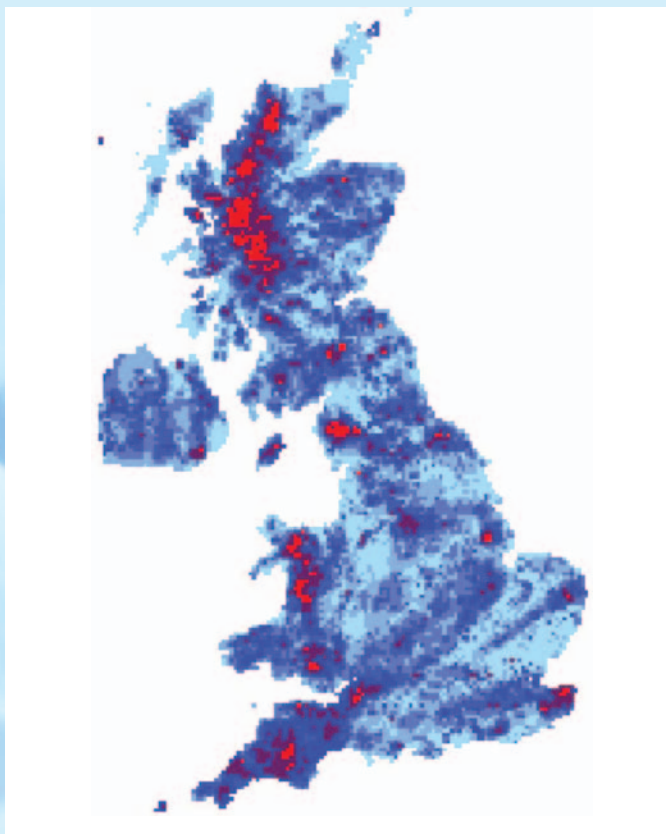


Project Outcomes

CRANIUM is developing new methodologies for analysing uncertainty and making robust risk-based decisions for infrastructure design and management in the face of climate change. We are developing and applying new methods for analysing uncertainties in key climate variables, for example rainfall and temperature, and demonstrating how these climate changes impact upon the performance of infrastructure systems, including railways and hydro-electric power. We are developing methods to enable this type of analysis to be carried out faster, more robustly and comprehensively. Finally we are investigating with stakeholders how, in the light of these insights, decision making about operation of, or investment in, infrastructure systems can be managed or modified to reflect potential climate change impacts and in particular the uncertainties surrounding them.



A map of the most extreme observed rainfall in the UK. Similar maps are being produced for future climates.

Stakeholder's Comments

"CRANIUM fills an important gap in present understanding for informed application of quantitative risk assessment and decision making for climate change impacts assessment and adaptation planning"

Arup

"Better decision making in the light of climate change requires that a systematic approach be taken which identifies risks and uncertainties and which makes these explicit within the decision making process"

Environment Agency

Project Description

We are analysing the level of uncertainty in global climate models to enable climate predictions on timescales and in places that are relevant to UK infrastructure owners. We have generated probability distributions of regional climate and are using advanced statistical methods to study the probability of extreme rainfall as a result of climate change.

To what extent will climate change impact upon the performance of infrastructure systems? To answer this question, we need not only to know about the potential change in future climate but also how infrastructure systems will respond to climate change. So, we are modelling the performance of reservoirs and railway embankments to demonstrate how new statistical methods can be used to investigate the sensitivity of these infrastructures to climate change. We are developing methods to identify the weak links in infrastructure systems that are the most vulnerable and to demonstrate where monitoring and maintenance efforts should be concentrated.

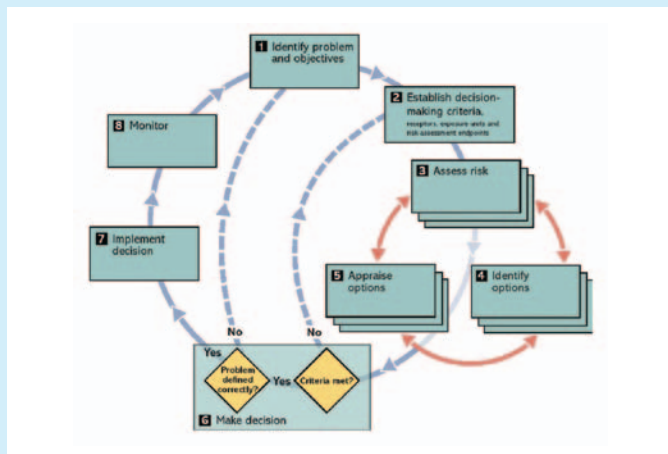


Analysing the vulnerability of linear infrastructure systems subject to multiple climate threats involves assessing the probability of at least one weak link failing.

Potential Applications

CRANIUM is being undertaken in collaboration with stakeholder organisations with responsibility for climate-critical infrastructures: Scottish and Southern Energy, Arup, Halliburton KBR, Halcrow, Network Rail and The Environment Agency's Centre for Risk and Forecasting.

We have reviewed the literature, held workshops, interviews and case studies. Managers responsible for the built environment, transport and utilities are evaluating the suitability of a range of decision-making techniques. One such approach is the climate adaption decision-making framework developed by UKCIP and the Environment Agency.



Framework for decision-making for climate adaptation (courtesy of UKCIP).

The research will be applied through the uptake by industry of new analysis and decision-making techniques, supplementing the experience of professional engineers. These methods will mean that new evidence on climate change can be included in decision making in a rational and transparent way. Users will be able to demonstrate that their decisions are robust with regard to uncertainties in climate projections.

Contact Details

Project Manager: Professor Jim Hall

Civil Engineering and Geosciences
University of Newcastle upon Tyne
jim.hall@newcastle.ac.uk

UKCIP:

Gerry Metcalf

UK Climate Impacts Programme
OUCE/University of Oxford
gerry.metcalf@ukcip.org.uk



One case study is on hydropower schemes in Scotland and how their operation will be affected by climate change (courtesy of Scottish and Southern Energy)

Sharing the Outcomes

CRANIUM is developing new methodologies, with demonstration examples to help uptake of these advanced methodologies. We have published and presented our work on downscaling climate variables and projecting uncertainties through infrastructure systems. We are now progressing case studies, which will be completed in 2006.

Key demonstrations include:

- assessing uncertainties in daily scenarios of UK climate extremes;
- assessing the probability of failure of linear infrastructures (e.g. railways and roads) that are influenced by climate variables (e.g. temperature and rainfall);
- estimating the probability of extreme rainfall under changing climates, particularly for estimating risk of dam break and reservoir safety.

See website for up-to-date details:
www.ncl.ac.uk/cranium

Anticipated project completion date:
January 2007

Stakeholder Contact:

Sharon Lee

Network Rail
Waterloo General Office
sharon.lee@networkrail.co.uk

EPSRC:

Dr Filomena La Porta

Climate Change, Energy Efficiency and Fusion
Engineering and Physical Sciences Research Council
filomena.laporta@epsrc.ac.uk