



**British
Geological Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Gateway to the Earth

The Role of a National Geological Survey in Understanding and Modelling Geology to better inform the design of the built environment

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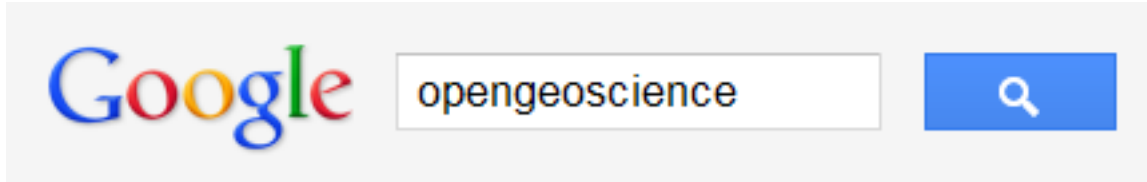
Outline

- **What information do we provide**
- **How is this information used**
- **How our role is changing**

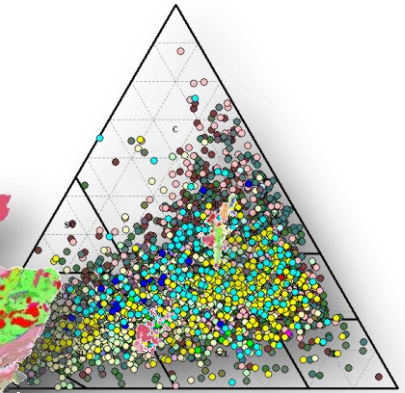
There is no such thing as a 'natural' disaster. Environmental hazards become disasters as a result of the risk and vulnerabilities that people are exposed to

Disasters are not single events but compound processes that must be understood in context

Our Role as the Custodian of Geological data



BS2004_name	GRADE OF	BS2004_name	GRADE OF	BS2004_name	MODE OF EXCAVATION	BS2004_name	MODE OF EXCAVATION
Extremely Strong	BLASTING	Extremely Strong	BLASTING	Extremely Strong	BLASTING	Extremely Strong	BLASTING
Very Strong	BLASTING	Very Strong	BLASTING	Very Strong	BLASTING	Very Strong	BLASTING
Strong	RIPPING	Strong	RIPPING	Strong	RIPPING	Strong	RIPPING
Medium Strong	RIPPING	Medium Strong	RIPPING	Medium Strong	RIPPING	Medium Strong	RIPPING
Weak - Strong	RIPPING	Weak - Strong	RIPPING	Weak - Strong	RIPPING	Weak - Strong	RIPPING
Weak - Medium	RIPPING	Weak - Medium	RIPPING	Weak - Medium	RIPPING	Weak - Medium	RIPPING
Weak	POWER TOOLS	Weak	POWER TOOLS	Weak	POWER TOOLS	Weak	POWER TOOLS
Very Weak - Very Strong	POWER TOOLS	Very Weak - Very Strong	POWER TOOLS	Very Weak - Very Strong	POWER TOOLS	Very Weak - Very Strong	POWER TOOLS
Very Weak - Strong	POWER TOOLS	Very Weak - Strong	POWER TOOLS	Very Weak - Strong	POWER TOOLS	Very Weak - Strong	POWER TOOLS
Very Weak	POWER TOOLS	Very Weak	POWER TOOLS	Very Weak	POWER TOOLS	Very Weak	POWER TOOLS
Extremely Weak	POWER TOOLS	Extremely Weak	POWER TOOLS	Extremely Weak	POWER TOOLS	Extremely Weak	POWER TOOLS
Hard	POWER TOOLS	Hard	POWER TOOLS	Hard	POWER TOOLS	Hard	POWER TOOLS
Very Soft	POWER TOOLS	Very Soft	POWER TOOLS	Very Soft	POWER TOOLS	Very Soft	POWER TOOLS
Soft	POWER TOOLS	Soft	POWER TOOLS	Soft	POWER TOOLS	Soft	POWER TOOLS
Very Soft	POWER TOOLS	Very Soft	POWER TOOLS	Very Soft	POWER TOOLS	Very Soft	POWER TOOLS
Stiff - Very Strong	POWER TOOLS	Stiff - Very Strong	POWER TOOLS	Stiff - Very Strong	POWER TOOLS	Stiff - Very Strong	POWER TOOLS
Stiff - Weak	POWER TOOLS	Stiff - Weak	POWER TOOLS	Stiff - Weak	POWER TOOLS	Stiff - Weak	POWER TOOLS
Stiff - Very Weak	POWER TOOLS	Stiff - Very Weak	POWER TOOLS	Stiff - Very Weak	POWER TOOLS	Stiff - Very Weak	POWER TOOLS
Stiff	HAND TOOLS	Stiff	HAND TOOLS	Stiff	HAND TOOLS	Stiff	HAND TOOLS
Firm - Stiff	HAND TOOLS	Firm - Stiff	HAND TOOLS	Firm - Stiff	HAND TOOLS	Firm - Stiff	HAND TOOLS
Firm	HAND TOOLS	Firm	HAND TOOLS	Firm	HAND TOOLS	Firm	HAND TOOLS
Soft - Firm	HAND TOOLS	Soft - Firm	HAND TOOLS	Soft - Firm	HAND TOOLS	Soft - Firm	HAND TOOLS
Soft	HAND TOOLS	Soft	HAND TOOLS	Soft	HAND TOOLS	Soft	HAND TOOLS
Very Soft - Weak	HAND TOOLS	Very Soft - Weak	HAND TOOLS	Very Soft - Weak	HAND TOOLS	Very Soft - Weak	HAND TOOLS
Very Soft	HAND TOOLS	Very Soft	HAND TOOLS	Very Soft	HAND TOOLS	Very Soft	HAND TOOLS
Very Dense	HAND TOOLS	Very Dense	HAND TOOLS	Very Dense	HAND TOOLS	Very Dense	HAND TOOLS
Dense	HAND TOOLS	Dense	HAND TOOLS	Dense	HAND TOOLS	Dense	HAND TOOLS
Medium Dense	HAND TOOLS	Medium Dense	HAND TOOLS	Medium Dense	HAND TOOLS	Medium Dense	HAND TOOLS
Loose - Medium Dense	HAND TOOLS	Loose - Medium Dense	HAND TOOLS	Loose - Medium Dense	HAND TOOLS	Loose - Medium Dense	HAND TOOLS
Loose	HAND TOOLS	Loose	HAND TOOLS	Loose	HAND TOOLS	Loose	HAND TOOLS
Very Loose	HAND TOOLS	Very Loose	HAND TOOLS	Very Loose	HAND TOOLS	Very Loose	HAND TOOLS
Variable	VARIABLE	Variable	VARIABLE	Variable	VARIABLE	Variable	VARIABLE
Not Applicable	N/A	Not Applicable	N/A	Not Applicable	N/A	Not Applicable	N/A



