

Data Dictionary

Five primary data sets are provided for each county:

- 1) A polygon shapefile containing a conversion of the raw gridded model/analysis outputs;
- 2) A vector shapefile containing the TIGER road layer and addressing data, with the hazard data layers attached to each road segment;
- 3) A vector shapefile of the TIGER hydrology layer;
- 4) PDF files containing an analysis of the number and value of structures in each of the hazard zones.

These data layers are also included in the on-line mapping system at <http://www.methaz.org/lmsmaps/>. The ASCII files are also available on-line in HTML and PDF format.

Data Layers

[COUNTY NAME]_grd

Format: ESRI® polygon shapefile
Components: [county name]_shp, [county name]_shx, [county name]_dbf
where [county name] is the county name in all lower case letters, e.g. bay_grd, miami-dade_grd.
Projection: Geographic, decimal degrees, WGS-84.
Extent: Each file is limited to a single county.

Description:

This shapefile is a layer containing the outputs of the study in polygons. The raw study outputs are in big-endian IEEE 4 byte real floating point format, covering the entire state at a nominal resolution of 30 meters. To facilitate the use of study outputs in commercial and open source GIS systems such as Arc/View and Mapserver, the outputs were converted to shapefiles. Each polygon contains the following attributes:

H100WIND	H50WIND	H25WIND	H10WIND
H100WATER	H50WATER	H25WATER	H25WATER
SS1WIND	SS2WIND	SS3WIND	SS4WIND
SS1WATER	SS2WATER	SS3WATER	SS4WATER
SS5WIND	SS5WATER		
WINDLC	FLOODLC	WIND5LC	FLOOD1LC
FIREPOT	WFIRELC		
TORNADO	SINKPOT	TSUNAMI	LULC
EQUAKE	SFLOOD	FEMAFIRM	TOPO
FRASLOC			

The meaning and source of each attribute is discussed in the data dictionary.

[COUNTY NAME]_haz

Format: ESRI® line shapefile
Components: [county name]_haz.shp, [county name]_haz.shx,
[county name]_haz.dbf
where [county name] is the county name in all lower case letters, e.g. bay_haz, miami-
dade_haz.
Projection: Geographic, decimal degrees, WGS-84.
Extent: Each file is limited to a single county.

Description:

This shapefile is a layer containing the US Census Bureau TIGER® road files, converted to shape file format, with the hazard values for each road segment center attached to the TIGER® data. The raw study outputs are in big-endian IEEE 4 byte real floating point format, covering the entire state at a nominal resolution of 30 meters. To facilitate the use of study outputs in commercial and open source GIS systems such as Arc/View and Mapserver, the study output data was attached to the TIGER road layer. This layer contains attributes suitable for address matching, and may be used to determine the hazards at a given address. Each line segment contains the following attributes:

US Census Bureau Attributes:

TLID	FNODE	TNODE	LENGTH	FEDIRP	FENAME
FETYPE	FEDIRS	CFCC	FRADDL	FRADDR	TOADDR
ZIPL	ZIPR	CENSUS1	CENSUS2	CFCC1	CFCC2
SOURCE					

The formal definitions of these fields are available at
http://www.census.gov/geo/www/tiger/tiger2003/ch6_2003.pdf.

KAC Analysis Attributes:

H100WIND	H50WIND	H25WIND	H10WIND
H100WATER	H50WATER	H25WATER	H25WATER
SS1WIND	SS2WIND	SS3WIND	SS4WIND
SS1WATER	SS2WATER	SS3WATER	SS4WATER
SS5WIND	SS5WATER		
WINDLC	FLOODLC	WIND5LC	FLOOD1LC
FIREPOT	WFIRELC		
TORNADO	SINKPOT	TSUNAMI	LULC
EQUAKE	SFLOOD	FEMAFIRM	TOPO
FRASLOC			

The meaning and source of each KAC supplied attribute is discussed in the data dictionary which follows this section.

[COUNTY NAME]_hyd

Format: ESRI® line shapefile
Components: [county name]_hyd.shp, [county name]_hyd.shx,
[county name]_hyd.dbf
where [county name] is the county name in all lower case letters, e.g. bay_hyd, miami-dade_hyd.
Projection: Geographic, decimal degrees, WGS-84.
Extent: Each file is limited to a single county.

