**<u>Czech Flood Scenario Proposal - Final</u>**

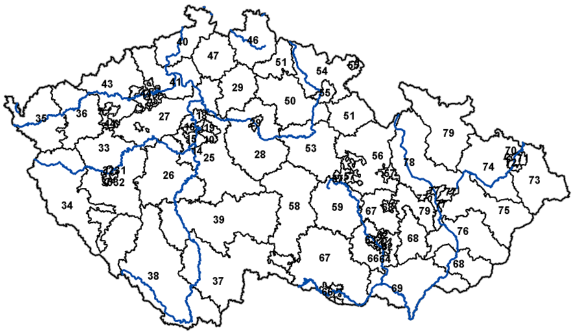
**Issue**

QIS5 scenario has zero relativity for 31 out of 59 zones. These were mostly in the east of the country. The tight deadlines of the original CEIOPS CTF precluded further work. CEIOPS was made aware of the limitation of this scenario by the CTF at the time.

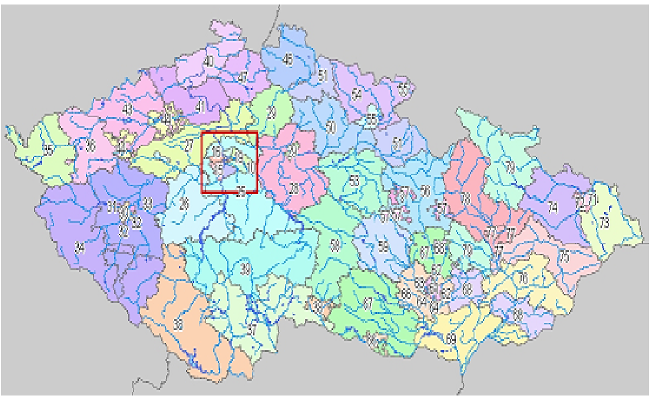
The need for the scenario to be revised was raised with EIOPA independently both by the CNB and some members of the original CTF.

**Flood Risk in Czech Republic**

*Major Rivers*



*River Network*



*Historic Events*

Significant flood event included 2002 in Czech (& Germany & Austria). Rainfall affecting multiple river catchments (including Danube, Elbe, Vltava, Mulde)

*Pluvial Flooding*

Flood risk is not limited to riverine (fluvial) flooding. Intense rain/cloudbursts can cause flash flooding (July 2011 in Copenhagen.)

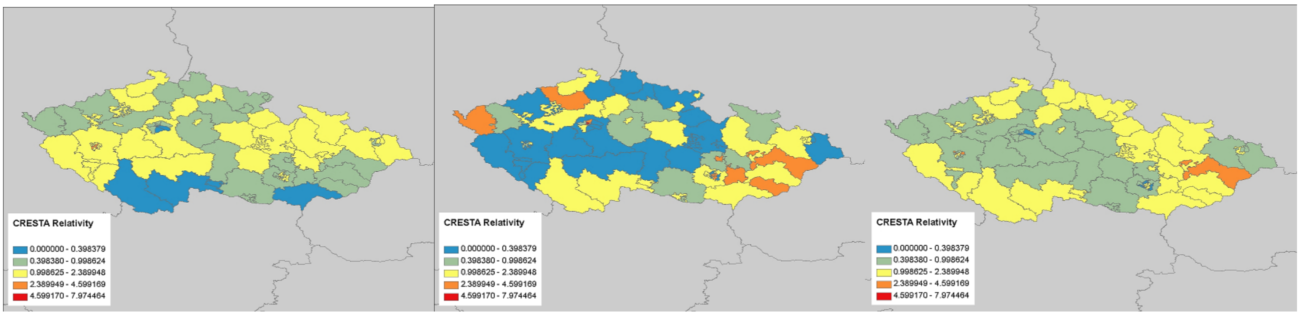
**<u>Model Availability</u>**

No commercial vendor (RMS, AIR, EQE) models available.
Broker Models are available and have come along way since early 2010.

