



MANAGEMENT OF **WEATHER** EVENTS IN THE **TRANSPORT** SYSTEM

# Improving the management of extreme weather events

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# Life after ***FUTURENET***



- ***FUTURENET***

- EPSRC funded ARCC project (2009-2013)
- Development of multidisciplinary framework for the assessment of climate change impacts on transport
- University of Birmingham, University of Loughborough, University of Nottingham, British Geological Survey, HR Wallingford, TRL, Network Rail, Highways Agency

- REWARD

- Network Rail data integration project (2012-2013)
- Use of train timing and delay data with meteorological data for the exploration and visualisation of the impact of extreme weather events

- MOWE-IT

- EC funded (FP7) project (2012-2014)
- Identification of best practice for the management of extreme weather events

14 institutions led by VTT (Finland)

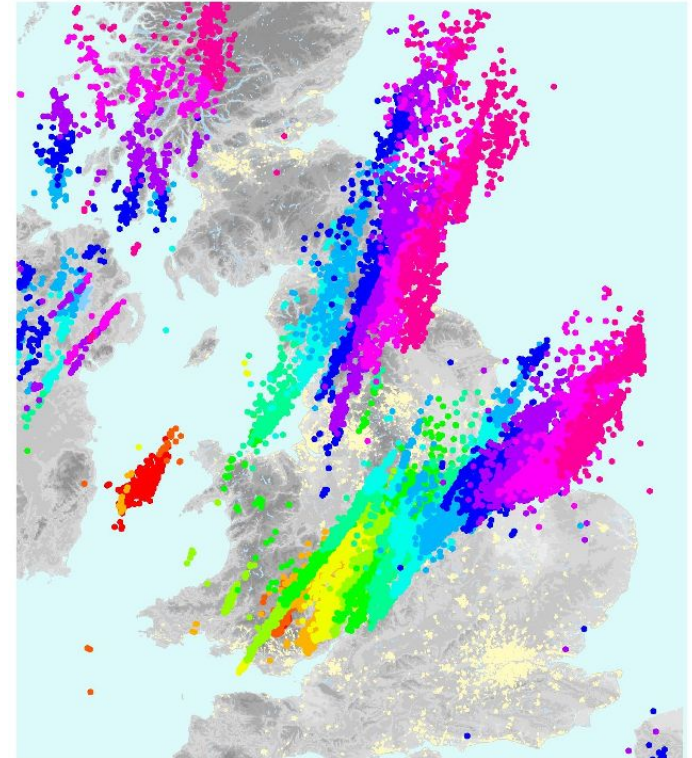


# June 28<sup>th</sup> 2012

- Intense storms with extreme rainfall (super cell)
- Rail transport between England and Scotland severed
- Flooding of Tyne and Wear Metro
- Freight train derailed in Scottish Highlands
- Flights disrupted at Birmingham International



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Lightning strikes 28th June 2012

Lightning strike times

|                  |                  |                  |
|------------------|------------------|------------------|
| • 05:00 to 06:00 | • 10:00 to 11:00 | • 14:00 to 15:00 |
| • 06:00 to 07:00 | • 11:00 to 12:00 | • 15:00 to 16:00 |
| • 07:00 to 08:00 | • 12:00 to 13:00 | • 16:00 to 17:00 |
| • 08:00 to 09:00 | • 13:00 to 14:00 | • 17:00 to 18:00 |
| • 09:00 to 10:00 |                  |                  |

Recorded lightning strikes during the 28th of June 2012 (© 2012 Crown Copyright, Met Office)

