The use and usability of probabilistic forecasts
Emerging themes from an interdisciplinary study

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• Sciences, social sciences & humanities

• Aims to deliver a framework, accountable to future generations, that will create actionable input on critical global issues

• Rethinking how we monitor, manage, maintain and allocate globally important resources

• Understandings of individual and collective behaviour and current institutional practice
Outline

• Motivation.

• Methodological approaches.

• Work in progress and preliminary findings.
Motivation

In the 90s USA:

- Water managers reluctant to use new probabilistic seasonal forecasts
- Cited poor reliability but did not demonstrate knowledge of forecast performance
- Institutional factors: regulations, reliability, infrastructure = disincentives to innovation
- Beyond rational choice models

“Weather forecasts are for wimps”

Has anything changed 15 years later?
- Forecasts’ skill has improved: does it make any difference?

Methodological approaches

**Ethnographic approach:** real-world situations in which forecasts are produced and interpreted, and resource decisions made

**Quantitative science-led approach:** do available forecasts meet performance requirements of the forecast user?

- Considering relative importance of technical and institutional factors
- Understanding practical processes of decision-making in probabilistic frameworks
- Exploring different ways that a forecast (or decision made from a forecast) can be more or less successful
  - What can we learn?
Case studies and qualitative approach

Case studies (public & private sector, NGOs)

- Modellers and forecasters
- Water resources & floods
- Public health
- Civil contingencies
- Finance & insurance
- Energy supply and demand
- Disaster risk reduction

Interviews and ethnography

- Organisational and individual goals, roles, decision-making
- Measures of success (formal/informal)
- Definitions of weather/climate sensitivities
- Accessing and using weather/climate information
Quantitative approach

**Forecast’s attributes**

- **Criteria**
  - Variables: temperature thresholds, precipitation amounts, wind speeds, etc.
  - Rationale: potential to cause damage, evidence based or experience, etc.

- **Probability of event**
  - Over a threshold
  - Deciles
  - Terciles

- **Lead times**
  - Early warnings and alerts: time to respond?
  - Planning

Understand how thresholds and lead times are chosen.
- Do they depend on the forecast quality? Is forecast value a criterium?
- If there was skill to change thresholds or lead times, would that affect the decision making?
Forecasts for Extreme Events

- NSWWS
- Flood Alerts
- PHE cold weather and heat wave alerts

Lead time
- Alerts < 24hs
- Warnings >24 hs
- Advice: up to 5 days
- 48 hs (cold-heat)
  Based on time to respond

Criteria
- Evidence based: epidemiological studies (temperature for heat wave)
- Potential to cause damage (wind, rain)
- Pragmatic (temperature for cold)

Probability
- > 60% for heat-cold
- Ranges for SWW alerts:
  < 20%, 20-40%, 40-60%, > 60%
  (forecaster decision)
  (before was only > 60%)
Monthly to seasonal forecast

- Climate outlook forums
- DRM

**Lead time**
- Time to plan
- Dictated by availability of information

**Criteria**
- No threshold, mostly for planning
- Based on available information

**Probability**
- Terciles:
  - Higher than normal
  - Average
  - Lower than average
Work in progress 1

Forecasts of extreme temperatures and impacts on health (PHE).

Forecast value/evaluation: skill of model output vs skill of alert-warning/how do we relate quality of model output (‘objective’ evaluation) with warning/alert (‘subjective’ evaluation)?

What’s the relevance of predefined met extremes for particular users/applications?
Forecasts for reservoir management (EA + water companies).

- Decision making potential of probabilistic forecasts for dynamic reservoir management.
- Potential use to improve long term performance (for climate change adaptation)

London Water Resources Zone model
What makes a ‘successful’ forecast?

- Defining forecasts and predicting impacts
- Linking forecast lead time/uncertainty and response
- Forecast quality and evaluation
  - ‘Forecast’ vs impact-based warnings
  - Reflexive uncertainty (Hulme & Dessai 2004)
  - False alarms vs missed events
  - Credibility, legitimacy, salience
    (Funtowicz & Ravetz 1993; Cash et al 2006)
What makes a successful forecast?

- Opportunities and constraints
  - Regulations and established practices, approaches to risk
  - Big (weather) events catalysing change
  - Forecasting partnerships (Haines & Stephens, forthcoming)
    - Development
    - Distance
    - Dialogue
Ongoing discussions

• Explore decision making approaches: how could they incorporate probabilistic forecasts?

• What are the variables of interest?

• What other information/knowledge is relevant?

• Find out about events/or organisational changes that facilitate/trigger incorporation of new scientific information into decision making

• Identify “appropriate” ways to use probabilistic forecasts, and examples of best practice
Thank you for listening.

Your questions, comments and feedback on any aspect of this research are appreciated.

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