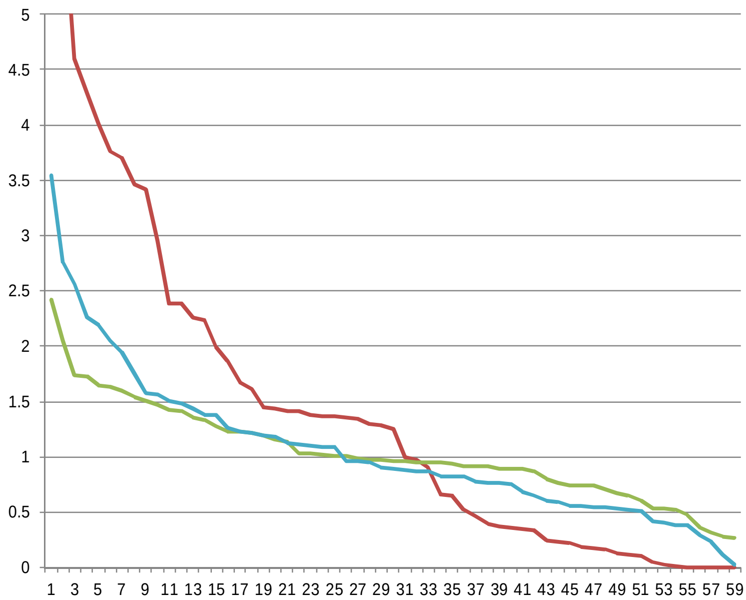
Preliminary outputs of the 3 models are quite different.  This is likely a reflection of -

a) difficulty of flood modelling (high resolution, defences etc)
b) assumptions on distribution of exposures within zones
c) different model scope (e.g including pluvial events)

**Relativities**



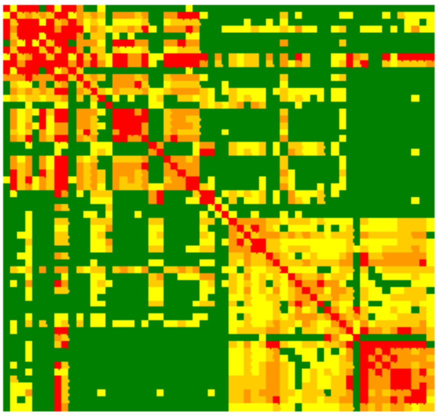
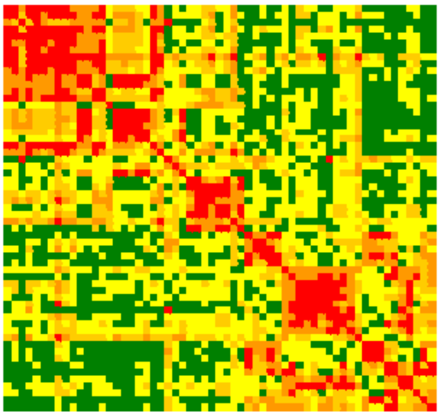
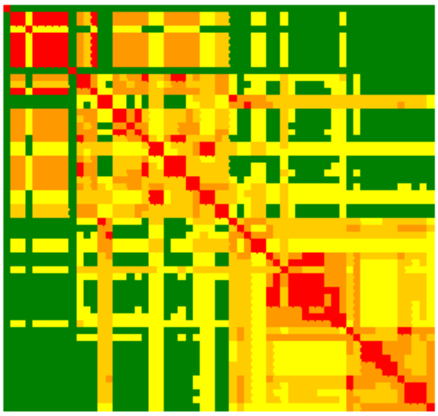

The 3 different models also showed different ratios of relative risk between the least and most risky zones.



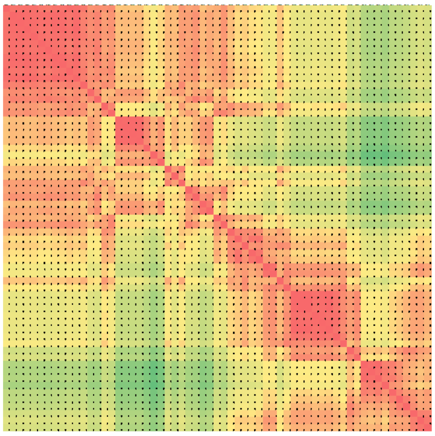

All 3 models contained outliers or potential anomolous results, especially with regard relativities e.g.