# Tebay landslip

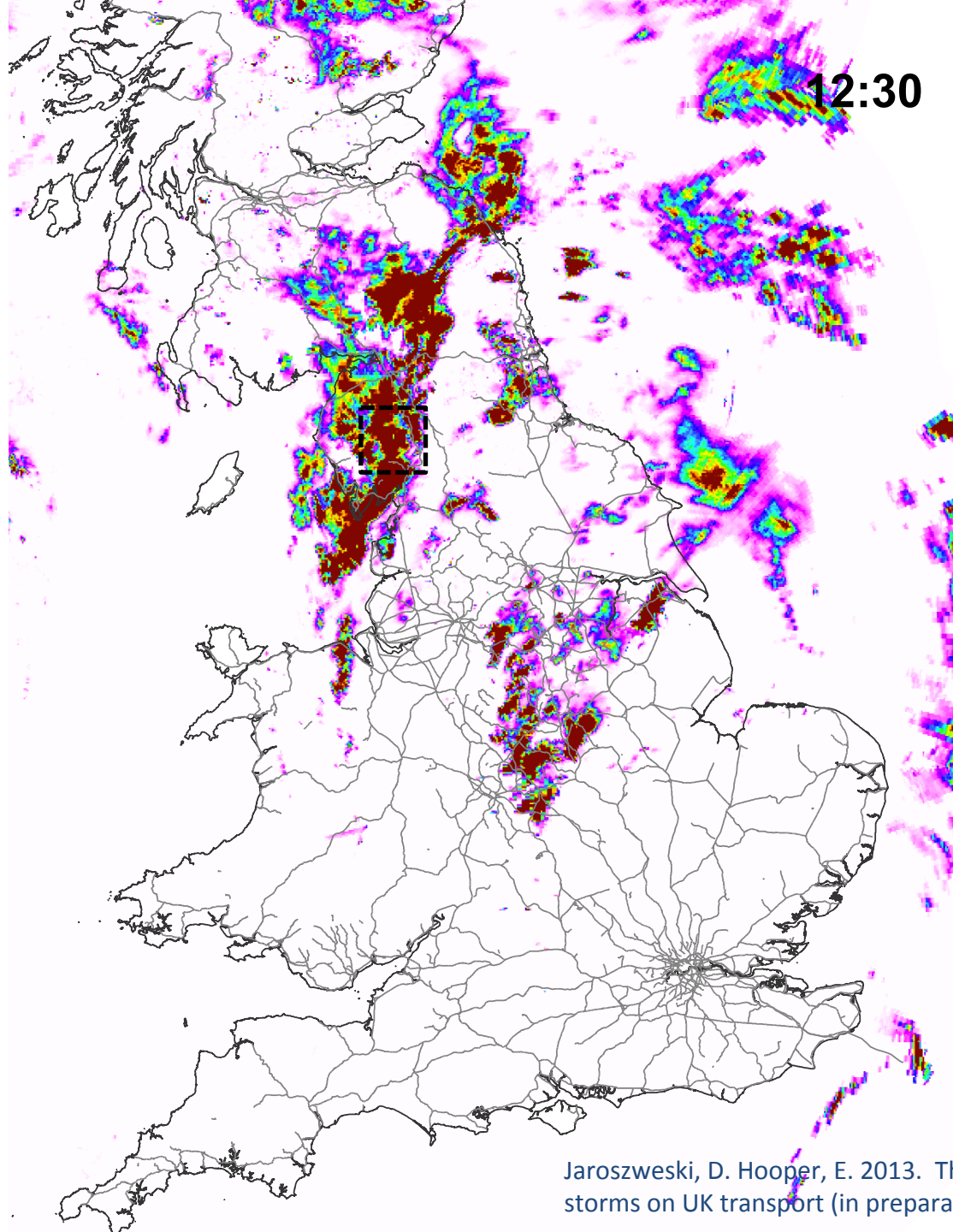
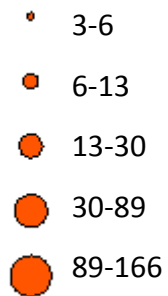


