



Spatial Analysis of Large-Scale Man-Made Disasters Using GIS

– An Exemplary Implementation for Air Traffic Incidents –

Motivation

A GIS tool was developed and implemented to prove the existence and measure the significance of certain factors, that influence the occurrence and distribution of man-made disasters, using geo-statistical methods. In expert talks with insurance underwriters it was mentioned that the incident locations and their spatial surroundings (substantiated on a per-country basis) were of great interest.

Approach

Air traffic incidents not happening during cruise flight (i.e. during parking, taxiing, take-off or landing) were chosen as exemplary topic for a prototype implementation of this approach. Research was focused on the correlation between the incidents themselves and the safety levels of the airports they were happening at or close to. The severity of the incidents (Incident Severity Index – ISX) was parameterized by the bodily injury and the tangible loss. The availability of certain safety features as well as the location and spatial surroundings of the respective airports were used to define the prevalent safety standard (Airport Safety Index – ASX).

Methodology

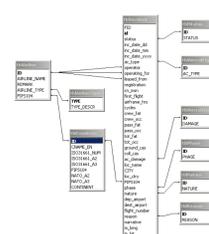
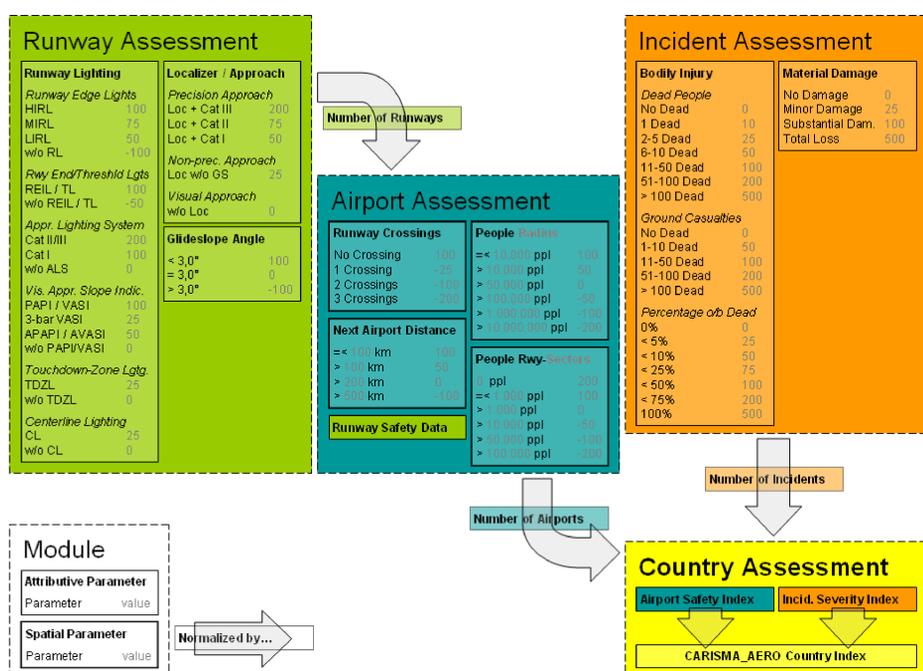
Analysis was based on two datasets: a unique air traffic incident database (property of Munich Re) and the Digital Aeronautical Flight Information File (DAFIF) provided by the United States National Geospatial-Intelligence Agency (NGA). Both databases contain extremely detailed information about the incidents and the airport safety features, respectively. For the analysis both descriptive statistics (e.g. minimum, maximum, mean, median, skewness) as well as spatial (Moran's I, semivariogram) and non-spatial correlation measures (Pearson Product Moment Correlation Coefficient r) were used.

Results

Due to missing calibration of the model no statistical correlation of the selected variables could be proven in the course of research. Yet, descriptive statistics revealed a correlation between the airport safety standards and its location.

As a result of this conceptual study about the meaningfulness and usefulness of spatial analysis of man-made disasters the following statements can be made:

- Large-scale man-made disasters are related to the spatial surroundings they are happening in.
- This correlation can be operationalized on a per-country basis.
- A semantically, spatially, and timely consistent collection and preparation of the data being used is imperative.



Relational data model of the incident database

Relational data model of the airport safety feature database (NGA DAFIF)

