Technical Documentation of FATHOM

Your City, Your Future Flood Hazard Datasets

1. Introduction of the dataset

The Fathom flood hazard data provides an overview of flood hazard across a range of return periods in the form of 3 arcsecond (~90 m) resolution flood maps. The data is intended to give users an overview of flood risk in cities for which such data has previously been unavailable – particularly in the developing world. The general lack of high-quality terrain, river and rainfall data in such regions makes flood modelling very challenging, and the Fathom team are at the forefront of academic research in this field.

2. Data Description

The data was produced using the Fathom Global Flood Hazard Model, full details of which are available in the open-access scientific papers referenced below. The model simulates both fluvial (riverine) and pluvial (surface-water) flooding, using a method known as regionalisation to best estimate the behaviour of river catchments under flood conditions. The principle behind this method is to group similar catchments together and infer the behaviour of those that do not have observational data for from those that do have observational data. The terrain data used for the model is derived from the MERIT DEM, the academic communities most advanced global digital elevation model (DEM). This DEM has been created with 3 arcsecond (~90m) resolution from a range of input datasets to help control for errors from sources such as vegetation, buildings and satellite orbital anomalies. While 1 arcsecond (~30 m) global DEMs do exist, their vertical accuracy at the pixel level is not good enough to provide any benefit for flood models whose primary sensitivity is to the vertical accuracy of terrain data. Flood defences are simulated dynamically by the model, using economic indicators to estimate the design standard of flood defences in different regions.

Maps of water depths for return periods ranging from the 1-in-5 year (low-magnitude, high-frequency) to the 1-in-1000 year (high-magnitude, low-frequency). Maps are available at each return period for undefended fluvial (riverine) flooding, as well as for surface water (pluvial) flooding.

3. Key Usage

- Insurance analytics
- Disaster response and resilience planning
- Supply chain risk management
- Large-scale strategic planning (note the data should not be used to make local engineering decisions but may be valuable in determining where local engineering studies will be required).

4. **Spatial Reference, Format & Resolution**
    - Spatial Reference WGS84 – EPSG 4326
    - Raster Format GeoTIFF
    - Spatial Resolution (90 metres)

5. **Each file is composed of a collection of identifying labels**
    - 'fluv_undef' - fluvial flood (riverine) ignoring estimated river flood defences
    - 'pluv' – pluvial flood (surface water)
    - '1in5', '1in10', …, '1in1000' – return period of the hazard map in years – i.e. the 1 in 5 year, 1 in 10 year, …, 1 in 1000 year

6. **Units of Data represented**
    - Water depth in metres (m). Permanent water bodies (oceans, lakes, major river channels) are given a value of '999'.

7. **Associated Scientific Papers**

    a. Sampson, C.C., Smith, A.M., Bates, P.B., Neal, J.C., Alfieri, L., Freer, J.E., 2015. A high-resolution global flood hazard model. Water Resources Research, 51, 7358–7381, doi:10.1002/2015WR016954.

    b. Smith, A.M., Sampson, C.C., & Bates, P.B., 2015. Regional flood frequency analysis at the global scale. Water Resources Research, 51(1), 539–553, 10.1002/2014WR015814

    c. Yamazaki, D., Ikeshima, D., Tawatari, R., Yamaguchi, T., O'Loughlin, F., Neal, J.C., Sampson, C.C., Kanae, S., Bates, P.D., 2017. A high-accuracy map of global terrain elevations. Geophysical Research Letters, 44, 5844-5853, doi:10.1002/2017GL072874

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