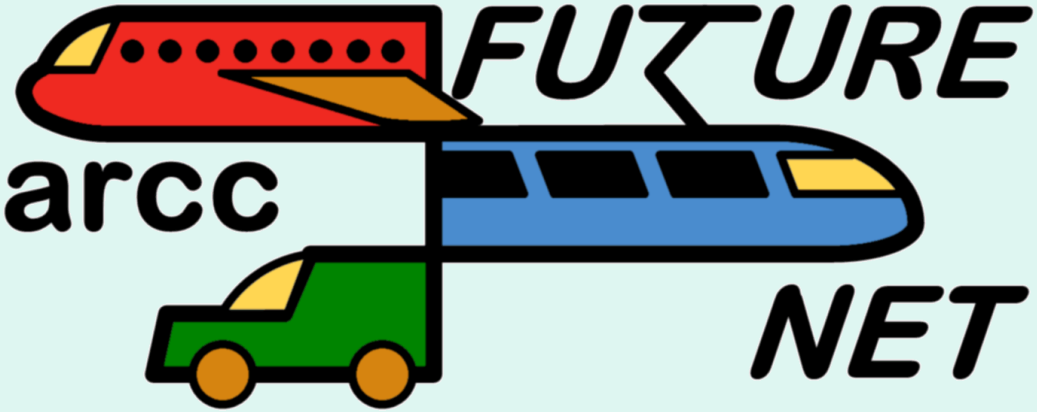
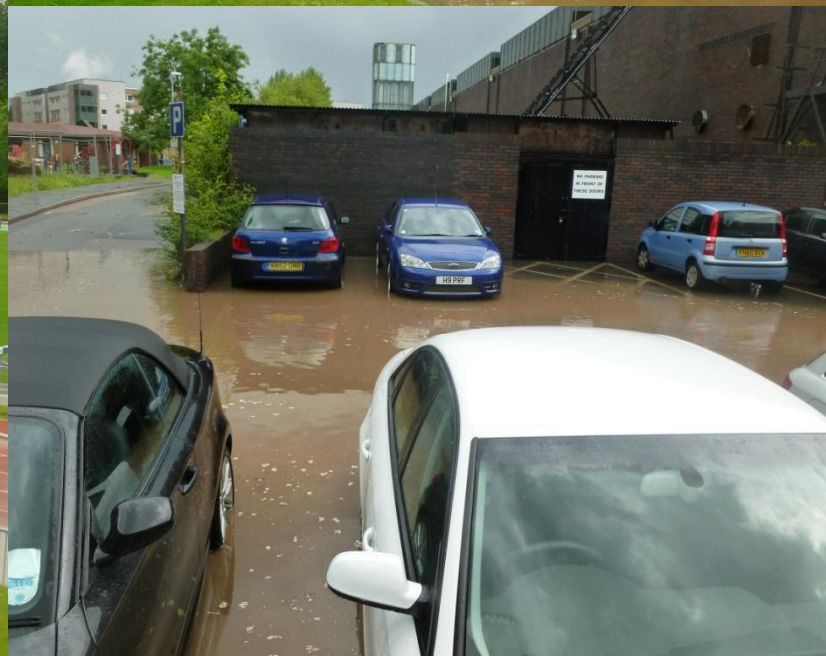