The Impact of Geology on the built environment?

BBC News - Hemel Hempst... x +

www.bbc.co.uk/news/uk-england-beds-bucks-h...

NEWS BEDS, HERTS & BUCKS

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15 February 2014 Last updated at 17:31

Hemel Hempstead sinkhole causes houses to be evacuated



BBC Flood risk from rising grou... x +

www.bbc.co.uk/news/uk-england-20882366

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England Regions

Flood risk from rising ground water in North Yorkshire

2 January 2013 | England

Parts of North Yorkshire are at risk of flooding from ground water levels, according to the Environment Agency.



BBC Drills break through into b... x +

www.bbc.co.uk/news/uk-england-london-217153

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England Regions London

Drills break through into busy London rail tunnel

8 March 2013 | London

Two construction drills broke through into a railway tunnel in east London on a busy First Capital Connect route.

Services on the Moorgate to Finsbury Park route were stopped after a driver said muddy water had poured on to his roof near Old Street Station.

An hour later, at about 11:00 GMT, two piling drills came through as a train with only a driver and Network Rail manager approached to inspect the area.



Rail staff spotted the drills which broke through into the tunnel


BBC NEWS

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England Regions York & North Yorkshire

Ripon homes evacuated after large sinkhole opens

10 November 2016 | York & North Yorkshire



Frances O'Neill describes discovering a sink hole in the rear garden of her Ripon home

Seven homes have been evacuated after a large sinkhole opened up behind a row of houses in North Yorkshire.

One resident said she felt the ground moving beneath her as she ventured into her back garden in Magdalen's Road, Ripon.

