Climate Change: Taking the planet into uncharted territory?

• Do we know what level of climate change is dangerous, where and for whom?

• Can we provide society with a ‘road map’ indicating what climate changes may be expected to occur, where, and with what implications?

• What should society do to mitigate and adapt to climate change to avoid its worst impacts?
• Allianz have estimated that annual damage globally from weather-related disasters will reach $80-$120bn over the period 2010-2019.
Climate Services: A Revolution in the Application of Climate Science

- From mitigation to mitigation, adaptation, resilience and preparedness
- From few to many customers/users/stakeholders
- Global century scenarios to regional predictions, days to decades ahead
- Climate change to climate change and climate variability
- Broad climate to characteristics of weather including extremes and impacts
- Operational delivery – regularly updated monitoring, forecasts, products & services
A Shifting Landscape of Risk

• Changing Exposure
  - Where we live

• Changing Vulnerability
  - How we live

• Growing Population
  - Pressure on resources

• Changing Climate
  - Hazardous weather & climate extremes
“... one flap of a sea-gull’s wing may forever change the future course of the weather”

Edward Lorenz
1969
A sense of urgency.....

Natural variations compounded by global warming may be giving unprecedented extremes

Protecting society against extreme weather events in the future requires predicting the climate at regional and local scales.
Will the coming UK summers be as wet as 2007, 2008 or 2012? Should we expect more intense rainfall in the coming decades and how bad will it be? What will it mean for drainage systems, river management?
Drought in Texas 2011/12

- Worst drought on record for over half of Texas counties
- 3 million (of 170 million) acres lost to wild fires
- $10 billion losses to crops, livestock and timber
- Over 1000 public water systems requesting water usage restrictions
Bridging the scales: Operational Forecasting Models 2013

Regional models can be re-located rapidly to anywhere on the globe.

**Seasonal:** GloSea5
- 60km atmos.
- ¼ deg. ocean

**Global:**
- 17km

**Regional:**
- 4km

**UK:**
- 1.5km
  - UK ensemble

+ Regional ensemble
+ Global ensemble
+ UK ensemble
Red Alert:
SW Floods 6\textsuperscript{th} – 7\textsuperscript{th} July 2012
Integrated Environmental Prediction
at Regional and Local Scales

- Established models exist for most components
- Modeling scales are converging
Earth System Modelling – complexity in an interconnected and multi-disciplinary world

Understanding the interactions and feedbacks
Defining Risk and Risk Pathways

WEATHER & CLIMATE EXTREMES

GEO-BIO PHYSICAL HAZARD

EXPOSURE

VULNERABILITY

Socio-Economic IMPACT

QUANTIFYING & REDUCING RISK

Major Uncertainty

Some progress, still a limiting factor

Considerable progress

Secondary pathway
Defining Risk and Risk Pathways

PROBABILISTIC FRAMEWORK

WEATHER & CLIMATE EXTREMES

GEO-BIO-PHYSICAL HAZARD

EXPOSURE

VULNERABILITY

Socio-Economic IMPACT

QUANTIFYING & REDUCING RISK
Climate Services: Unlocking the potential

- Increasingly complex science, modelling and prediction systems
- Increasingly complex user requirements, requiring multi-disciplinary and multi-scale approaches
- Partnerships in science and delivery are essential
- Dialogue with end users is vital
Thank you