# FUTURE RESILIENT TRANSPORT SYSTEMS

June 28th 2012

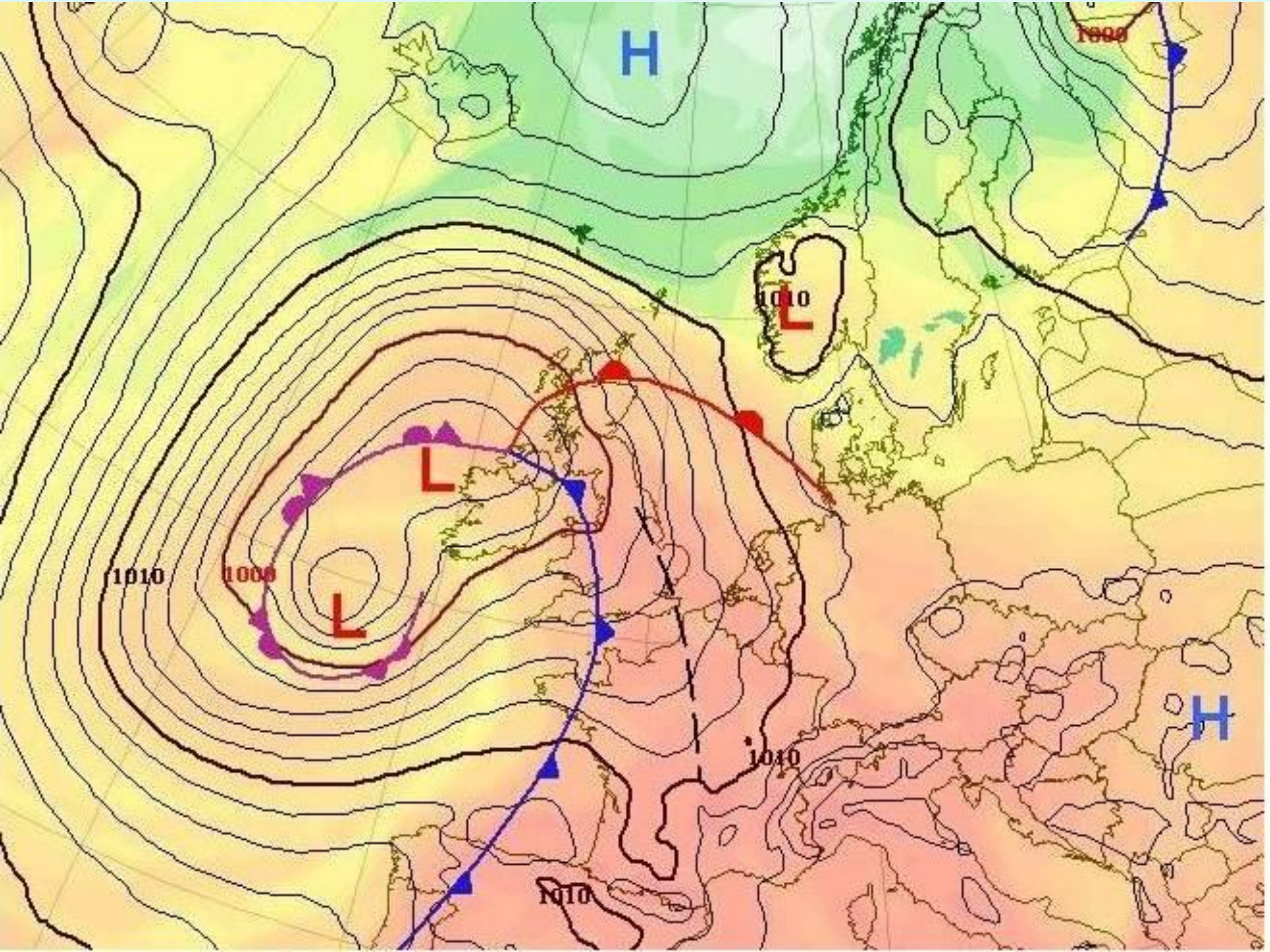
# Loughborough University



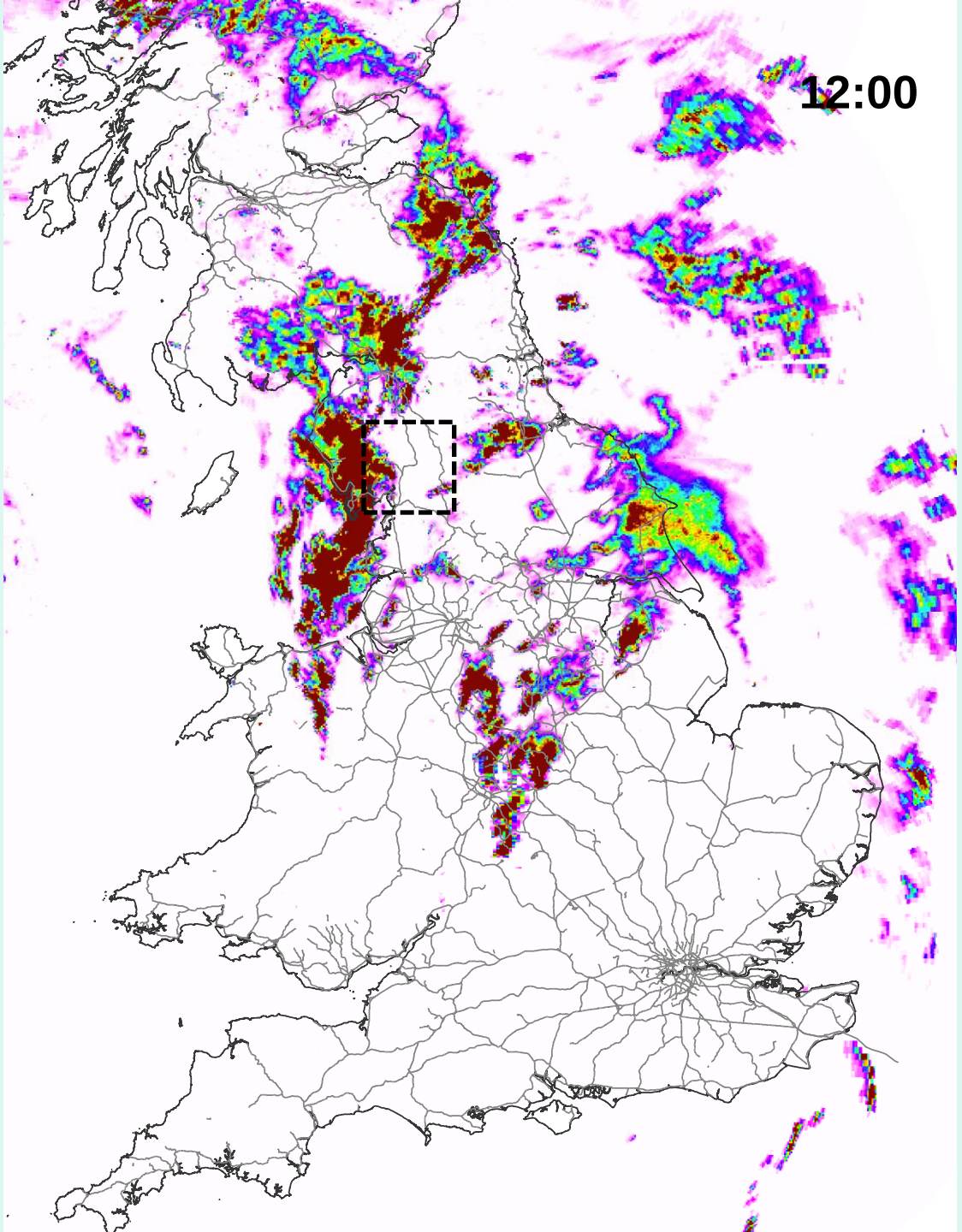

GBRf