Fire crews were called to the street at 22:30 GMT on Wednesday, where they

Top Stories

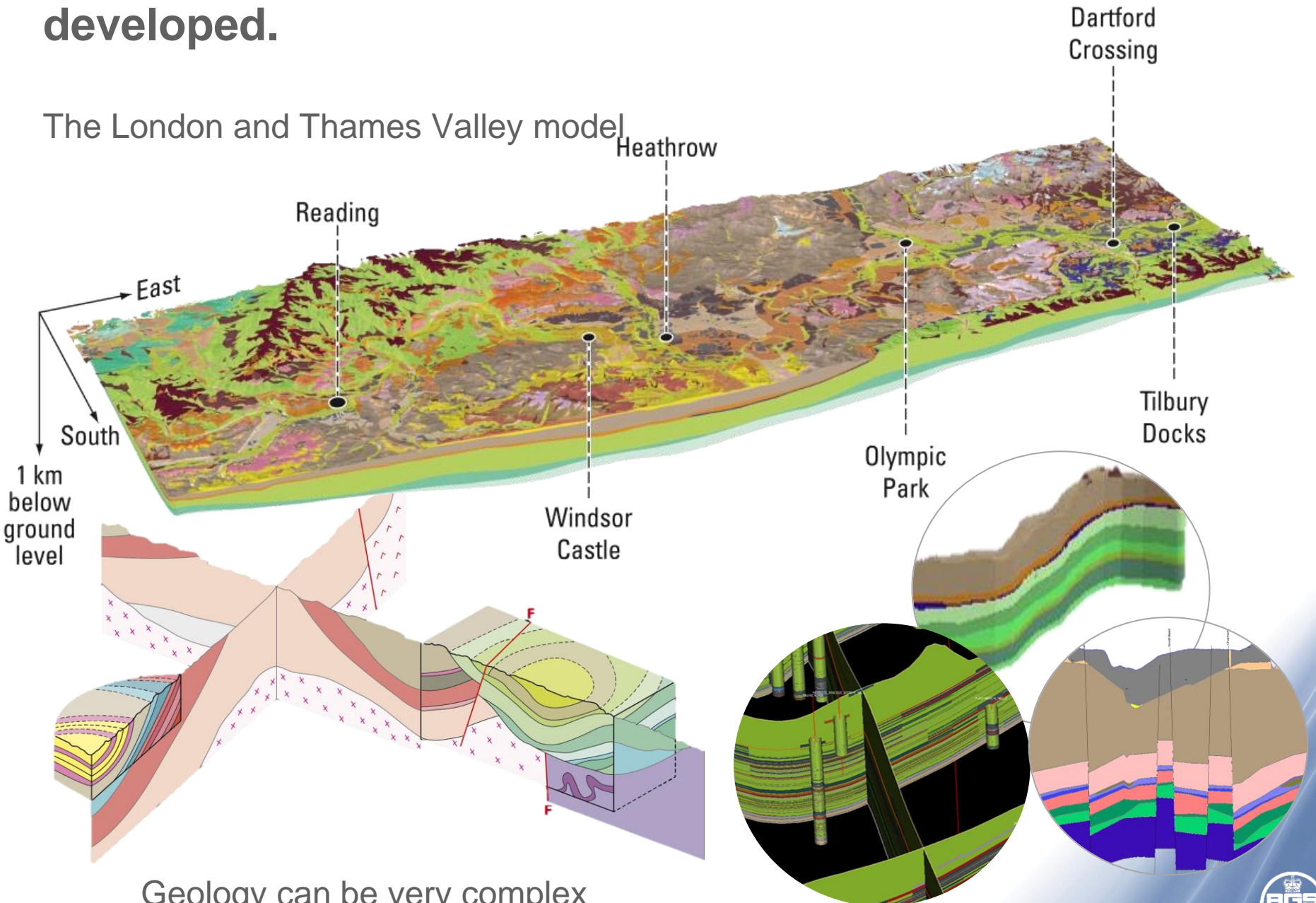
- Hammond aims for 'match fit' UK economy
- Angela Merkel to stand for fourth term
- Cargo ship hits barge in Storm Angus

Features

- Invisible addicts

Geology has influenced where and how our cities have developed.