- one model gave a zero relativity for some zones
- one zone was in the bottom 10 zones for risk in one model but the top 10 zones for the other two models.

**Aggregation Factors (aka ‘Correlations’)**
The aggregation matrices from the 3 models showed, as would probably be expected, more consistency.

As a (slightly naïve) comparison, the matrix below provides a visualisation of the physical distance between zones in the Czech republic. (red = close, green = far.)   There will be an imperfect match between the the models and the distances as geographically remote zones may be on the same river. Also, although geographically close zones may be on different rivers, cross-catchment rainfall and pluvial flooding will give rise to correlation of loss.



It was considered that, given these anomolies in relativities, and the lack of detailed information available on all 3 models, it would be better to come up with a way to select the relativities and aggregation matrix using information gained from all 3 models.

**Approach Adopted**

Relativities

- Zones were put in a ordering of riskiness based on the consensus rank of all 3 models (ie process to exclude outliers).
  ie. if a zone was ranked in top ten in two models and bottom ten in the other, it was considered to be in the top ten.

  e.g. zone 77 appears in the 3 models ranked as #1, #2 and #7. This is the most consistently highly ranked zone and, as a result, appears with the highest relativity in the proposal below.

- Relativities were then assigned to the ranked zones using a curve similar to the middle of the curves on the previous page. (Adjustments were made to smooth and to exclude the impact of zero or near zero relativities for the least risky zones.)

Aggregation matrix

- average of all models having a non-zero relativity for both zones of each pair.

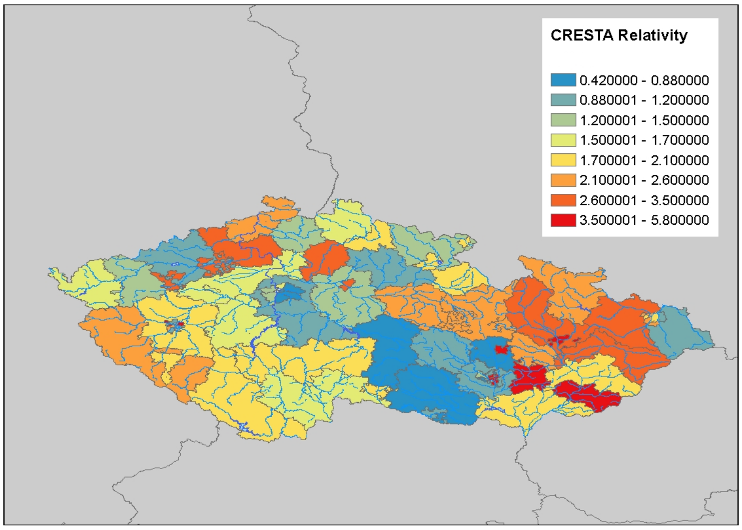
Normalisation

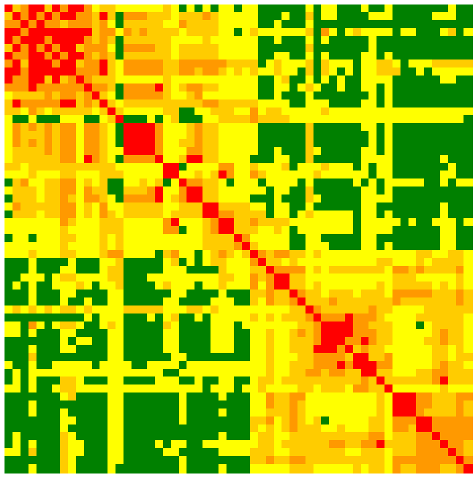
- As with all of the natural catastrophe scenarios, the relativities are ‘normalised’ so that the formula when the exposures of an undertaking with a portfolio representative of the nationwide geographic mix of bsuiness as run produces a result equal to the exposure multiplied by the market factor.
- The relativities were normalized based a member of the subgroup’s view of the industry exposure in the Czech Republic. This was based on aggregated client data representing a significant market share in total.