20
PA


AUTO INRPT
TV
W
+20
0
-20
-40
-60
-80
-100
-120
STBY
-180
-90
0
+90
+180
© MOD

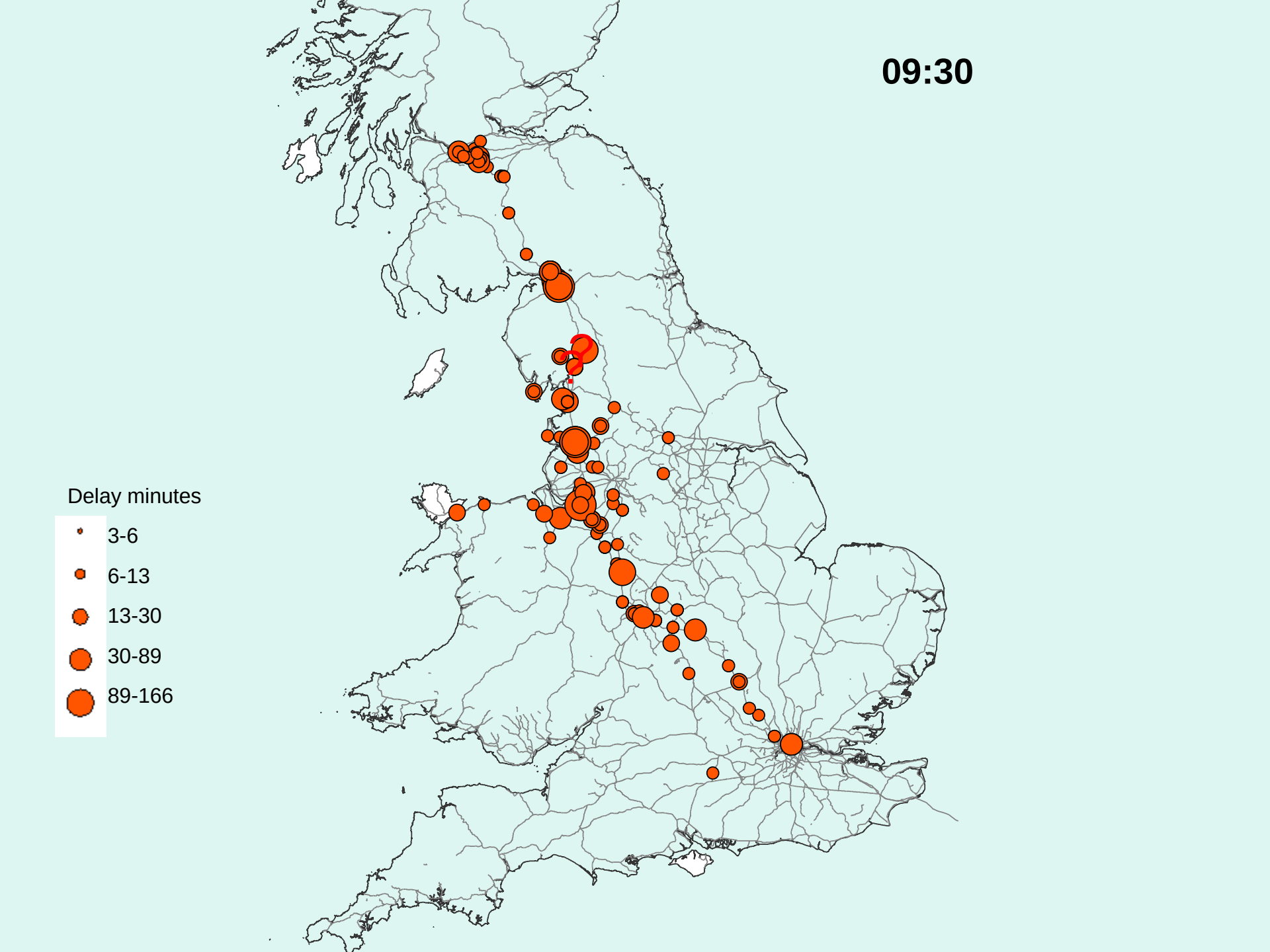

H
1000
L
1010
L
L
1010
1000
1010
H
1010