The London and Thames Valley model

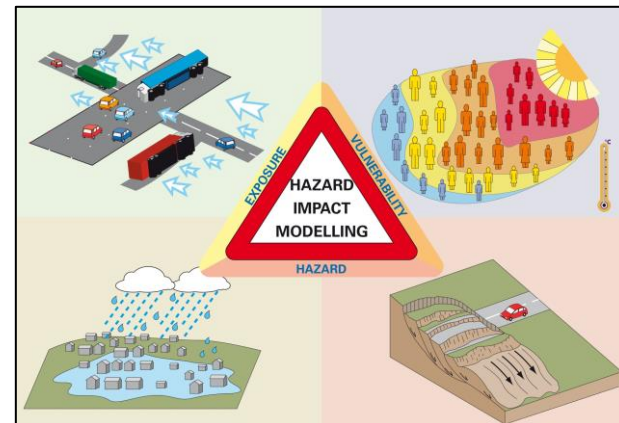
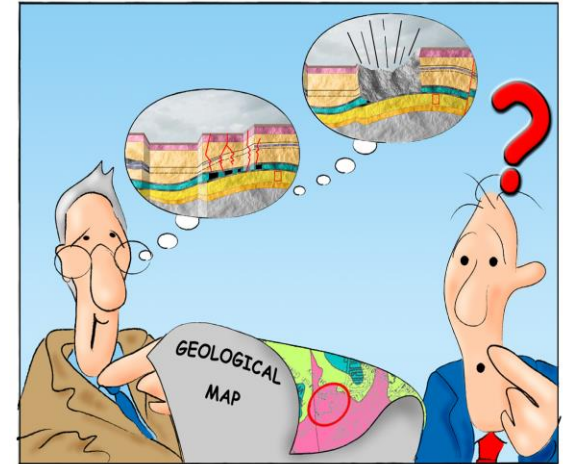


Geology can be very complex

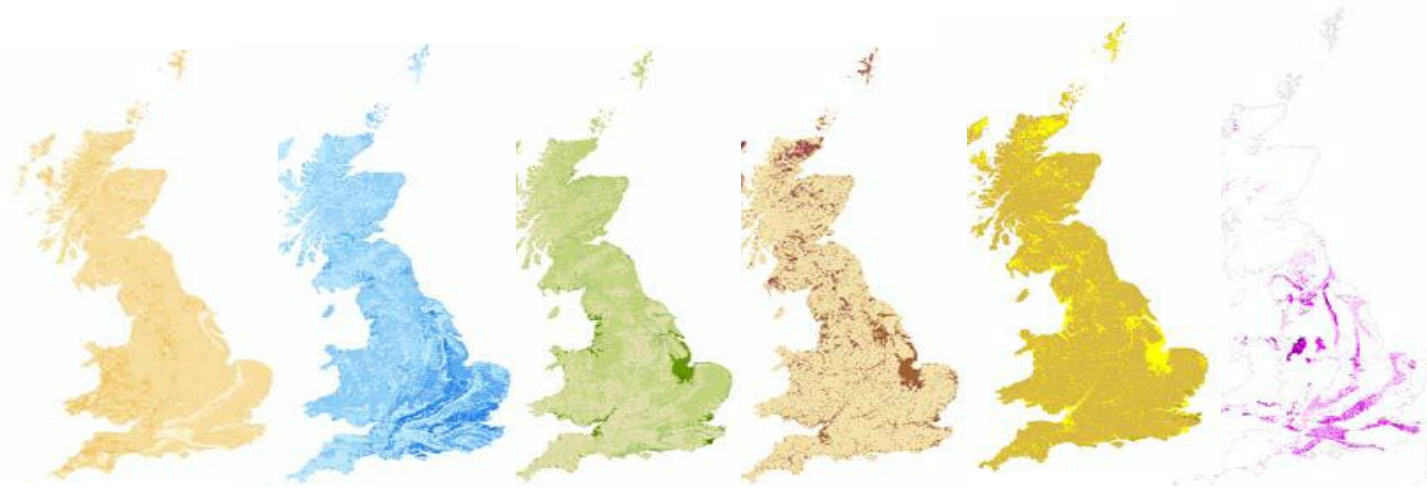
Key function

Exchange of Knowledge

- Our core function is to apply our science to meet the needs of society
- **BGS** has to bridge the understanding gap
- we have to listen and be imaginative, flexible and innovative in the way we exploit our data and information technology



Ground stability Hazards: GeoSure



- **Naturally occurring hazards**

- Subsidence (Shrink-swell; compressible, +/-dissolution)
- Landslides (domains; landslide database; debris flow; pathway analysis/run-out; falls)

