PRELIMINARY COMPARISON

OF

BUILDINGS CLIMATE-ZONE MAPS

FOR THE

UNITED STATES

by

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A Briefing Report
for
ASHRAE Technical Committee 4.2 on Climatic Information
2010 ASHRAE Winter Meeting
Orlando, FL
January 23-27, 2010

Sponsored
by the
NASA Applied Sciences Program
Earth-Sun System Division

SUMMARY

A NASA study entitled "***High Spatial Resolution Global Climate Data in Support Of The Buildings and Renewable Energy Industries"*** was selected for funding by NASA through a peer reviewed proposal that uses a more-advanced reanalysis data set known as **MERRA** (Modern Era Retrospective-analysis for Research and Applications). Partners for the proposal are NASA's Langley Research Center (Dr. Paul Stackhouse and Dr. Charles Whitlock) and Goddard Space Flight Center (Dr. Michael Bosilovich) with contributions from Department of Energy (Drury Crawley). The results available as of January 15, 2010 are shown in following charts and tables as described.

Charts 1 and 2 compare the original Briggs, et al. buildings climate zone map with a USGS elevation map. It must be emphasized that Briggs, et al. acknowledge in their web site report that there may be a problem with the assumption of a constant altitude within counties. The assumption had to be made because building codes are fixed on a county-wide basis over most of the United States. That is **not** the situation over the whole globe.

NASA has developed a correction procedure that can be used to spatially 'downscale' temperature fields from NASA's reanalysis models such as MERRA which provides estimates of the average temperatures over the model grid element to a local ground site. For the MERRA model the grid element is 2/3 x 1/2 degree. Chart 3 illustrates how terrain height may change over the model grid area, and illustrates the need to take into account the complexity of the terrain when using the modeled temperature fields, as well as extrapolating ground site observations to non-observational sites as was done in construction the climate zone map shown in Chart 1. We note that our original proof-of-concept analysis used the NASA reanalysis model designated as GEOS-4 which had a 1-degree grid cell. Our downscaling scaling approach is based upon the use of lapse rates derived through "calibration" of the NASA model values to observations from a local to regional ground network to adjust the model temperatures to local ground site values. This initial work has been presented at a previous meeting of Technical Committee 4.2.

Chart 4 shows an estimate of the Briggs, et al. climate zones over the United States after lapse rate corrections were applied to the 1 x 1 degree latitude/longitude reanalysis model temperatures. Chart 4 is an estimate of climate zone distribution on a 10-minute latitude/longitude scale. Height adjustments were based on the difference in height between that of the 1-degree reanalysis model cell and that of the actual USGS 10-minute topography value in Chart 2. The Chart 4 title notes that the Briggs, et al. climate zone distributions are similar to a map of Natural Vegetation in GOODE'S World Atlas.

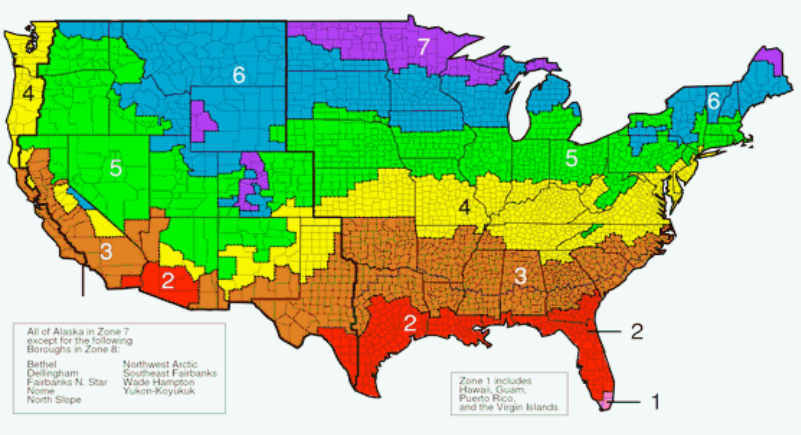

Chart 1. Original buildings climate zone map based on cluster analysis for counties using 1961 - 1990 NCDC SAMPSON ground-site data from 230 sites. ASSUMES CONSTANT-HEIGHT TOPOGRAPHY WITHIN EACH COUNTY according to Briggs, Lucas, and Taylor, www.energy codes, 2000.