1010

# Tebay landslip



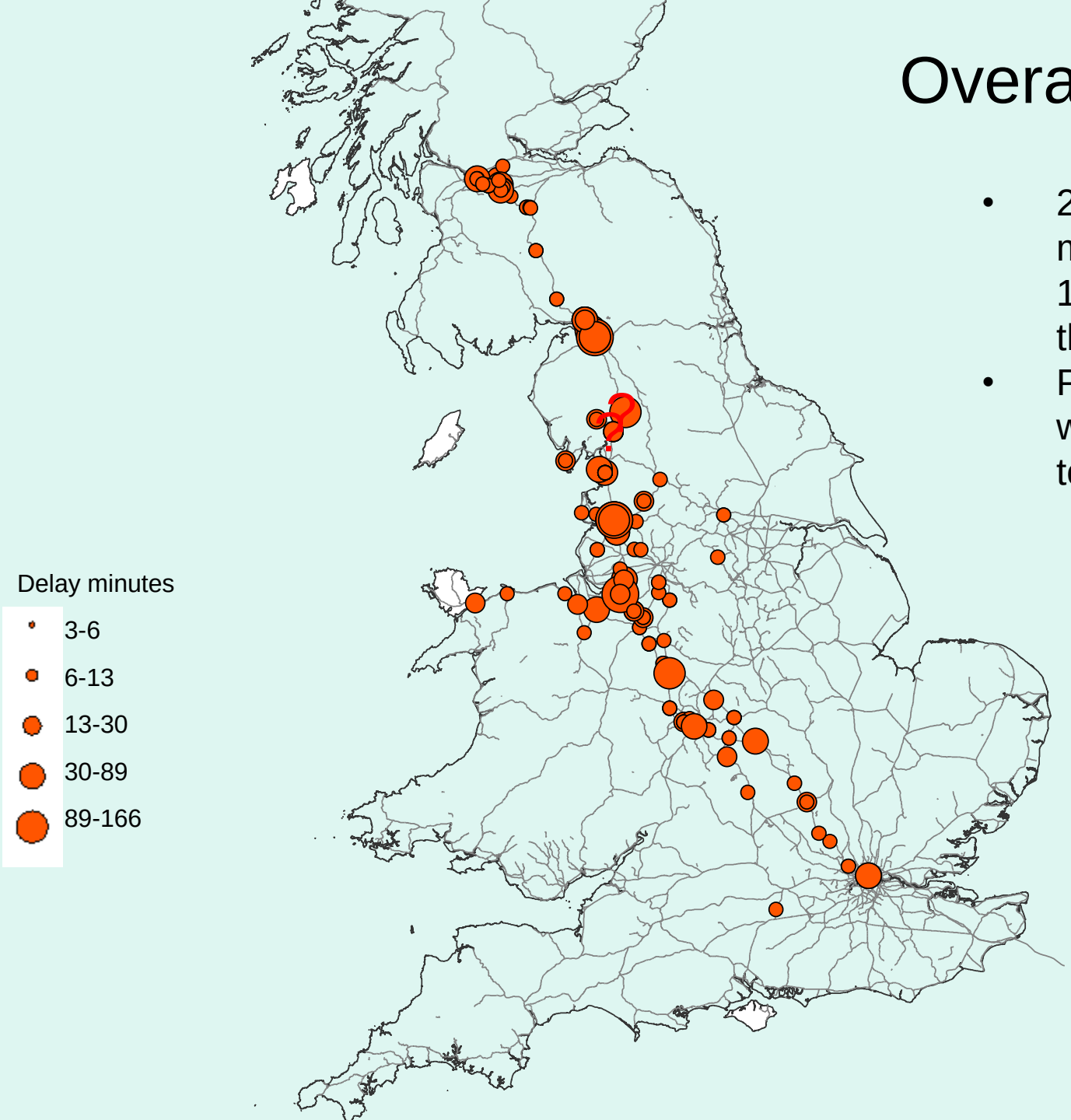

Delay minutes

- 3-6
- 6-13
- 13-30
- 30-89
- 89-166


09:30
Delay minutes
3-6
6-13
13-30
30-89
89-166