- **Anthropogenic-influenced hazards**

- Running sand
- Compressible
- Collapsible



Responding to changing Needs

- **Stern Review 2007** *'economic benefits of strong early action on climate change outweigh the costs'*
- **Pitt Review 2010** *'all organisations have a duty to share information, better visualisation tools; improve modelling and forecasting'*
- **Eyjafjallajokull 2010** *'better understanding of the hazard is needed, thresholds for safe flying should be defined on the basis of evidence, risk aversion should not be a strategy for any future eruption scenario'*
- **TE2100 Plan 2012** *'we must either invest more in flood and coastal management or learn to live with increased flooding'*

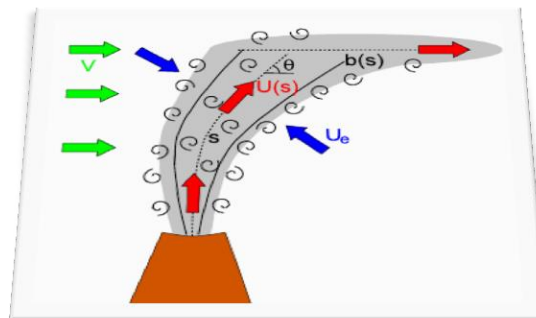
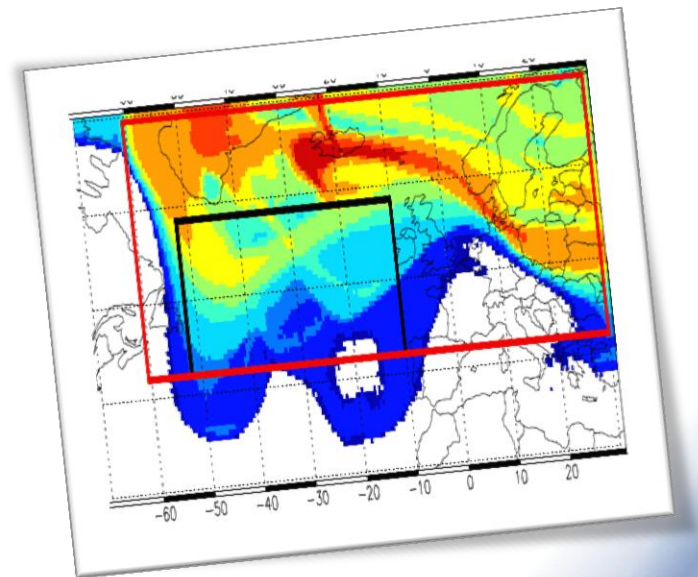
Lessons learned

- Manage risks not avoid
- Governments and responders need access to all the scientific data and information in one place in a form that can be easily and quickly interpreted
- We need to be able to improve our modelling of hazards so that we can improve our forecasting and scenario planning tools
- Cost-benefit can't protect everything...what is its value?
- Scientist need to be able to communicate complex scientific concepts to the non-scientist

It's only a
failure
if you don't
learn
something

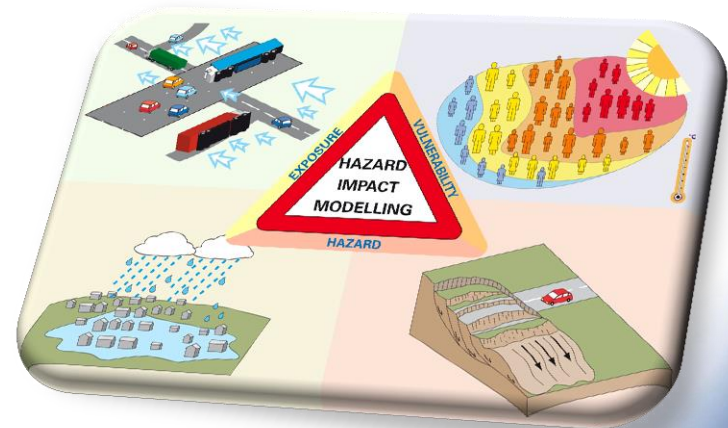
Volcanic and Atmospheric Near- to far-field Analysis of plumes Helping Interpretation and Modelling

- Lead by NCAS, BGS and 7 other institutions
- Response to 2010 Eyjafjallajokull eruption
- Improve information provided to the aviation community by developing better dispersion models
- Dispersion models can be improved through better characterisation of plume dynamics and the physical properties of the ash and gases in the plume



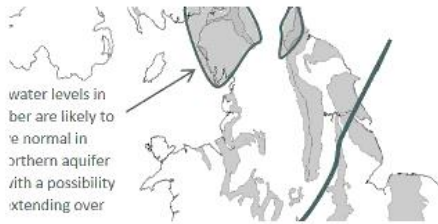
National Hazard Partnership

- Setup in 2011
- Consortium of public bodies
- Exchanges knowledge, ideas, expertise, intelligence & best practice
- Provides a timely and consistent source of advice to government & emergency responders for civil contingencies & disaster response
- Creates an environment for the development of new services to assist in disaster response





Latest Outlook



water levels in
ber are likely to
e normal in
rthern aquifer
with a possibility
xtending over

The Hydrological Outlook UK is published monthly.
The latest can be viewed here.