Rainfall-induced  
landslip on  
cess ballast



28<sup>th</sup>  
June  
2012  
Tebay landslip

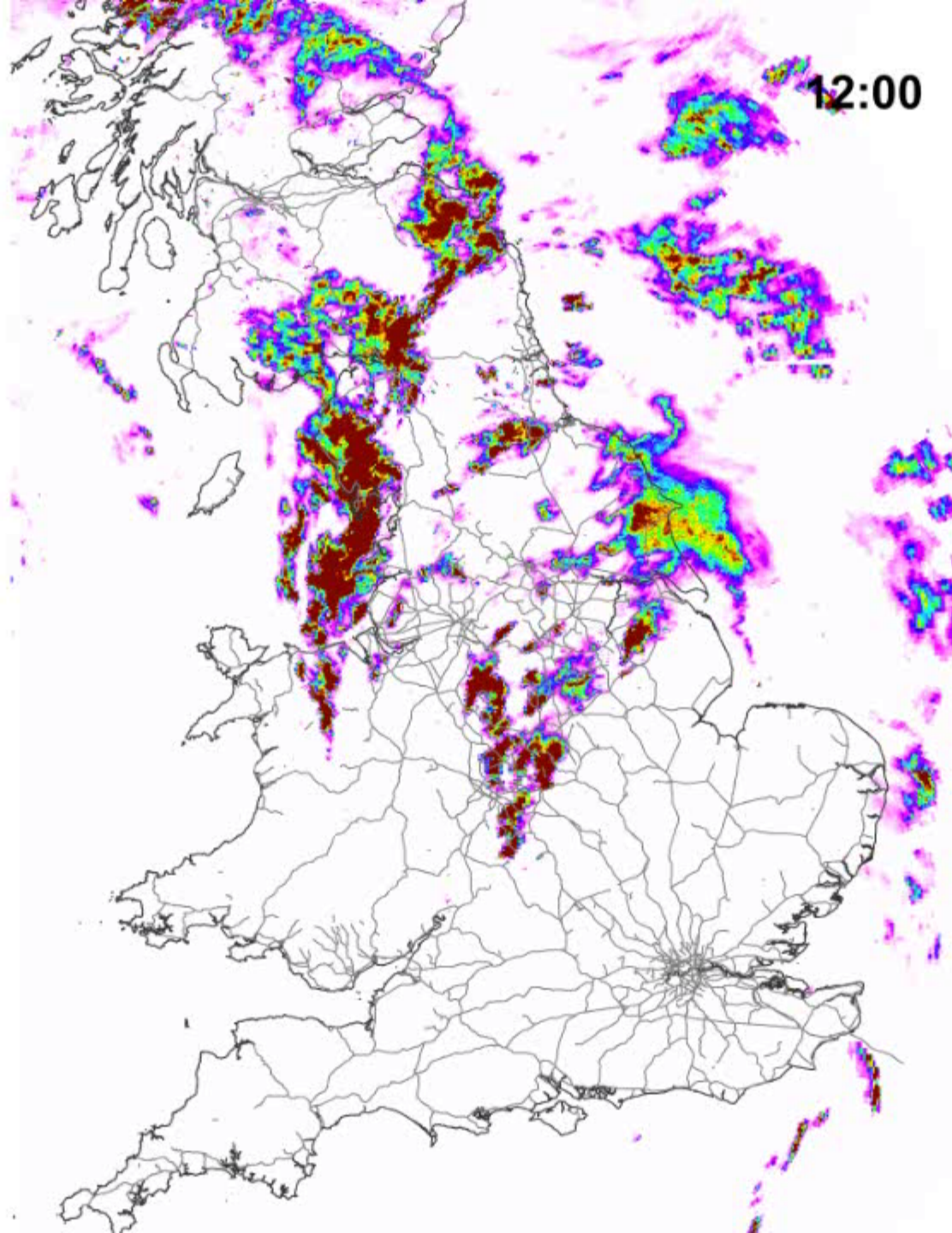
Delay minutes



Jaroszweski, D. Hooper, E. 2013. The impact of the 28<sup>th</sup> June 2012 storms on UK transport (in preparation)

12:00

Delay minutes

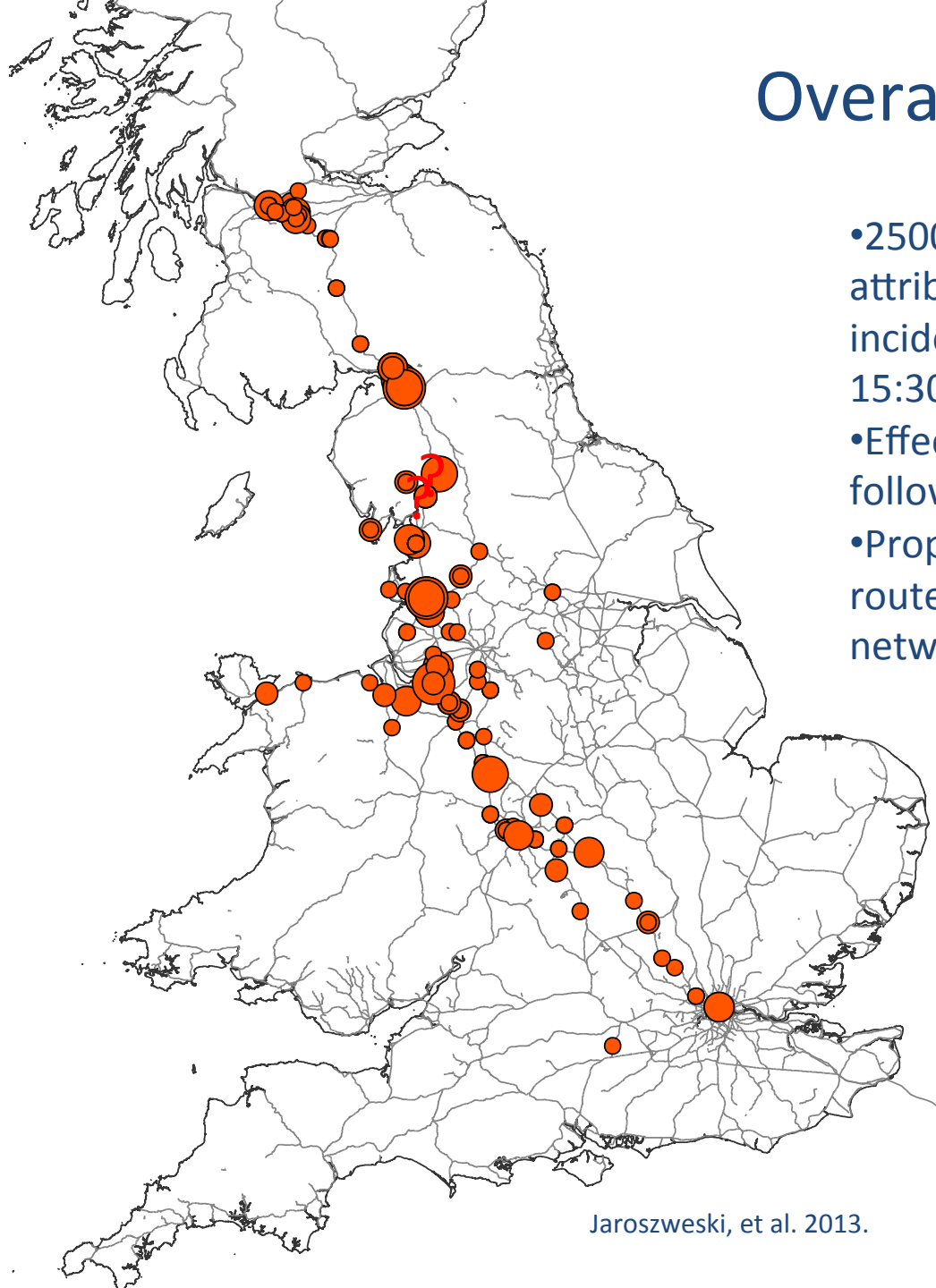
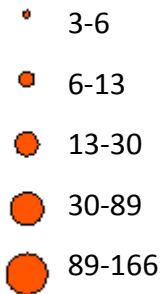