Description:

This shapefile is a layer containing the US Census Bureau TIGER® line hydrographic feature layer, converted to shape file format. This layer is provided for reference in support of the TIGER® road layer. The formal definitions of the fields in this layer are available at http://www.census.gov/geo/www/tiger/tiger2003/ch6_2003.pdf.

[COUNTY NAME]_report, statesum_report

Format: PDF file
Components: [county name]_report.PDF, statesum_report.pdf
where [county name] is the county name in all lower case letters, e.g. bay_report.pdf, miami-dade_report.pdf.
Projection: N/A
Extent: Single county or statewide summary.

Description:

This file is a table containing the value and number of structures in each hazard zone for the hazards analyzed. This data is also available on-line in HTML format.
Data Dictionary

Data Elements

HxxxWIND, where xxx is the return period in years, e.g. H50WIND is the 50 year wind speed.
Format: Integer
Values: Peak two minute 10 meter (ASOS compatible) wind speed in miles per hour.

This variable contains the maximum likelihood estimate (MLE) peak wind speed for 10, 25, 50, and 100 year return periods.

References:

Johnson, M. E. and C. C. Watson. (1999). "Hurricane Return Period Estimation," 10th Symposium on Global Change Studies, Dallas, TX, 478-479.
Watson, C. C., Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," Solutions for Coastal Disasters (sponsored by ASCE and NOAA), San Diego, CA.

HxxxWATER, where xxx is the return period in years, e.g. H50WATER is the 50 year storm surge height.

Format: Integer

Values: Peak storm surge in feet above mean sea level.

This variable contains the maximum likelihood estimate (MLE) peak storm surge for 10, 25, 50, and 100 year return periods.

References:

Johnson, M. E., 1997: Caribbean Storm Surge Return Periods, Organization of American States Caribbean Disaster Mitigation Project Workshop, Kingston, Jamaica, October 31, 1997.

Johnson, M. E. and C. C. Watson. (1999). "Hurricane Return Period Estimation," 10th Symposium on Global Change Studies, Dallas, TX, 478-479.

Watson, C. C., Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," Solutions for Coastal Disasters (sponsored by ASCE and NOAA), San Diego, CA.

SSxWIND, where x is the Saffir/Simpson storm category, e.g. SS3WIND is the peak wind expected at the site as a result of a storm with category three intensity at landfall.

Format: Integer

Values: Peak two minute 10 meter (ASOS compatible) wind speed in miles per hour.

This variable contains peak wind speed expected at the site as a result of a storm of the given category making landfall anywhere in the state. The following wind speeds were used at landfall:

Category	Wind Speed
1	85 mph
2	100 mph
3	122 mph
4	145 mph
5	165 mph

References:

Watson, C. C., Jr., 1995: The Arbiter Of Storms: a high resolution, GIS based storm hazard model, National Weather Digest, 20, 2-9.

Watson, C. C. and M. E. Johnson. (1999). "Design, Implementation, and Operation of a Modular Integrated Tropical Cyclone Hazard Model," AMS 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX.

SSxWATER, where x is the Saffir/Simpson storm category, e.g. SS3WATER is the storm

surge expected at the site as a result of a storm with category three intensity at landfall.

Format: Integer

Values: Peak storm surge in feet above mean sea level.

This variable contains the peak storm surge expected at the site for a given Saffir/Simpson storm category.

References:

Watson, C. C., Jr., 1995: The Arbiter Of Storms: a high resolution, GIS based storm hazard model, National Weather Digest, 20, 2-9.

Watson, C. C., Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," Solutions for Coastal Disasters (sponsored by ASCE and NOAA), San Diego, CA.

WINDLC, Wind Damage Loss Cost.

Format: Float

Values: Loss cost in dollars per \$1000 of exposure for wind damage.

This variable contains the expected annual loss due to wind damage for a typical structure, expressed in dollars per \$1000 of exposure. Wind loss costs include damage from hurricanes, tornadoes and severe thunderstorms, and winter storms. For example, a structure valued at \$150,000 with a loss cost of \$1.87 per \$1000 would be expected to suffer average losses of \$280.50 in wind damage per year. Note that most years would be no damage, but some years would be considerably higher due to a direct hit by a hurricane or tornado. Loss costs are valuable for comparing the risk between locations, as well as ascertaining the long term benefits of mitigation.