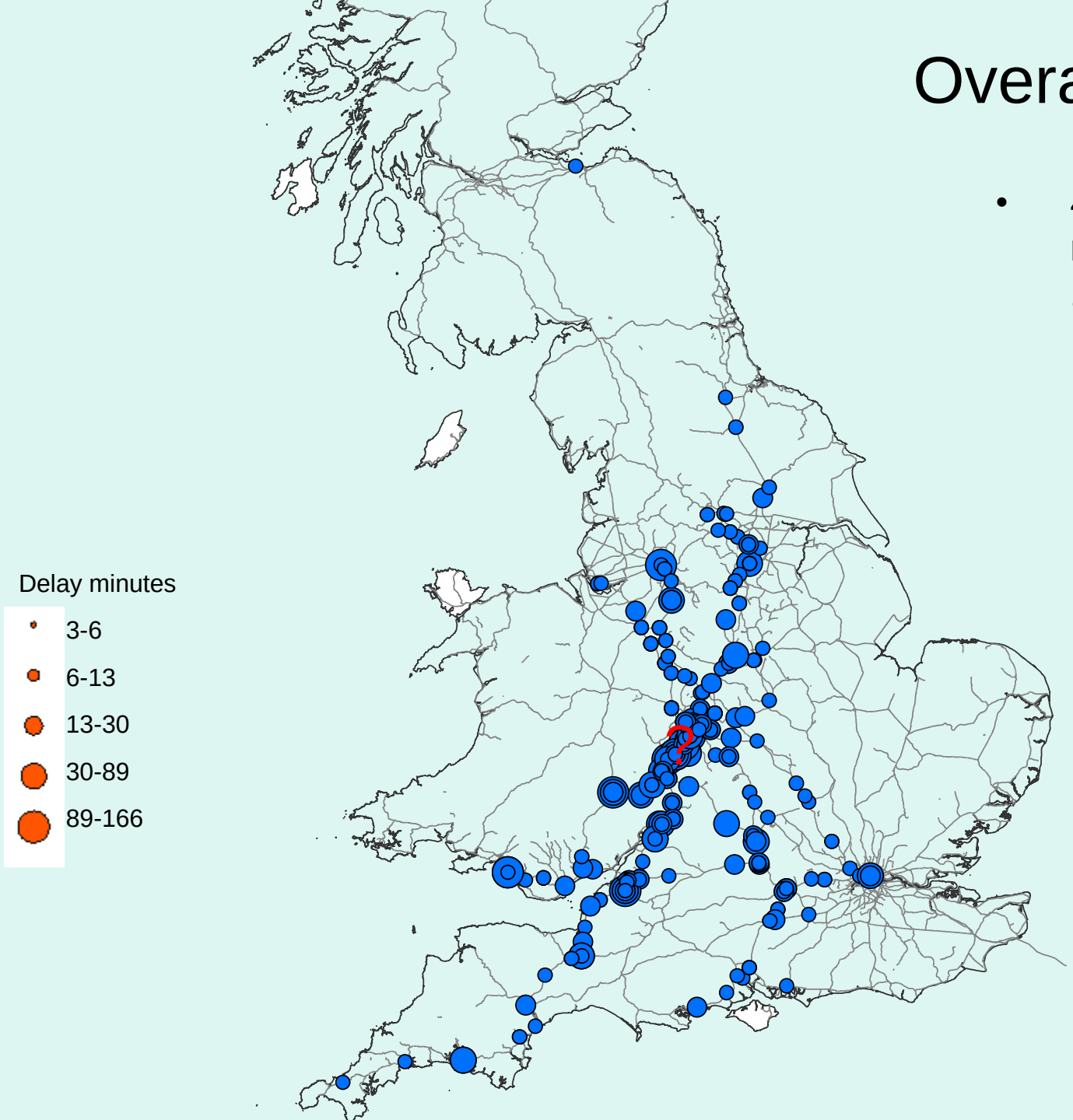
# Overall delays

- 2500 delay minutes between 15:30 – 09:30 the following day
- Propagation within route and to wider network