Although this approach adopted is not particularly scientific and not ideal, it was considered the most pragmatic and practicable option available in the circumstances. The resulting scenario is a clear improvement on the original QIS5 scenario.

**Resulting Proposal**

Full details are in the accompanying spreadsheet. The maps and diagram below show graphically the proposal.



**Additional Commentary (for 20 Feb meeting)**

During the first discussion of this proposal at the EIOPA CTF meeting, questions were raised re the zones with the highest relativities, including where these were and whether these made sense. We have therefore looked at the 3 zones with proposed relativities above 4.0.

These are :-

| Zone | Relativity | Town/City | Area(km$^2$) | River(s) |
|---|---|---|---|---|
| 77 | 5.8 | Olomouc | 123 | Morava |
| 31 | 4.8 | Plze• | 35 | Radbuza, Mze, Uhlava, Uslava, Berounka |
| 61 | 4.2 | Brno | 51 | Svitava, Svratka |

It is important to remember that the zonal relativities do not just represent the hazard in the zone. Rather, they also include an allowance for the concentration of risk. A flood of a given area will cause more damage, in terms of % of exposure value, in a small zone than in a larger zone.

In all 3 cases these are concentrations of exposures in large towns/cities locations on a major river or at a confluence of multiple rivers. The areas of these zones are also relatively small compared to the average size of zone in the country (around 1,300 km$^2$.)

**Further Review of Olomouc (77) & Plzen (31)**

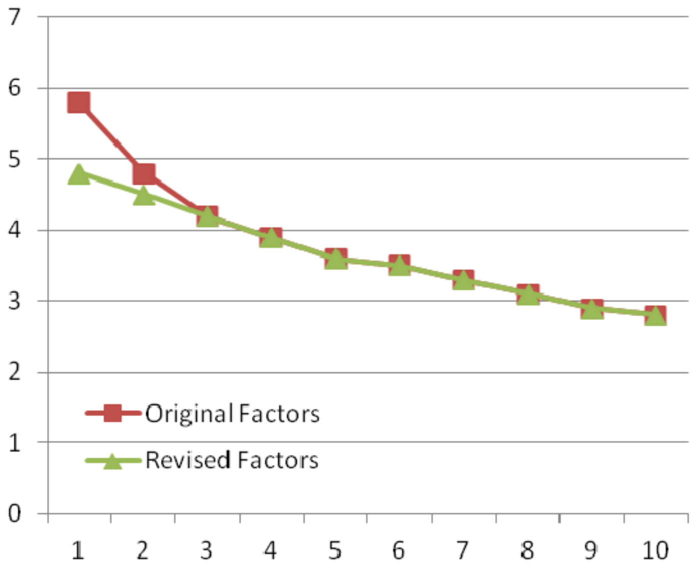
At the meeting on 20 February, whilst there was no disagreement that these zones were high risk, the extent to which their factors exceeded the next zones in order of riskiness was questioned.

Marcela Stedova, representing the Czech Industry agreed to provide (and subsequently did provide) some information about flood defence improvements in these towns. At least some of these improvements are not reflected completely in the models used. Although it is not practicable for the current purposes to updated the models, this information does provided a directional steer for these 2 zones.

In addition, whilst all 3 models each have 1 or 2 most risky zones with factors significantly higher than the next riskiest zones, a number of different zones are implicated.  It might therefore be argued not clearly fairly to pick out 2 zones in particular as the more extreme outliers.

With this and the defence infomation and this in mind, we are suggesting reductions in the factors for these zones that bring them more into line with the trend of factors for the next riskier zones.

| | |
|---|---|
| 77 Olomouc | from 5.8 to 4.8 (ie down 17 %) |
| 31 Plzen | from 4.8 to 4.5 (ie down 6.3 %) |




Due to the small size of these 2 zones and the relatively small contribution to the countrywide exposure (around 0.5%) these adjustments to relativities have an insignificant impact on the normalization.  As a result no other values need change.