References:

Watson, C. C. Jr., and Johnson, M.E., 2003: An assessment of computer based estimates of hurricane loss costs in North Carolina, Kinetic Analysis Corporation, Savannah, GA; available on-line at <http://www.methaz.com/ncdoi/>.

Watson, C. C., Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," Solutions for Coastal Disasters (sponsored by ASCE and NOAA), San Diego, CA.

FLOODLC, flood damage loss cost.

Format: Float

Values: Loss cost in dollars per \$1000 of exposure for flood damage.

This variable contains the expected annual loss due to flood damage for a typical structure, expressed in dollars per \$1000 of exposure. Flood loss costs include hurricane storm surge, riverine flooding, and flooding from winter storms. For example, a structure valued at \$150,000 with a loss cost of \$1.87 per \$1000 would be expected to suffer average losses of \$280.50 in flood damage per year. Note that most years would be no damage, but some years would be considerably higher due to a direct hit by a hurricane or riverine flood event. Loss costs are valuable for comparing the risk between locations, as well as ascertaining the long term benefits of mitigation.

References:

Watson, C. C. Jr., and Johnson, M.E., 2003: An assessment of computer based estimates of hurricane loss costs in North Carolina, Kinetic Analysis Corporation, Savannah, GA; available on-line at <http://www.methaz.com/ncdoi/>.

Watson, C. C., Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," Solutions for Coastal Disasters (sponsored by ASCE and NOAA), San Diego, CA.

WIND5LC, Wind Damage Loss Cost, assuming 5mph performance improvement.

Format: Float

Values: Loss cost in dollars per \$1000 of exposure for wind damage.

This variable contains the expected annual loss due to wind damage for a typical structure, expressed in dollars per \$1000 of exposure, assuming that the performance of the structure has been improved by 5mph. For example, a typical wood frame structure will begin to sustain damage in 40mph winds, and be totally destroyed with 160mph sustained winds. The 5 mph "improved" structure would not see damage until 45mph.

Reference:

Watson, C., Johnson, M., and Simons, M., 2004: Insurance Rate Filings and Hurricane Loss Estimation Models, Journal of Insurance Research, Spring 2004 (in press).

FLOOD1LC, flood damage loss cost, assuming 1ft mitigation effort.

Format: Float

Values: Loss cost in dollars per \$1000 of exposure for flood damage.

This variable contains the expected annual loss due to flood damage for a typical structure, expressed in dollars per \$1000 of exposure, assuming that flood events are reduced by 1ft. To achieve a 1ft mitigation, the structure could be raised by 1 ft, or engineering works could be put in place to reduce peak floods by 1 ft.

Reference:

Watson, C., Johnson, M., and Simons, M., 2004: Insurance Rate Filings and Hurricane Loss Estimation Models, Journal of Insurance Research, Spring 2004 (in press).

SFLOOD, Supplemental Flood Damage

Format: Text

Values: Four possible values –

- 1) damaging floods recur every 10 years or less.
- 2) 25 year flood plain.
- 3) 50 year flood plain.

- 4) 100 year or greater.

This variable contains a general assessment of the potential of the site for flooding by rainfall, ponding, or riverine flooding.

References:

Watson, C. C., Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," Solutions for Coastal Disasters (sponsored by ASCE and NOAA), San Diego, CA.

SINKPOT, Sinkhole Potential

Format: Text

Values: Five possible values –

- 1) Very Low
- 2) Low
- 3) Moderate
- 4) High
- 5) Very High

This variable contains a general assessment of the potential of the site for sinkhole development. Sinkhole potential was computed as follows. Sinkhole potential was determined according to points assigned to each 90m grid cell in the state. Three classes of points were assigned, for distance to historic sinkholes, geology, and soils:

- 2 points if cell was within 2000m of an existing sinkhole;
- 1 point if cell between 2000m and 5000m of an existing sinkhole;
- 1 point if the cell was in the same USGS surface geologic unit as an existing sinkhole;
- 1 point if the cell was in the same NRCS soil unit as an existing sinkhole.

Thus, each cell received an ultimate value of from 0 to 4:

- 0: Very Low risk
- 1: low risk
- 2: moderate risk
- 3: high risk
- 4 very high risk.

Reference:

Internal KAC Analysis.

EQUAKE, Earthquake Risk

Format: Text

Values: Four Possible Values.