[Read more](#)

Methods



Do you wish to know more about the methods used to
produce the Hydrological Outlook UK?

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Supporting outputs



Further information on the research that underpins the
Hydrological Outlook UK is available.

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ResilienceDirect



Cabinet Office



Department for
Communities and
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Welcome

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This is for you to make it easier to do your job.

The future service will be designed and built with you.

ResilienceDirect is by you, the Resilience Community.

About ResilienceDirect



Commissioned by the Cabinet Office and supported by Ordnance Survey, ResilienceDirect is a service that was launched in March 2014.

[Learn more](#)

Communities prepared



The Communities Prepared website is a new, free resource to help you build the resilience of communities and groups that you work with.

[New free resource](#)

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Goodbye from @UKResilience @OrdnanceSurvey @CommunitiesUK at stand P19. Thanks for a great show @emergencyukahow #ESS2014 #ResilienceDirect
5:44PM - 25 Sep 2014 from London

There's still time to visit P19 and trial the #ResilienceDirect mapping tool, brought to you in collaboration with @OrdnanceSurvey #ESS2014
2:07PM - 25 Sep 2014 from London

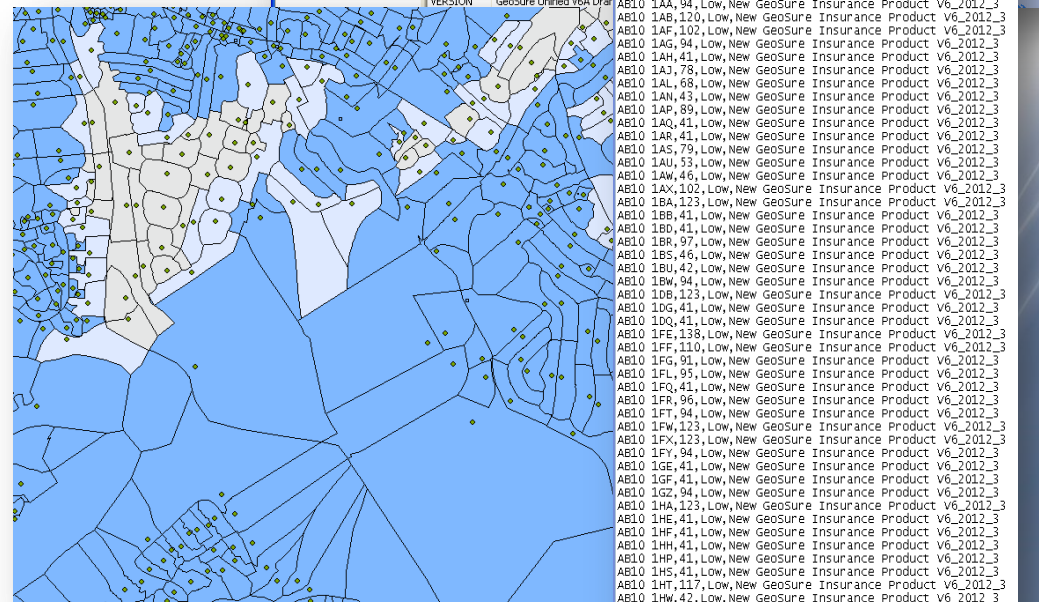
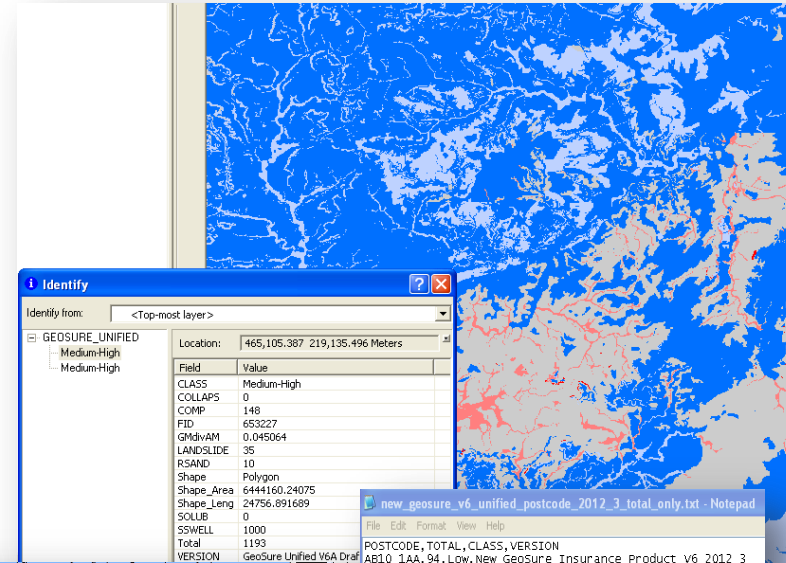
Proud winners of the EPS Resilience Awards 2014 Most Innovative Product of the Year, thank you #ResilienceDirect <http://t.co/BJHKSIMlJU>
12:34PM - 25 Sep 2014 from London