28<sup>th</sup>  
June  
2012  
Tebay landslip

## Overall delays

- 2500 delay minutes attributed to two incidents between 15:30 - 9:30
- Effects continue into following day
- Propagation within route and to wider network

Delay minutes





# Tebay landslip



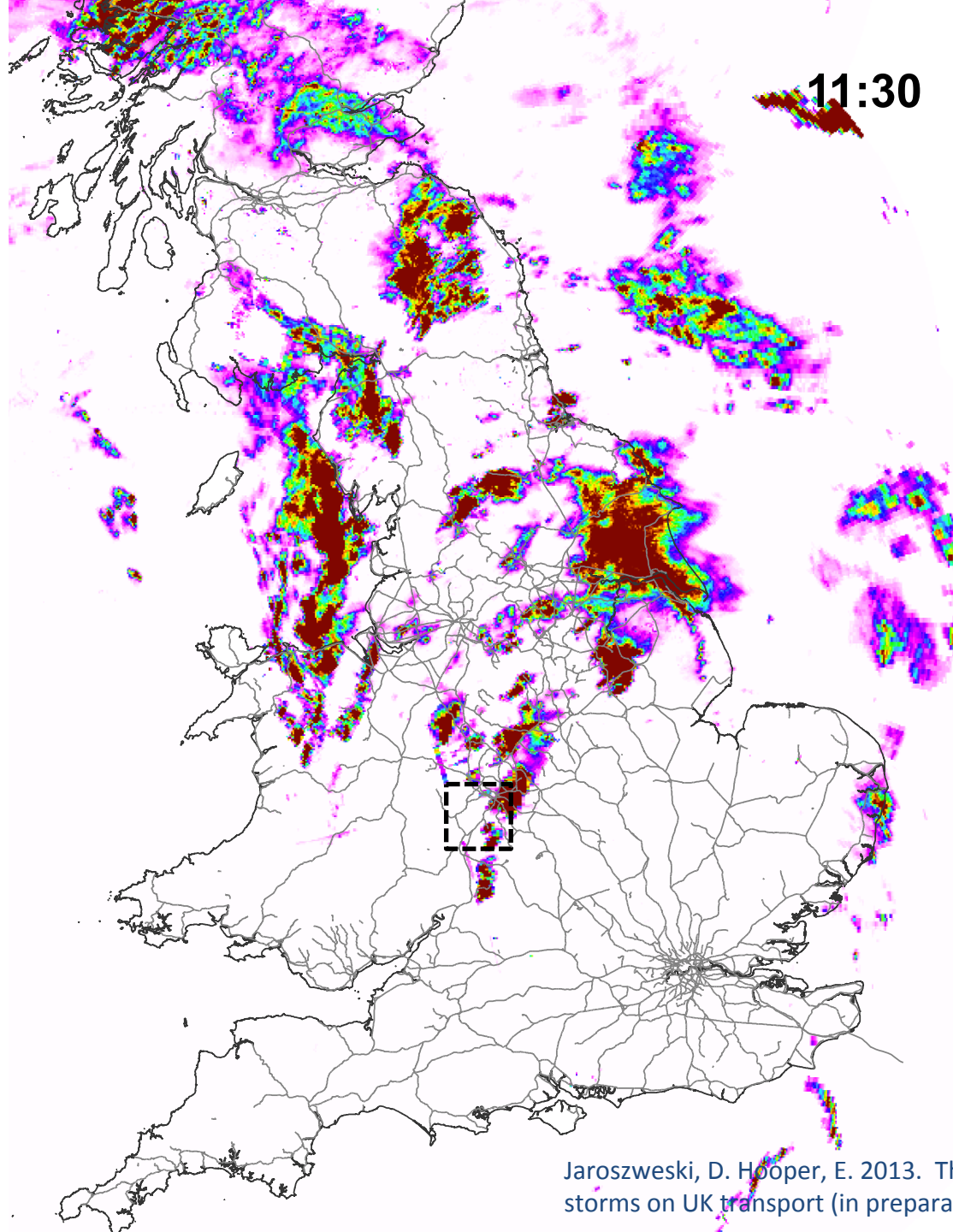
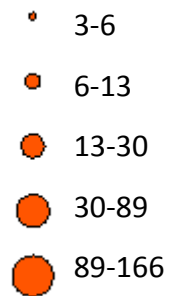


