Global Hazard Map: Socio-economic Impact Evaluation

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Joanne Robbins and Helen Titley
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The "Global Hazard Map" (GHM) aims to summarise the probability of high-impact weather across the globe in the next 7 days.

- Web Map Service – easy to overlay info, zoom/pan, flexible format for data layers
- Based on global ensemble forecasts (currently ECMWF ENS and MOGREPS-G)
- Symbol-based summary map, coloured by lead time, gives ‘at a glance’ view of all hazards
- Can then drill down to particular variables / days / models / areas of interest
- For gridded fields forecasts the probability of exceeding the 99th centile of forecast climatology
- Can overlay vulnerability and exposure layers to give information on likely impact
- Includes TC tracks and recent earthquakes
Does GHM capture weather events that lead to socio-economic impact

**Aim:** assess performance of GHM summary forecast fields in identifying events which resulted in impacts upon communities, infrastructure and businesses

**Case study method:** comparing single event in space and time against forecasts for the same event

**New method:** semi-automatic approach for conducting spatial and temporal comparisons between GHM summary forecasts (polygon features) and recorded socio-economic impacts over a historical reference period.
GHM forecast layers and identifying high-impact weather events

**ECMWF ENS; MOGREPS-UK: Multi-Model**

- **Day 3 forecast from 00Z 09/03/2016**
- **Day 4 forecast from 00Z 19/01/2016**
- **Day 4 forecast from 00Z 25/03/2016**

**24hr Precipitation Accum.**

**24hr Snowfall Accum.**

**24hr Max. Wind Gust**

**Excess Heat Factor (EHF)**

**Excess Cold Factor (EHF)**

Currently only available in ‘Test’ version
Method for comparing forecasts with socio-economic impacts

1) Generate historical archive of forecast weather events for specific hazards
   • Archive of all multi-model generated summary polygons for all forecast runs since previous GHM system upgrade
   • Focus on precipitation

2) Construct a database of historical socio-economic impact records for the same reference period and hazard, including geo-spatial reference

3) Assess and capture impact database uncertainty

4) Run comparison between forecast weather events and recorded socio-economic impacts
### Heavy Rainfall Database

<table>
<thead>
<tr>
<th>Spatial_ID (entry ID)</th>
<th>Event_ID (hazard event ID)</th>
<th>Record Date</th>
<th>Start Date</th>
<th>End Date</th>
<th>Hazard Type ('Heavy rainfall')</th>
<th>Trigger/Cause</th>
<th>Secondary Hazards</th>
<th>Hazard Notes</th>
<th>Country Name</th>
<th>Region/State/Province Name</th>
<th>Region/State/Province Latitude</th>
<th>Region/State/Province Longitude</th>
<th>Settlement Name</th>
<th>Settlement Latitude</th>
<th>Settlement Longitude</th>
<th>Impact Information</th>
<th>Impact Categorisation</th>
<th>References</th>
</tr>
</thead>
</table>

Between February 8th and December 31st 2015 a total of 261 heavy rainfall events were recorded, resulting in 853 database entries.
Impact databases: challenges

- Identifying appropriate data sources for impact information
- Construction with appropriate temporal and spatial information
- Maintenance (real-time v's retrospective)
- Capturing uncertainty associated with impact records
- Ensuring consistency across a database
- Clear focus on types of impacts being collected (primary hazard impacts v's impacts associated with primary & secondary hazards; general impact information v's asset specific impacts)
- Impact categorisation
Method for comparing forecasts with socio-economic impacts

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Impact database uncertainty
Options and approaches

Meteorological cross-referencing

Spatial and temporal variability
- Assess spatial uncertainty of the record by categorising the detail of location information available
- Converting impact point locations to areas using Global Administrative Areas (GADM) data – however important to consider which Admin level should be used
- Rules applied to determine heavy rainfall occurrence dates

Can be used to produce an ‘impact-recording uncertainty metric’
Method for comparing forecasts with socio-economic impacts

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Evaluation Results

- Forecasting climatological extremes is challenging, with uncertainty quickly growing with lead time.
- Impacts triggered by convective rainfall may not be captured.
- Heavy rainfall impacts are largely associated with secondary impacts.
- 24hr precipitation is only one component contributing to observed impacts.

Compare intersects between heavy rainfall impact polygons and GHM forecast precipitation summary polygons, for matching occurrence ('observed') and validity ('forecast') dates.
Ongoing/Future work

1. Alter probability thresholds used to generate summary polygons
2. Look at methods to assess false alarms
3. Apply methodology to other hazards (e.g. heatwaves and coldwaves)
4. Review drivers of high-impact events both meteorologically and socially
5. Investigate application of social media for impact database generation in real-time
Questions?