIPCODE as the basis of some geographic functions. In the example above, an older version of SASHELP.ZIPCODE would return the value “Eagle Rock” for the ZIPCITY function for zip code 27523, while using the newer version of SASHELP.ZIPCODE with ZIPCITY and the zip code 27523 would yield “Apex.” Similarly, distance calculations accomplished with ZIPCITYDIST would be incorrect using an older version of SASHELP.ZIPCODE.

THE WORLD IS NOT ENOUGH! OTHER SAS MAPS ONLINE TREASURES

As well as the current and archived SASHELP.ZIPCODE files, SAS MAPS ONLINE has a wealth of useful datasets, sample programs, relevant links, and helpful tips. This paper will discuss a few useful but little known files the authors have encountered. Users are encouraged to explore the site on their own!

Maps Online >Resources

HomeMapsWhat's NewDownloadsResources

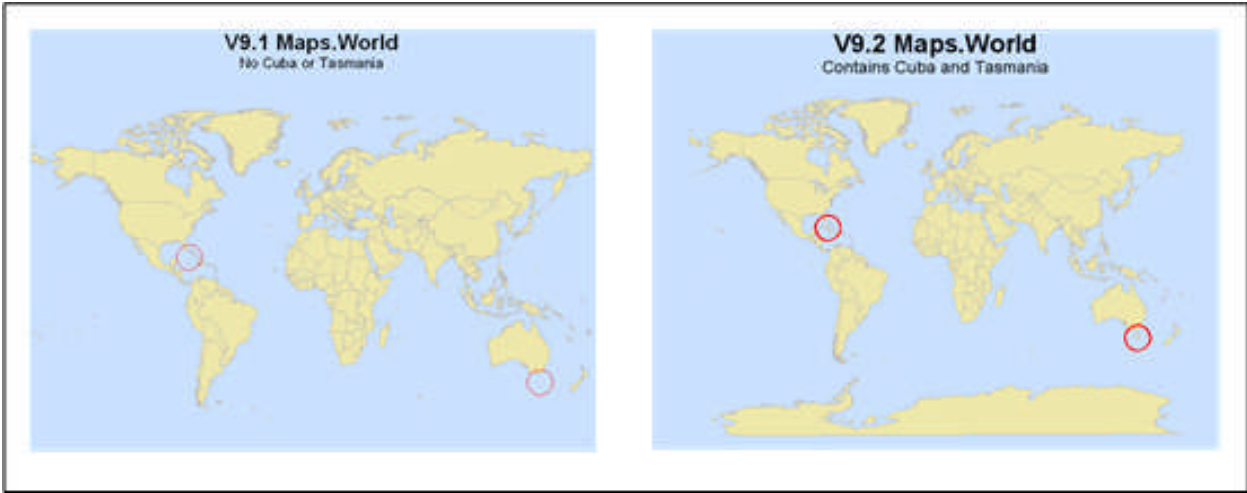
Sample Data
Sample Programs
Tools
Useful Links

The links in this section will provide the following information:

- Sample Data that can be used for mapping.
- SAS/GRAPH Sample Programs that use the map data.
- Tools that might be useful to you.
- Some Useful Links of data providers.
- [About macros used.](#)

9

UPDATED MAPS



SAS map data sets are updated on a regular basis. For 9.2 (and available now for free download from SAS MAPS ONLINE for versions 8 and above) an updated WORLD map data set is available. This data set includes Cuba and Tasmania (not to mention Antarctica), which were missing in the earlier version of the WORLD map data set.

Please check SAS MAPS ONLINE regularly for updates to your favorite map data sets. Ireland, Mexico, Peru, Canada, Germany, US Counties, Brunei, China, Montenegro, Russia, Ukraine and Vietnam are among the map data sets that have been updated in 2009.

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2008 2007 2006 2005 2004 2003 2001-2002

Note: After downloading and unzipping these tables you must take them out of transport format by running the [CIMPORT procedure](#) using the VERSION INDICATED or a HIGHER VERSION of the SAS System. Datasets for download are stored in a version 8 format that is accessible to SAS V8 users and beyond.