# Tebay landslip



28<sup>th</sup>  
June  
2012  
Barnt Green  
flooding

Delay minutes



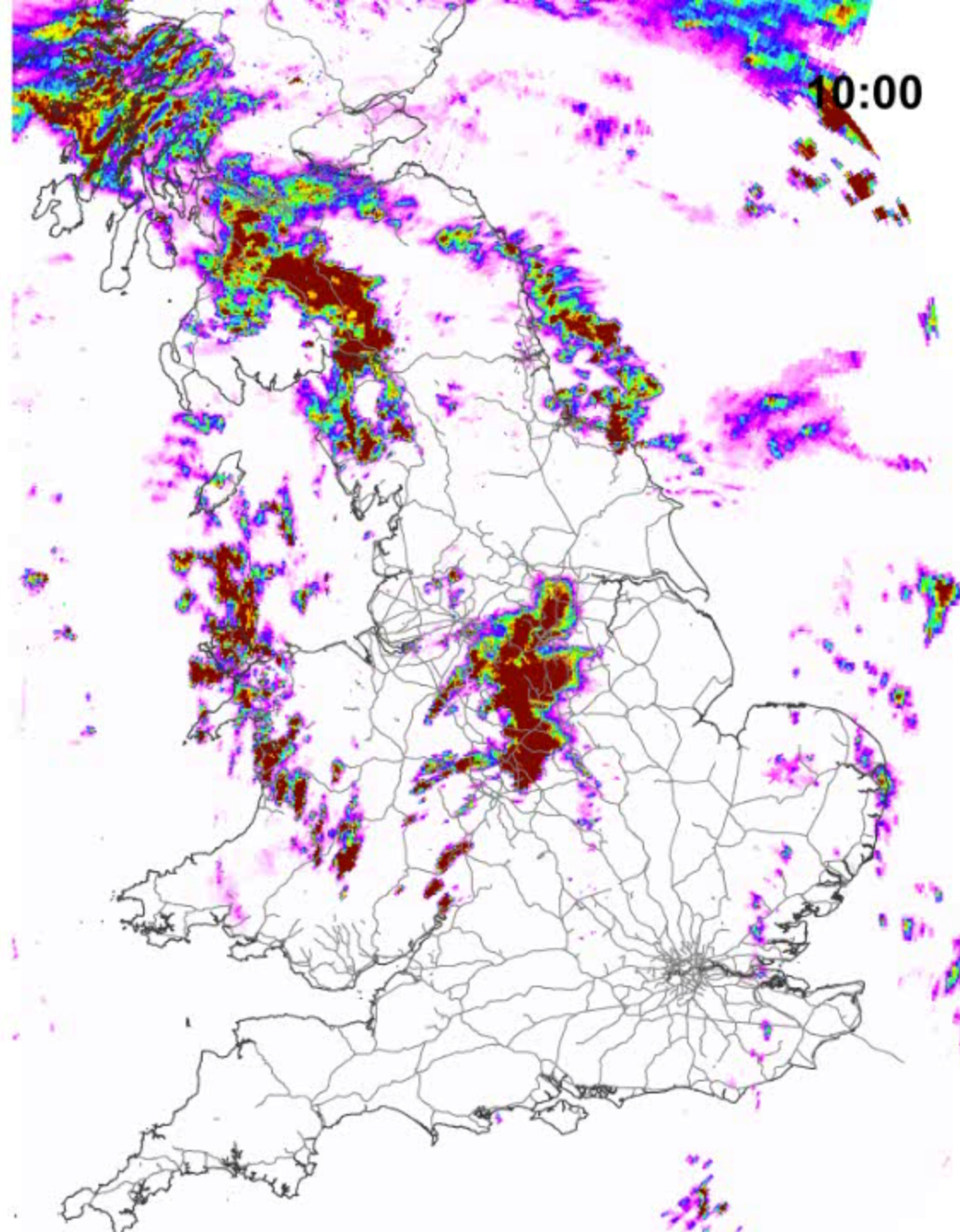
Jaroszweski, D. Hooper, E. 2013. The impact of the 28<sup>th</sup> June 2012 storms on UK transport (in preparation)