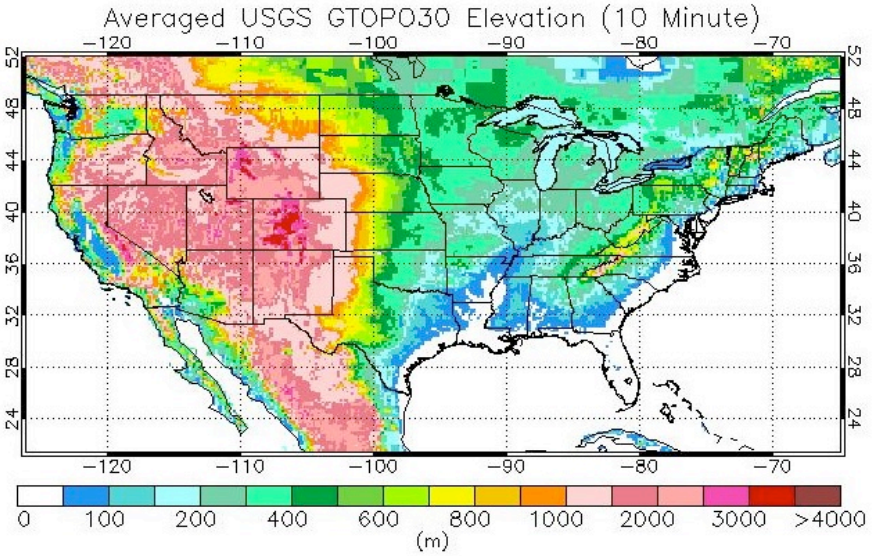

Chart 2. Earth-surface elevation above mean sea level at 10-minute latitude/longitude spatial resolution.

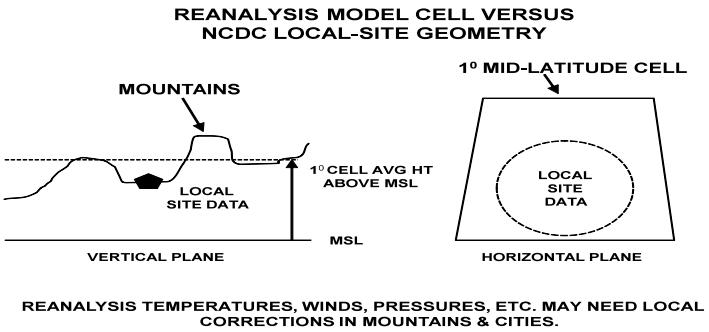

Chart 3. Height and horizontal influence of a local meteorological site in a valley within a 1-degree GEOS-4 cell in the mountains.

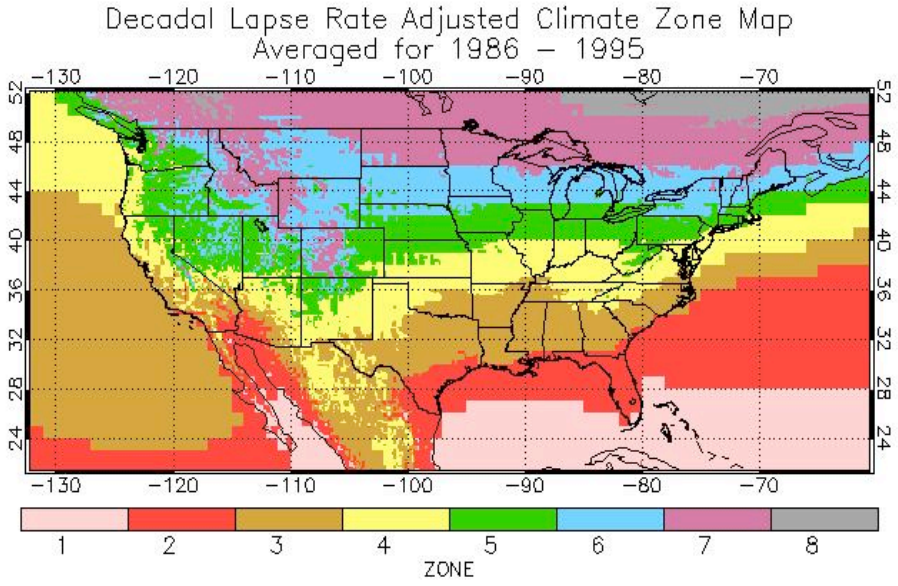

Chart 4. NASA buildings climate zone map using Briggs et al. climate zone definitions with satellite and radiosonde reanalysis one-degree data in combination with lapse-rate corrections based on 10-minute spatial resolution USGS topography values (Chart 2). (Note: For interior regions, this map has similar patterns to the NATURAL VEGETATION map in Rand McNally GOODE'S WORLD ATLAS, 18th edition, 1990, pp. 66.)

The discussion above leads to the following schedule for this NASA effort.

1. Analyze MERRA lapse rate and offset corrections using native grid. Compare to surface measurements and to results using GEOS-4. (note: collaborate with NASA GSFC for data products, analysis) ---------- December 2009

2. Interim report to ASHRAE Climate Committee (report to respond ------ January 2010

3. Complete analysis of regional and seasonal lapse rate and offset corrections in collaboration with GSFC ---------- February 2010

4. Analyze annual precipitation fields from GPCP, TRMM, and MERRA in collaboration with GSFC ---------- May 2010

5. Complete draft of 10 minute climate zone map of Western US/US Plains regions ---------- June 2010

6. Presentation of Draft Final report to ASHRAE Climate Committee ---------- June 2010

7. Complete assessment of draft map in terms of impact to current zones; potential global land processing based upon assessment ---------- August 2010

8. Completion of final feasibility report to NASA ---------- September 30, 2010

9. Completion of Task Final Report/Submission to ASHRAE Climate Committee (next meeting January 2011) ---------- September 30, 2010