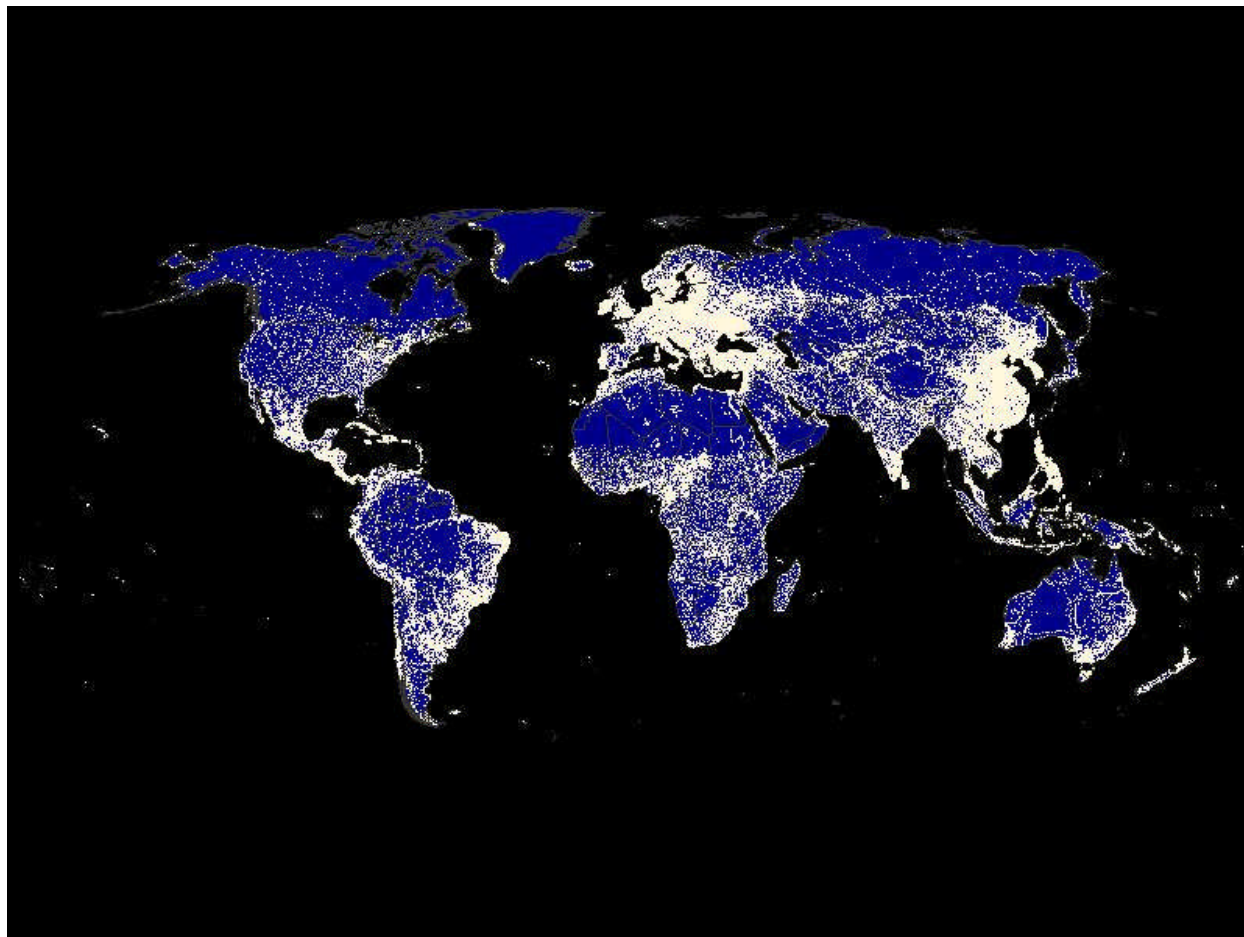
Name	Description	Date Added	SAS Version
Ireland	IRELAND/IRELAND2: New datasets for Ireland. Provide more accurate latitude and longitude coordinates.20,089 records - 26 counties - 4 provinces; OLDID variable used in previous release; DENSITY variable which can be used for the following display resolutions: 1e 9 ==> 14400x11520 1e 8 ==> 6000x4800 1e 7 ==> 2400x1800 1e 6 ==> 1600x1200 1e 5 ==> 1280x1024 1e 4 ==> 800x600 1e 3 ==> 640x480 1e 2 ==> 400x300 1e 1 ==> 220x240		