The USGS 50 year 10% likelihood data set was used to assign earthquake risk. The peak ground acceleration (PGA) value was used to create four zones:

< 0.01g	Almost none
0.01g	Minimal
0.02g	Very low
0.03g	Low

Note that the earthquake risk, even in the “highest” risk zone in the state, is quite small.

References:

Frankel, Arthur, Mueller, Charles, Barnhard, Theodore, Perkins, David, Leyendecker, E.V., Dickman, Nancy, Hanson, Stanley, and Hopper, Margaret, 1997, Seismic-hazard maps for the conterminous United States, Map F - Horizontal spectral response acceleration for 0.2 second period (5% of critical damping) with 2% probability of exceedance in 50 years, U.S. Geological Survey Open-File Report 97-131-F.

Arthur D. Frankel, Mark D. Petersen, Charles S. Mueller, Kathleen M. Haller, Russell L. Wheeler, E. V. Leyendecker, Robert L. Wesson, Stephen C. Harmsen, Chris H. Cramer, David M. Perkins, and Kenneth S. Rukstales, Documentation for the 2002 Update of the National Seismic Hazard Maps, Open-file Report 02-420

TORNADO, Tornado Risk

Format: Text

Values: Three Possible Values.

Tornado track data since 1950 from the National Weather Service was analyzed to determine the annual probability that a tornado would cause damage to a structure in each 90m grid cell in Florida. The data was stratified in to four classes:

High risk (1 in 100 or greater),
Medium risk (1 in 101 to 1 in 250),
Low (1 in 250 to 1 in 500 chance).

Reference:
Internal KAC Analysis.

TSUNAMI, Tsunami Risk

Format: Text

Values: Two Possible Values.

Tsunami risk in Florida is difficult to assess, as there are no reliable historical records and few publications on the subject. Therefore, simulation techniques were used. Five types of events were simulated: Caribbean volcanic events, Caribbean and Central American earthquakes, continental shelf sediment slumping, small asteroid impacts, and East Atlantic (the Cumbre Vieja volcano, on the island of La Palma, in the Canary Islands) volcanic events. In general, on the Gulf Coast of Florida, these events produced at worst a 4 meter wave, while in some parts of the Atlantic coast this value grew to 6 to 7 meters. Expert Opinion suggests that these would be approximately 1 in 500 year events. Note that these areas are mostly in the Category 5 hurricane zone, which is probably an event of comparable frequency in North Florida. However, a tsunami wave from the worst case La Palma event would more than likely inundate the entire Atlantic coastline, as opposed to only a few dozen miles of coastline in the case of a hurricane. The potential and magnitude of such an event is highly controversial, with a minority of researchers suggesting waves as high as 40 meters, with most estimates in the 5 meter range.

Reference:

Internal KAC Analysis.

FEMAFIRM, FEMA Flood Insurance Rate Map Zones

Format: Text
Values: 14 Possible Values.

This data layer reports the FEMA FIRM zones, for 57 of the 67 counties in Florida. This data layer was created by combining the county level data sets available from the University of Florida Geoplan Center's Florida Geographic Data Library, at <http://www.fgd.org>. The original data sets were reprojected from Albers to Geographic for compatibility with mapserver.

Reference:

Federal Insurance Administration, 1992: Guidelines and specifications for Study Contractors (FEMA-37), FEMA, Washington, D.C.

FIREPOT, Wildland Fire Potential

Format: Text

Values: Three Values: Low, Medium, High.

FIRELC, Loss Cost due to Wildland Fires.

Format: Float

Values: Loss cost in dollars per \$1000 of exposure for wildland fire damage.

The first variable is an assessment of the relative hazard of wildland fires based on the potential fuel within 500 meters of the location. The second variable contains the expected annual loss due to wildland fire damage, expressed in dollars per \$1000 of exposure.

Caution: these layers were created to support the calculation of economic losses from wild fires and the creation of a loss cost compatible with the other data layers in this study. The approach used was designed for compatibility with the requirements of the Disaster Mitigation Act of 2000, and while statistically and scientifically valid, these layers should not be considered as the official fire risk data set used by the State of Florida. The Florida Division of Forestry has created the Fire Risk Analysis System (FRAS), which should be referenced for other wildland fire assessment purposes.