Delay minutes



10:00



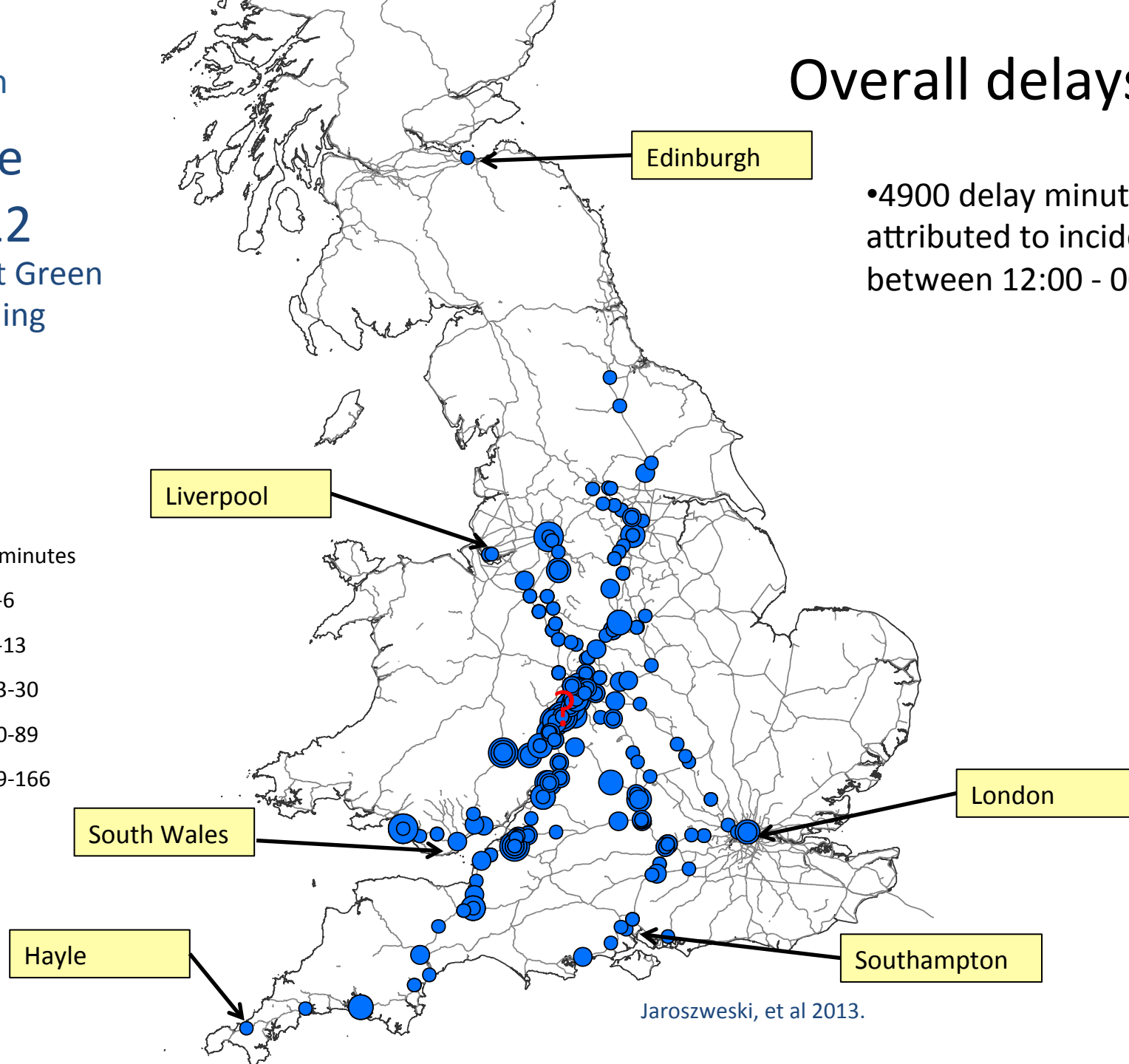
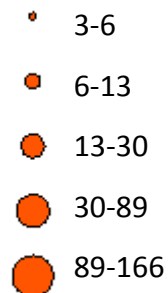


28<sup>th</sup>  
June  
2012  
Barnt Green  
flooding

# Overall delays

•4900 delay minutes  
attributed to incident  
between 12:00 - 00:30

Delay minutes



Jaroszweski, et al 2013.

# MOWE-IT

- The goal of the MOWE-IT project is to identify existing best practices and to develop methodologies to assist transport operators, authorities and transport system users to mitigate the impact of natural disasters and extreme weather phenomena on transport system performance.
- Response to the 2010 volcanic ash could event
- Work packages for road, rail, aviation, inland waterways and maritime transport, as well as cross-modal substitution



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# Objectives (rail)

- To identify the problems specific to passenger and freight train operations in extreme weather conditions.
- To assess the overall operational and maintenance requirements for railways in extreme weather conditions
- To identify the information needs and technology availability for increasing resilience of rail transport
- To develop a best practice guide for rail management and operation during extreme weather conditions.





