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Transfrontier macroseismic data exchange in NW Europe: examples of non-circular intensity distributions

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Macroseismic data acquisition recently received a strong increase in interest due to public crowdsourcing through internet-based inquiries and real-time smartphone applications. Macroseismic analysis of felt earthquakes is important as the perception of people can be used to detect local/regional site effects in areas without instrumentation. We will demonstrate how post-processing macroseismic data improves the quality of real-time intensity evaluation of new events. Instead of using the classic DYFI representation in which internet intensities are averaged per community, we, first, geocoded all individual responses and structure the model area into 100 km^2grid cells. Second, the average intensity of all answers within a grid cell is calculated. The resulting macroseismic grid cell distribution shows a less subjective and more homogeneous intensity distribution than the classical irregular community distribution and helps to improve the calculation of intensity attenuation functions.

In this presentation, the 'Did You Feel It' (DYFI) macroseismic data of several >M4, e.g. the 2002 M_L 4.9 Alsdorf and 2011 M_L 4.3 Goch (Germany) and the 2015 M_L 4.1 Ramsgate (UK), earthquakes felt in Belgium, Germany, The Netherlands, France, Luxemburg and UK are analysed. Integration of transfrontier DYFI data of the ROB-BNS, KNMI, BCSF and BGS networks results in a particular non-circular, distribution of the macroseismic data in which the felt area for all these examples extends significantly more in E-W than N-S direction. This intensity distribution cannot be explained by geometrical amplitude attenuation alone, but rather illustrates a low-pass filtering effect due to the south-to-north increasing thickness of cover sediments above the London-Brabant Massif. For the studied M4 to M5 earthquakes, the thick sediments attenuate seismic energy at higher frequencies and consequently less people feel the vibrations at the surface.

This example of successful macroseismic data exchange from multiple seismological institutions should encourage more seismological institutes to exchange macroseismic data more often, either in real-time or while post-processing.