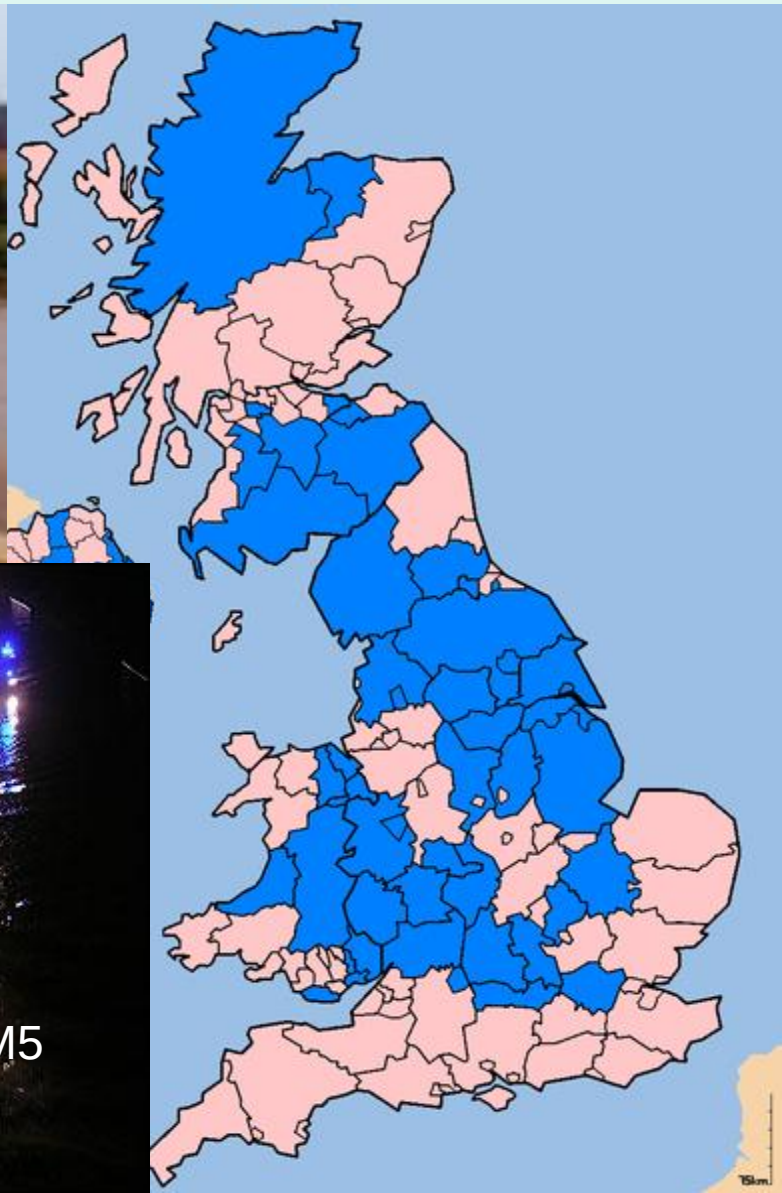
# Overall delays

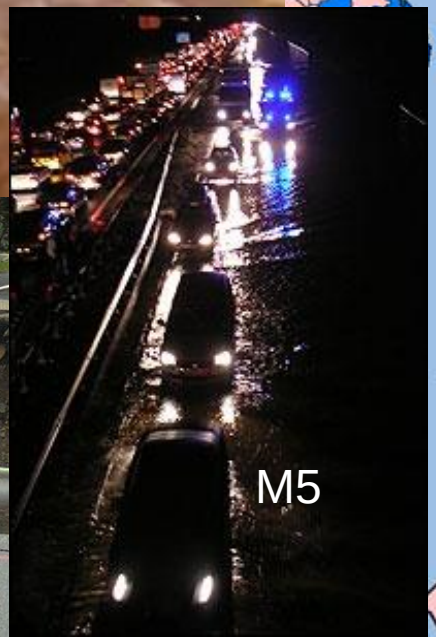
- 4900 delay minutes between 12:00 - 00:30



# The effect of other extreme weather on UK transport operation

# July 2007




# Snow 2010/11


1730
Transporte
Kurier- & Expressdienst
Autovermietung
Lagerlogistik
0221 1771-0

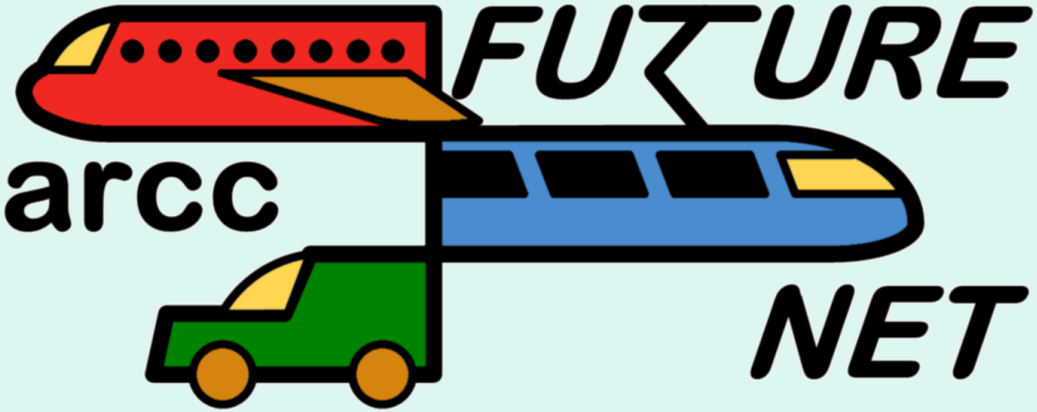

ROAD
CLOSED


P17H


Network Rail Air Operations Team


SW

| | Typical % Increase In Overtopping | Events Resulting In Both Lines Being Shut |
|---|---|---|
| 2006 | 0 | 1 in 6 |
| 2020 | 50% | 1 in 3.5 |
| 2050 | 125% | 1 in 2 |
| 2080 | 250% | 1 in 1 |




# FUTURE RESILIENT TRANSPORT SYSTEMS

# Programme

- ***FUTURENET*** (Prof C Baker)
- What does the future look like? (Dr A Quinn)
- Modelling system resilience (Prof N Dixon)
- Using ***FUTURENET*** methodology (Mr J Dora)
- Summing up (Prof C Baker)
- Questions with panel