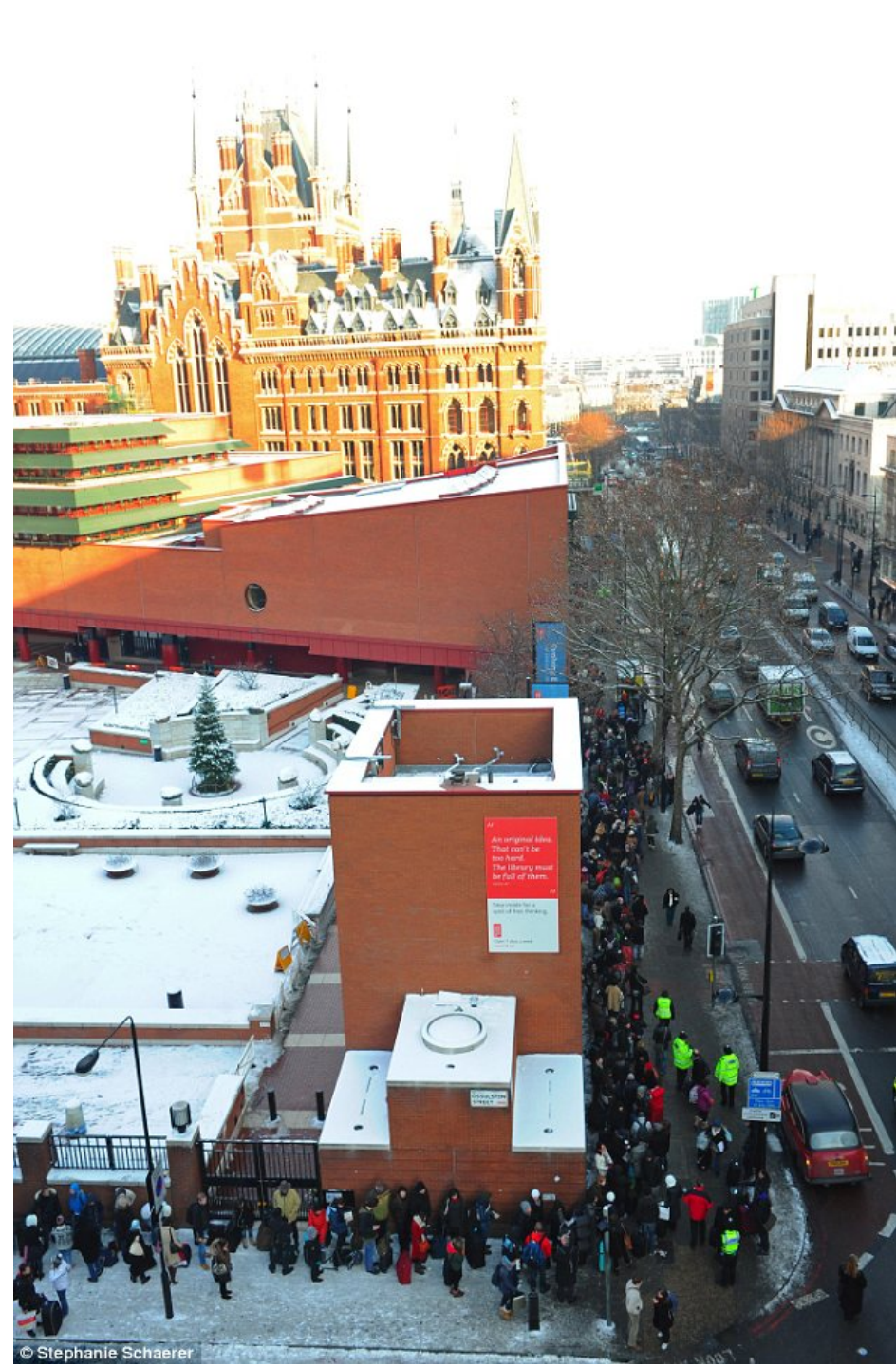
# Case studies

- Weather types chosen
  - Flooding / heavy rain
  - Wind
  - Snow / winter conditions
- Analysis
  - Meteorological situation
  - Impact on rail infrastructure and operations
  - Event management
  - Repairs

