With the increasing popularity of GIS for spatial modeling, the compatibility (or incompatibility) of the GIS output, in particular maps, with the decision maker requirements has been examined by A Zerger in "Examining GIS decision utility for Natural Hazard risk modeling" (2002). Monmonier's book (1991) "How to lie with maps" gives the GIS modeller useful guidance into the pitfalls of cartography, and hints for the map user in interpreting maps and in recognizing of the pitfalls.

Natural Hazards are complex spatial occurrences, with multi-variable, three-dimensional relationships. Maps provide useful 2-D, selective views of reality. Without generalization, maps would be too cluttered to allow interpretation, but the value of the map depends on how well it is generalized and on how well it reflects reality (Monmonier, 1991).

Map users generally trust the mapmaker to present a true picture of reality, but with the acceptance of GIS (Geographical Information Systems) many "mapmakers" have very little understanding of cartography. Cartographers learn about cognitive aspects of map-making, whereas the new mapmaker - the GIS expert - knows software, spatial data and modelling approaches rather than human perception of the maps produced (Zerger, 2002).

Software developers make it easy for GIS users to make misleading maps. Schools encourage critical analysis of written and verbal communications; e.g. read between the lines; read the fine print; and be wary of the misuse of statistics, but little is taught about map interpretation (Monmonier, 1991).

The first two choropleth maps below show the same data, the percentage of brick dwellings per postcode for Sydney, but different categorizations have been used. Figure 1 shading is calculated using equal ranges of values (lowest value to highest value) and Figure 2 used an equal number of values per category, both valid interpretations of the data. Similarly, Figures 3 and 4 map the classified composite hazard potential for NSW. Figure 3 is based on use-defined ranges and Figure 4 equal areas at a national level. At a glance these maps appear to show totally different distributions.
It is a responsibility of the GIS modeller to ensure that categorization is clear and useful to the user. The user may be able to assist in the process by providing a list of requirements, e.g., threshold values required in their decision-making. The form of output has to be carefully considered. Graduated shading, as used here, clearly shows high and low percentage regions, but care must be taken to ensure that colours remain distinguishable on printing or transfer to other systems. Colour schemes become more complicated as the number of categories increase - 5 or 6 is enough for most purposes.

All models have errors or uncertainty in the results. These may be caused by errors in:

- the input data; for example, DTM data are given an accuracy of 0.5x grid spacing (2.5m vertical accuracy on a 5m DTM); or
- approximations used in modeling techniques; or
- uncertainties, due to lack of information on which to calibrate models.

How do GIS modelers represent these uncertainties with maps? Goodchild is quoted in Zerger (2002) as providing 3 options:

1. Omit reference to them
2. Attach some form of description to the output
3. Show samples from a range of maps or outputs possible.

Zerger (2002) tested the third approach, as it appears to have the greatest potential benefit in both communicating uncertainty and educating the user in the significance of the issue. A range of Cairns Storm surge inundation maps, showing the uncertainty, were produced for Emergency Managers. Their response was generally, that the maps provided too much spatial data, as their main interest is "worst case scenario". There was a resistance to the use of uncertainty maps, as they implied policy uncertainty and may result in individual decision ambiguity.

At the present time, the GIS models produced by Risk Frontiers do not use many maps for communicating model results. Maps are generally used to display background information and show examples of the results. Uncertainties, limitations and assumptions used in modeling are described in the final reports, rather than presented in a range of maps. As our clients become familiar with the benefits of GIS and its outputs, our results may also be presented in GIS formats.

References:


Monmonier, M, (1991), How to lie with maps, The University of Chicago