# The context

- Climate Change Act
- Adaptation reporting requirements
  - Network Rail
  - Highways Agency
  - London Underground
- Research Councils
  - Living with Environmental Change
  - Adaptation and Resilience to Climate Change

# ARCC projects

- **All in One**: Feasibility analysis of supplying all services through one utility product, Dr Fatih Camci, Cranfield University
- **ARCADIA**: Adaptation and Resilience in Cities: Analysis and Decision making using Integrated Assessment, Prof. Jim Hall, Newcastle University
- **ARCC-Water**: Water System Resilience, Dr Mark New, University of Oxford
- **ARCoES**: Adaptation and Resilience of Coastal Energy Supply, Prof. Andrew Plater, University of Liverpool
- **ARIES**: Adaptation and Resilience In Energy Systems, Prof. Gareth Harrison, University of Edinburgh
- **BIOPICCC**: Built Infrastructure for Older People in Conditions of Climate Change, Prof. Sarah Curtis, Durham University
- **CLUES**: Challenging lock-in through urban energy systems, Prof Yvonne Rydin, UCL

# ARCC projects

- **DeDeRHECC** : Design & Delivery of Robust Hospital Environments in a Changing Climate, Prof. Alan A Short, University of Cambridge
- **FUTURENET**: Future Resilient Transport Networks Prof. Chris Baker, University of Birmingham
- **ITRC**: The UK Infrastructure Transitions Research Consortium, Prof Jim Hall, Newcastle University
- **Land of the MUSCos**: Multiple-Utility Service Companies, Dr Julia K Steinberger, University of Leeds
- **RESNET**: Resilient Electricity Networks for GB, Prof. Kevin Anderson, University of Manchester
- **Retrofit2050**: Re-engineering the city 2020-2050: Urban foresight and transition management, Prof Malcolm Eames, University of Cardiff

# ARCC projects

- **SECURE**: Self-conserving urban environments, Prof Margaret Bell, Newcastle University
- **SHOCK (not) Horror**: Prof Stephanie Glendinning, Newcastle University
- **SNACC**: Suburban neighbourhood adaptation for a changing climate: identifying effective, practical and acceptable means of suburban re-design, Prof. Katie Williams, University of the West of England
- **STEP-CHANGE**: Sustainable Transport Evidence and modelling Paradigms: Cohort Household Analysis to support New Goals in Engineering design, Prof Miles Tight, University of Birmingham
- **TUCP**: Transforming Utilities' Conversion Points, Dr Liz Varga, Cranfield University
- **Undermining Infrastructure**: Avoiding the scarcity trap, Prof Phil Purnell, University of Leed

# Other projects

- EU FP7
  - EWENT
  - WEATHER
  - MOWE-IT
- RSSB – TRaCCA




# FUTURENET

- ARCC funded project 2010-2013
- Project addresses two issues
  - What will be the nature of the UK transport system in 2050, both in terms of its physical characteristics and its usage?
  - What will be the shape of the transport network in 2050 that will be most resilient to climate change?

# Climate change?

- Quote by Sir John Beddington, Government Chief Scientific Advisor

  “Anyone is allowed to have their own opinion, but not their own facts”

- Those who doubt the influence of man on climate change should look at the facts

  http://www.newscientist.com/topic/climate-change

# Climate change forecasts

- A clear message from the models is that variability and occurrence of extreme events will increase.
- Standard deviation of precipitation and temperature events are forecast to change **2X** that of mean values

# FUTURENET

- Definition of resilience
  - Resilience is the ability to provide and maintain an acceptable level of service in the face of challenges to normal operation
  - Acceptable service level different for different sectors