Methodology:

The Arbiter Of Storms (TAOS) hazard modeling system uses land cover data sets derived from LANDSAT images (Watson and Johnson, 1999, Watson, 2002). The LANDSAT images are processed to create a land cover data layer using the Anderson classification (Anderson et al, 1976), with checks and updates using 2003 MODIS images. In TAOS, each Anderson level II classification has values associated with for wind and water friction values (specifically, friction length z_0 and Manning's N). For the wild fire analysis, an additional field was added to equate the Anderson classification with fuel models used in the National Fire Danger Rating System (Burgan et al, 2000). These fuel models are an indication of the ability of a fire to start and spread in the given terrain type, and are used as the input to the Fire Potential Index as well as fire spreading models. The resulting map was compared with the NFDR Fuel Model Map created by the US Forest Service (USFS). The NFDR Fuel Model Map is used for the next generation fire danger rating system being developed by USFS, and is a nationwide map at a resolution of 1000 meters per grid cell based on data from 1997. The KAC developed map for Florida is at a resolution of 90 meters, and compares well the much more general national map while providing a great deal of additional detail, as well as being more up to date due to land cover changes.

Each of the fuel models was assigned to a risk code of "low", "medium", or "high", based on fire spreading potential during a climatologically "dry" year, and processed with the statewide parcel data base to create the tables supplied with the LMS analysis. The mode of the fuel types within 500 meters of the parcel was used to determine risk category for the parcel.

The numerical approach outlined in Turcotte et al, 2002, was used for determining probability and extent of fires. Due to the limited availability of suitable climatological data, additional data was obtained from 100 years of simulated climate from a series of runs using the Community Climate Model (CCM) Version 3.2. The Haines Index (Haines 1988) was used to assess days favorable for fire ignition and development, which was used as the basis for the temporal probability of occurrence. A full description of the approach will be submitted in a forthcoming journal paper.

References:

Anderson, J.F., Hardy, E.E., Roach, J.T., Witmer, R.E.: 1976. A land use and land cover classification system for use with remote sensor data. U.S. Geological Survey Professional Paper 964, 28pp.

Burgan, R, Klaver, R, and Klaver, J: 2000. Fuel Models and Fire Potential from Satellite and Surface Observations, USDA Forest Service Science and Applications Branch, 15pp.

Goodrick, S., D. Wade, J. Brinner, G. Babb, and W. Thomson, Relationship of daily fire activity to the Haines index and the Lavdas dispersion index during 1998 Florida wildfires, "Ecological and Economic Consequences of the 1998 Florida Wildfires".

Harrison, M. and C. Meindl, 2001: A statistical relationship between El Niño-Southern Oscillation and Florida wildfire occurrence. *Physical Geography* 22: 187-203.

Mercer, D. J. Pye, J. Prestemon, D. Butry, and T. Homes, 2000: Economic Effects of Catastrophic Wildfires, Final Report, Topic 8 of the Research Grant, "Ecological and Economic Consequences of the 1998 Florida Wildfires".

Turcotte, D., B. Malamud, F. Guzzetti, and P. Reichenbach, 2002: Self-organization, the cascade model, and natural hazards, *Proceedings of the National Academy of Sciences*, Vol. 99, Suppl. 1, 2530-2537.

Watson, C. C., Jr., 1995: The Arbiter Of Storms: a high resolution, GIS based storm hazard model, *National Weather Digest*, 20, 2-9.

Watson, C. C. and M. E. Johnson. (1999). "Design, Implementation, and Operation of a Modular Integrated Tropical Cyclone Hazard Model," AMS 23rd Conference on Hurricanes and Tropical Meteorology, Dallas, TX.

Watson, C. C. , Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," *Solutions for Coastal Disasters* (sponsored by ASCE and NOAA), San Diego, CA.

FRASLOC, Florida Division of Forestry Wildland Fire Level of Concern

Format: Integer
Values: 0 to 9 scale.

Note: This is the official wildland fire level of concern (LOC) layer from the Division of Forestry. For a variety of production reasons, we were unable to use this layer for the calculation of loss costs.