 Oct09 | V8 |

WORLDCTS DATA SET

The example below is created by creating an annotate data base with light dots representing world cities sized according to population overlaid on a world map (excluding Antarctica.) The world map is created from the SAS-supplied world map data set, while the latitude, longitude, and population of world cities comes from the SAS-supplied WORLDCTS (world cities) data set. [Note: due to missing population numbers in many instances, the version of WORLDCTS available for download no longer contains population data. However, this data is available elsewhere and can be merged onto the WORLDCTS data set which contains the latitude and longitude data for cities.] There is no need to wait for version 9.2 to create this, or similar, graphic presentations. The WORLDCTS data set is available for download from SAS MAPS ONLINE->RESOURCES now. The WORLD data set will be

present in your current SAS maps directory, but as demonstrated above, should be updated with the version in SAS MAPS ONLINE. This technique offers an excellent way to represent various statistics on a world-wide basis.



The program to create this map is located in a zip file on the paper's sascommunity.org page.

SASHELP.MAPFMTS

The overlay map example below is based on one of Robert Allison's samples and employs GREPLAY. It also utilizes a relatively obscure SAS-provided dataset, SASHELP.MAPFMTS, to produce current world country names matching the world map data set. This dataset can be downloaded from SAS MAPS ONLINE.

The program to create this map is located in a zip file on the paper's sascommunity.org page.

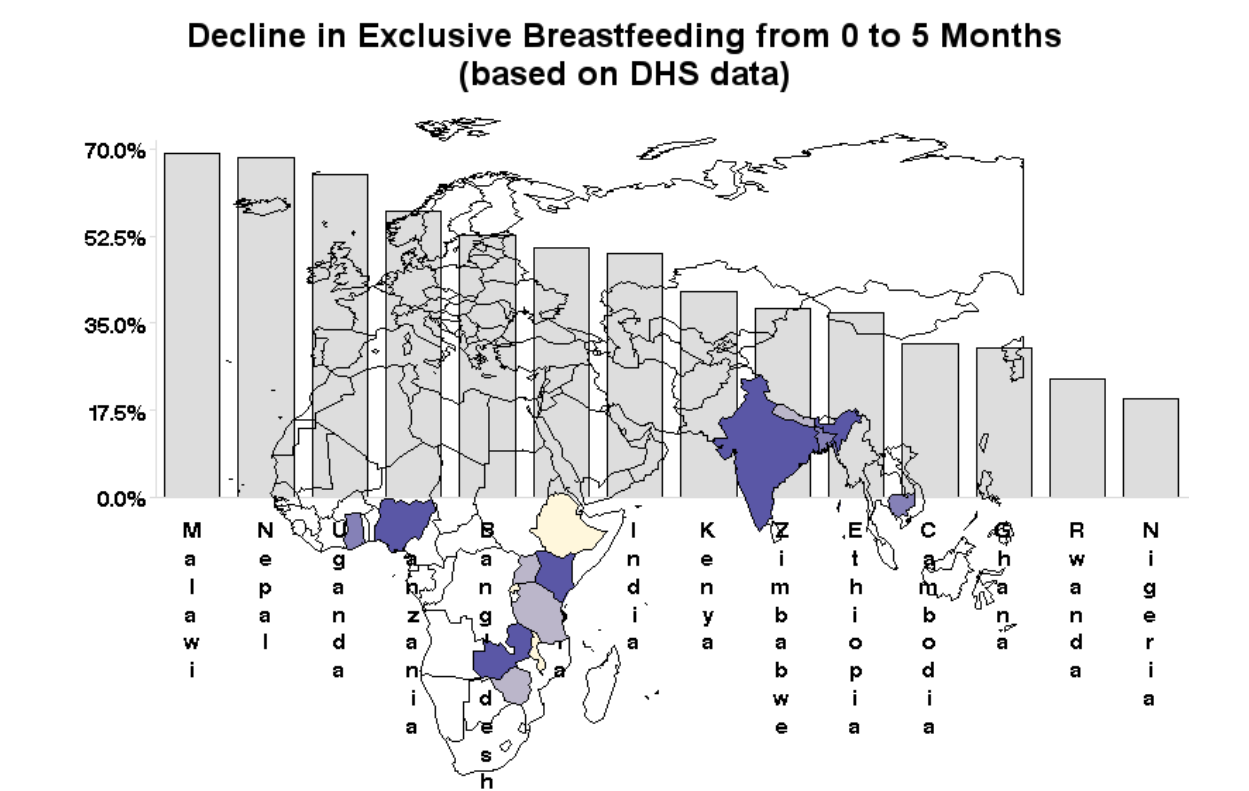
To use one of the formats for maps, you must specify the SASHELP.MAPFMTS catalog on the FMTSEARCH= option on a SAS OPTIONS statement:

```
options fmtsearch=(sashelp.mapfmts);

data work.world;
  set work.world;
  length country_name $20;
  country_name=put(country, glcnsm.);
  country_name=propcase(country_name);
run;
```