# FUTURENET

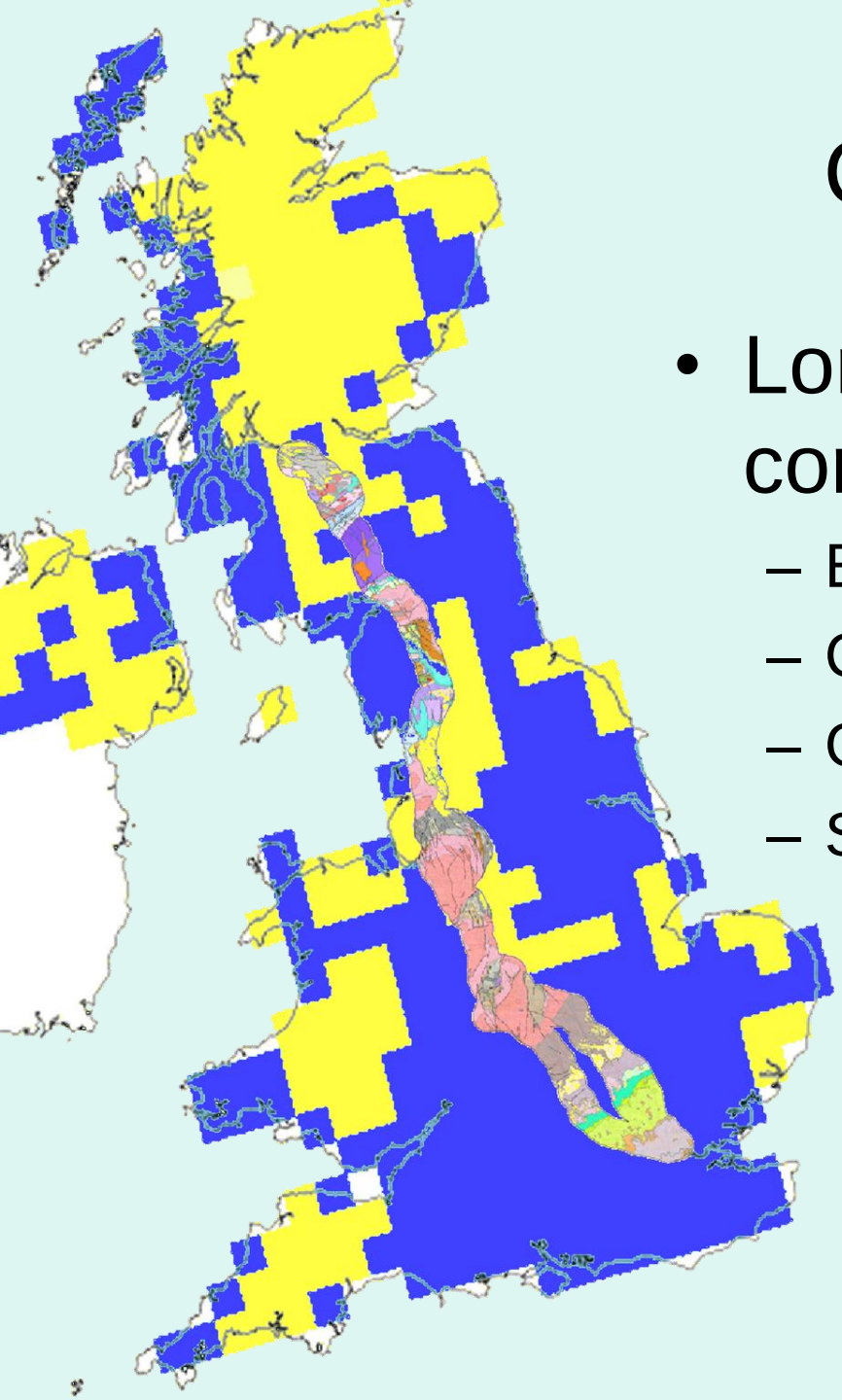
- Three viewpoints
  - Policy maker
  - Infrastructure manager
  - Traveller
- Quantitative and qualitative approaches
  - Numerical values of “resilience”
  - Consideration of different futures

# The approach – model integration

- Integration of
  - Social scenario studies
  - Travel behaviour studies
  - Meteorological / climate studies
  - Transport modelling
  - Weather effects on infrastructure and vehicles

# The approach

- Levels of calculation
  - Calculation of resilience of complete routes (London-Glasgow chosen as example)
  - Detailed calculations of local effects of different weather events (landslip, flooding etc)
- Ideal calculation would begin with local modelling and aggregate results for complete route

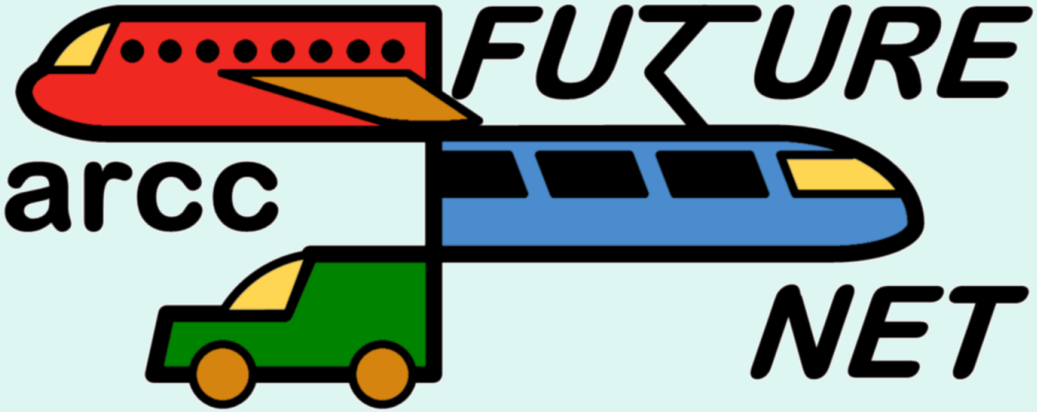


# Case study route

- London-Glasgow route corridor chosen
  - Economically important
  - Climatic factors vary
  - Geographic diversity
  - Significant sub-routes

# Outputs

- Resilience calculation methodologies for
  - Complete routes
  - Specific infrastructure
- Identification of issues to be addressed




# FUTURE RESILIENT TRANSPORT SYSTEMS