Good morning and welcome to day 2 #ESS2014. Visit us on stand P19 with @OrdnanceSurvey & @CommunitiesUK to see our system #ResilienceDirect
9:40AM - 25 Sep 2014 from London

Great day with @emergencyukahow @OrdnanceSurvey & @CommunitiesUK. At #ESS2014 tomorrow? Visit P19 #ResilienceDirect <http://t.co/xVHz5Vpvu9>
9:40AM - 25 Sep 2014 from London

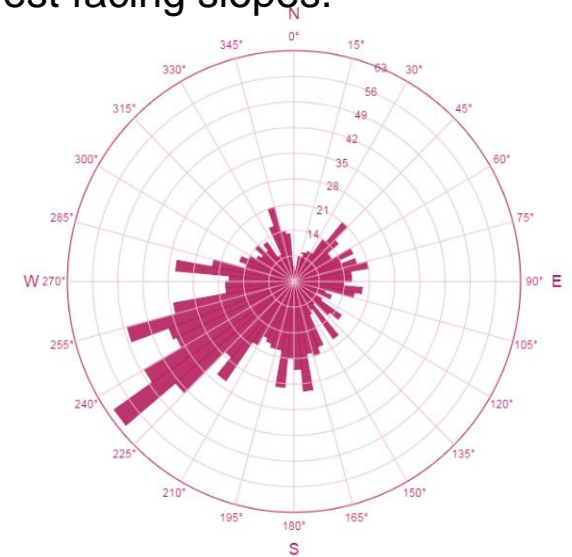
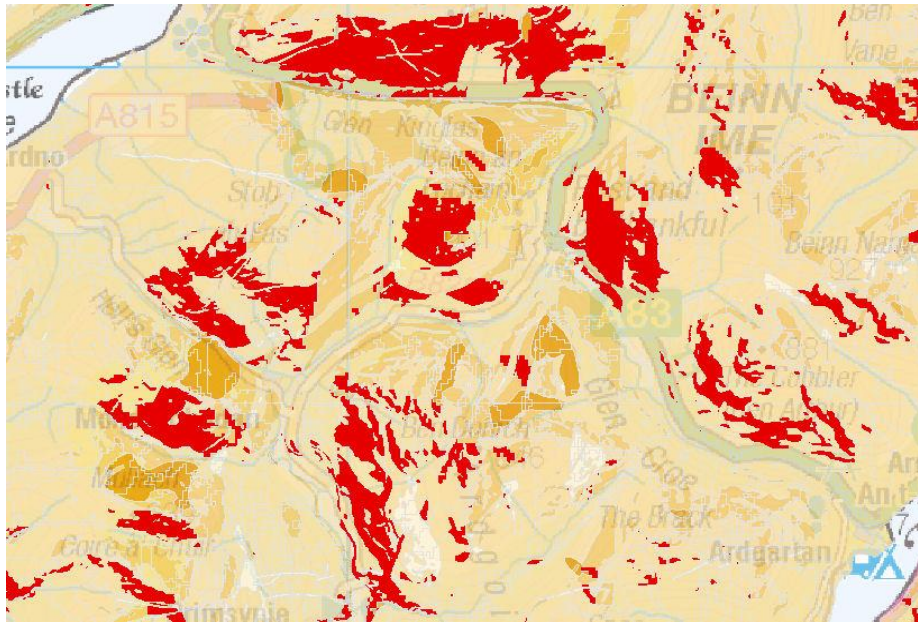
GeoSure Insurance Product