For more information on SASHELP.MAPFMTS, see

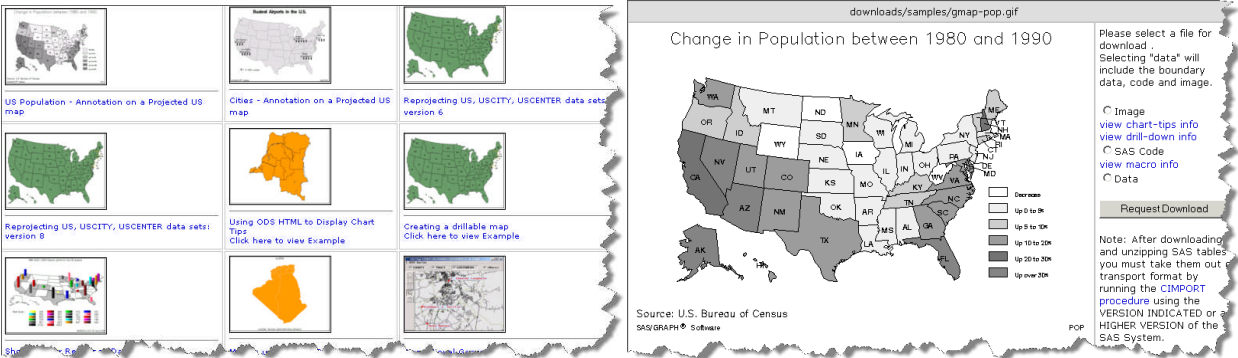
<http://support.sas.com/documentation/cdl/en/graphref/59607/HTML/default/a002230502.htm>



Other features of the program are use of PROC TEMPLATE to define colors used in the GMAP procedure as discussed above, reduction of the map area and density using PROC SQL; a PROC GMAP (using nodisplay) to create the underlying map; a PROC GCHART to create the overlay bar chart (again using nodisplay), and a PROC GREPLAY to display both images in the same space. The HTML file accompanying the PNG file has additional functionality. Mousing over the colored countries provides additional information on breastfeeding rates and GNI in a tooltip for each country.

SAMPLE PROGRAMS

Under Resources->Sample Programs, users can select from attractive thumbnails showing various examples. These sample programs are extremely useful and can be run right “out of the box.” Clicking on a thumbnail gets you to a screen where you can choose to download sample code, data, etc.



Users can also contribute their own examples, which is a great way to give back to SAS MAPS ONLINE.

CONCLUSION

Like other utility files in the SASHELP subdirectory supplied by SAS, the SASHELP.ZIPCODE file is well worth exploring. The SASHELP.ZIPCODE file has utility in many different SAS arenas such as the data step, reporting, distance calculations and of course, mapping. SAS provides quarterly updates to the SASHELP.ZIPCODE file on SAS MAPS ONLINE, which contains a wealth of useful data sets, samples, and advice. The mysteries of SAS MAPS ONLINE are well worth exploring.

ACKNOWLEDGMENTS

Darrell Massengill and Liz Simon 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; Robert Allison of SAS who provides wonderful examples of using SAS/GRAPH and mapping tools, including some of the examples shown in this paper.

REFERENCES AND RECOMMENDED READING

The paper's web page! Get your code samples, links to helpful URLs, and sample data here.

http://www.sascommunity.org/wiki/ZIP_Code_411:_Decoding_SASHELP.ZIPCODE_and_Other_SAS%C2%AE_Map_s_Online_Mysteries#Online_Materials

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Zdeb, Mike. 2002. Maps Made Easy Using SAS. Cary, NC: SAS Institute Inc.



CONTACT INFORMATION

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Take a look at the paper's web page! Get your code samples, links to helpful URLs and sample data here.

http://www.sascommunity.org/wiki/ZIP_Code_411:_Decoding_SASHELP.ZIPCODE_and_Other_SAS%C2%AE_Map_s_Online_Mysteries#Online_Materials

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