The Level Of Concern is an integer scaled from 0 to 9 indicating the relative risk of Wildland Fire, and is an output of the Florida Division of Forestry Fire Risk Assessment System (FRAS). More information on FRAS and the LOC value is available at:

<http://flame.fl-dof.com/fras1/FRAS User Guide.pdf>

This data set is courtesy of the Florida Division of Forestry, and comes with the following disclaimer:

“The user assumes the entire risk related to their use of the FRAS published maps. The Florida Department of Agriculture and Consumer Services is providing these data “as is” and disclaims any and all warranties, whether expressed or implied, including (without limitation) any implied warranties of merchantability or fitness for any particular purpose. In no event will the Florida Department of Agriculture and Consumer Services be liable to you or to any third party for any direct, indirect, incidental, consequential, special, or exemplary damages or lost profit resulting from any use or misuse of this data. “

Reference:

Space Imaging/FL Div. of Forestry, 2002: FRAS User’s Guide, Florida Division of Forestry, Tallahassee, FL.

Consolidated References

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- Burgan, R, Klaver, R, and Klaver, J: 2000. Fuel Models and Fire Potential from Satellite and Surface Observations, USDA Forest Service Science and Applications Branch, 15pp.
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- Frankel, Arthur, Mueller, Charles, Barnhard, Theodore, Perkins, David, Leyendecker, E.V., Dickman, Nancy, Hanson, Stanley, and Hopper, Margaret, 1997, Seismic-hazard maps for the conterminous United States, Map F - Horizontal spectral response acceleration for 0.2 second period (5% of critical damping) with 2% probability of exceedance in 50 years, U.S. Geological Survey Open-File Report 97-131-F.
- Goodrick, S., D. Wade, J. Brinner, G. Babb, and W. Thomson, Relationship of daily fire activity to the Haines index and the Lavdas dispersion index during 1998 Florida wildfires, "Ecological and Economic Consequences of the 1998 Florida Wildfires".
- Harrison, M. and C. Meindl, 2001: A statistical relationship between El Niño-Southern Oscillation and Florida wildfire occurrence. *Physical Geography* 22: 187-203.
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- Johnson, M. E., Iman, R. L., and Schroeder, T. A., "Assessing Hurricane Effects: Part 1 – Sensitivity Analysis," *Reliability Engineering and System Safety*, Vol. 78, pp. 36-50, 2002.
- Johnson, M. E., Iman, R. L., and Schroeder, T. A., "Assessing Hurricane Effects: Part 2 – Uncertainty Analysis," *Reliability Engineering and System Safety*, Vol. 78, pp. 51-59, 2002.
- Mercer, D. J. Pye, J. Prestemon, D. Butry, and T. Homes, 2000: Economic Effects of Catastrophic Wildfires, Final Report, Topic 8 of the Research Grant, "Ecological and Economic Consequences of the 1998 Florida Wildfires".
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- Watson, C. 1992: Monitoring Near and Off Shore Sediment Formations by Satellite, Archives of the XVII International Congress for Photogrammetry and Remote Sensing, August, 1992, Volume XXXIX, Commission IV, pp. 321-325.
- Watson, C. 1992: Distributed Geoprocessing Techniques, Proceedings from the 1992 annual conference of the Urban and Regional Information Systems Association, Volume III, pp. 144-150.
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- Watson, C. 1995: Advanced Numerical Modeling Techniques for Land Use Planning, Proceedings of the First Environmental Information and Technology Conference, Washington, DC, Oct. 1995.
- Watson, C. 1995: Incorporating Environmental Variability in the Storm Hazard Assessment Process, NOAA Workshop on Hurricane Variability at Decadal Time Scales, National Hurricane Center, Miami, FL, 8 Feb 95.
- Watson, C. 1996: Using GIS and Historical Satellite Imagery to Analyze Urban Ecosystems and Policy, Pecora 13 Symposium, Sioux Falls, SD, Aug. 1996.
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- Watson, C. C., Jr. 2002: "Using integrated multihazard numerical models in coastal storm hazard planning," Solutions for Coastal Disasters (sponsored by ASCE and NOAA), San Diego, CA.
- Watson, C. C. Jr., and Johnson, M.E., 2003: An assessment of computer based estimates of hurricane loss costs in North Carolina, Kinetic Analysis Corporation, Savannah, GA; available on-line at <http://www.methaz.com/ncdoi/>.
- Watson, C., Johnson, M., and Simons, M., 2004: Insurance Rate Filings and Hurricane Loss Estimation Models, Journal of Insurance Research, Vol. 22, No. 3.
- Watson, Charles C., Johnson, Mark E. Hurricane Loss Estimation Models: Opportunities for Improving the State of the Art Bulletin of the American Meteorological Society 2004 85: 1713-1726