- Provides information specifically for the insurance industry
- Indicates the potential insurance risk for natural ground instability to be active at a site
- Provides an analysis of all potential hazards present but delivered in a simple valorised format
- Uses Sheffield Elicitation Framework to derive the probability of occurrence and impact



Temporal services: Forecasting heighten susceptibility

- This dataset can then be used to highlight potential areas that might be susceptible to heightened landslide hazard due to its slope aspect.
- Debris flows might be more susceptible on the south – west facing slopes.
- These can be highlighted in the data as shown below



Areas of moderate (Geosure C) to high (Geosure D and E) susceptibility on south – west facing slopes are highlighted in red.

Communication



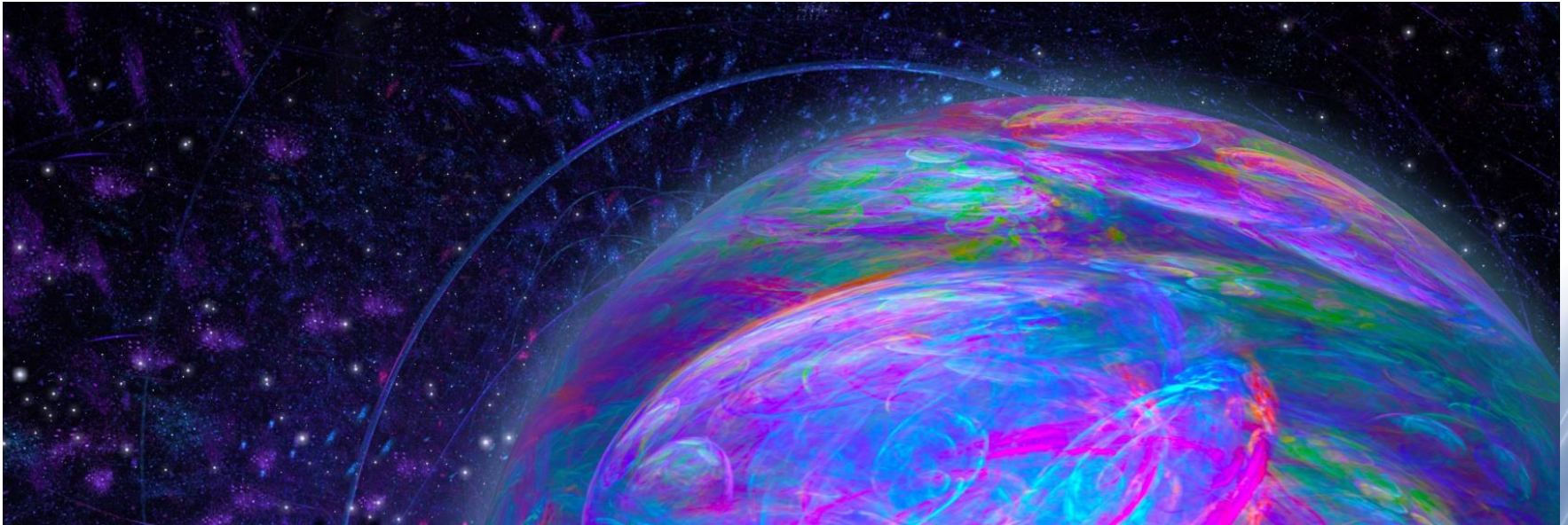
- Critically Important to communicate risk well, saying enough to be helpful while avoiding blanket statements
- Use of models and forecasting means that we have to be able to communicate the uncertainties..... Just using words without numerical reference points can be misleading
- Speaking a common language
- Sound bite communication



L'Aquila earthquake
20096 scientists
prosecuted for
involuntary
manslaughter

IS UNCERTAINTY A BAD THING?

Uncertainty is *not* a weakness of science. It is inevitable when finding out about how the world works – there will always be uncertainty when we push back new frontiers.



Conclusions

- Data isn't useful unless it is interpreted, assessable and provided in a useable format
- There has been a change from static attributed map provision to complex models that can be used for forecasting and scenario planning
- Communication is key