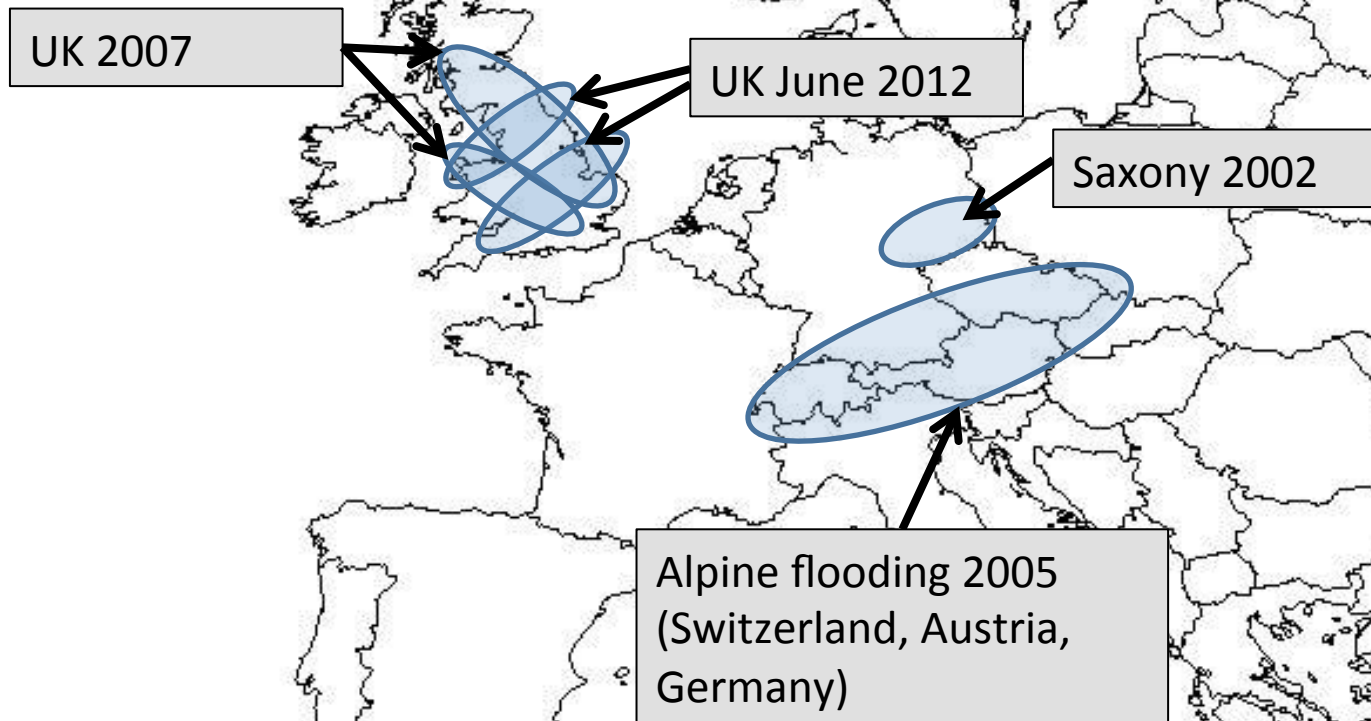


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Passengers queuing for at  
St Pancras for Eurostar  
services, December 2009



# Flooding/heavy rain



# Wind/storm

## Storm Kyrill

2006 (UK,

Netherlands, Belgium,  
France, Germany, Poland,  
Austria, Czech republic,  
Denmark, Switzerland,  
Slovenia)

Storm Gudrun,  
Sweden 2005

Hurricane  
Sandy 2012

Storms Lothar  
and Martin  
1999 (France,  
Switzerland,  
Germany)



# Snow/winter

Sweden, heavy  
snow  
2009/2010

Southern  
Finland,  
extreme  
winter  
2009-2010

Channel  
Tunnel 2009

Stockholm  
2001-2002

Winter 2009-2010

# Expert workshop

- Workshop to discuss guidelines and recommendations identified from case studies
  - 25+ delegates
  - Austria, Belgium, France, Netherlands, Finland, Germany, UK, USA, Australia, Singapore
- Specific guidelines
  - Before
  - During
  - After
  - Long-term
- General guidelines



Included speakers from industry and researchers  
Led by John Dora a widely respected rail industry figure on climate adaption



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# Examples of guidelines (wind)

## Long-term preparation

- Train personnel (and subcontractors) to understand the specifics of clean-up and repair-works after heavy wind-events (during the clean-up works following the windstorm Kyrill there were several fatalities)
- **Design a risk-based approach for speed restrictions and line closures**

## Immediately before event

- Advance preparations for dealing with predicted impacts of wind event should be discussed (identification of persons/groups to coordinate the work, identification of critical locations, deployment of subcontractors, ensure the availability necessary resources like cranes, chain saws etc.)
- Deploy diesel engines in the areas likely to be most affected in the case of disruption to electrical equipment

## During

- **Reduce speed limits and cancel traffic where appropriate**
- Have additional personnel on standby to help with additional duties during a heavy wind event or to replace crews displaced by delayed/cancelled trains and to take care of passengers

## After

- Where repairs and reconstruction are carried out, damaged infrastructure should be upgraded to improve resilience to future wind events
- Identify of critical locations



# Guidebooks and conference

- Five modal guidebooks
  - Road, rail, aviation, maritime, inland waterways
- Detailed documents for the 3 major weather types (rail)
- Individual case studies of 15 major and many minor events (rail)
- Three dissemination conferences
  - **London** (Institution of Mechanical Engineers) 4<sup>th</sup>-5<sup>th</sup> September (rail and waterborne transport)
  - **Berlin** 8<sup>th</sup>-9<sup>th</sup> September (road and aviation)
  - **Thessaloniki** 15<sup>th</sup>-16<sup>th</sup> September (road, aviation and waterborne transport)



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# Where do we go from here?

- LivingRAIL
  - Barriers (technical and policy) to modal shift to rail
- RSSB – TRaCCA
  - Developing knowledge throughout the rail industry
  - Metrics and Systems thinking in disruption analysis
- REWARD
  - NR risk mapping based on disruption and weather data
  - Novel ways of presenting information and decision support
- Wind Alarm systems
  - Using new NR weather data to improve preparedness, response and recovery to extreme events





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# Thank you for listening

Any questions?



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