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Future Water Demand in light of uncertainty regarding climate change

Presented by Ben Piper, Technical Director (Atkins)

On behalf of original CC:DEW project team:

Tom Downing (GCAP)

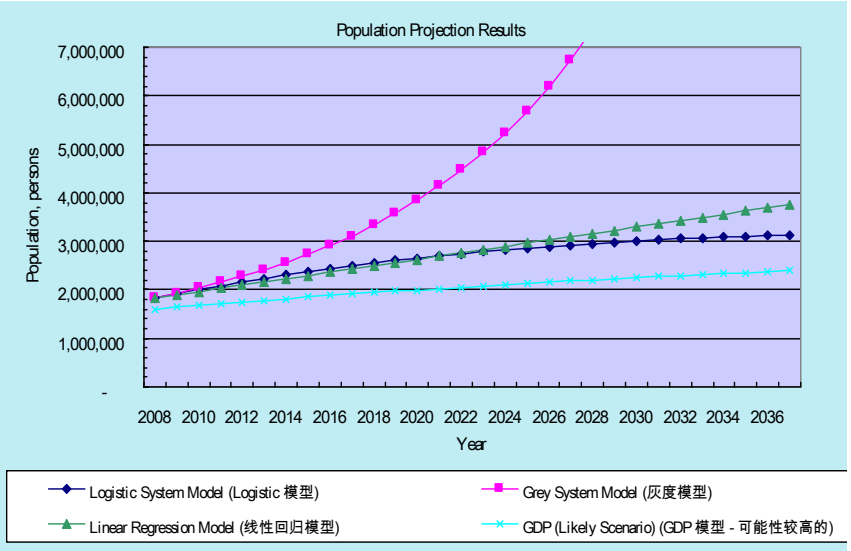
Keith Weatherhead &

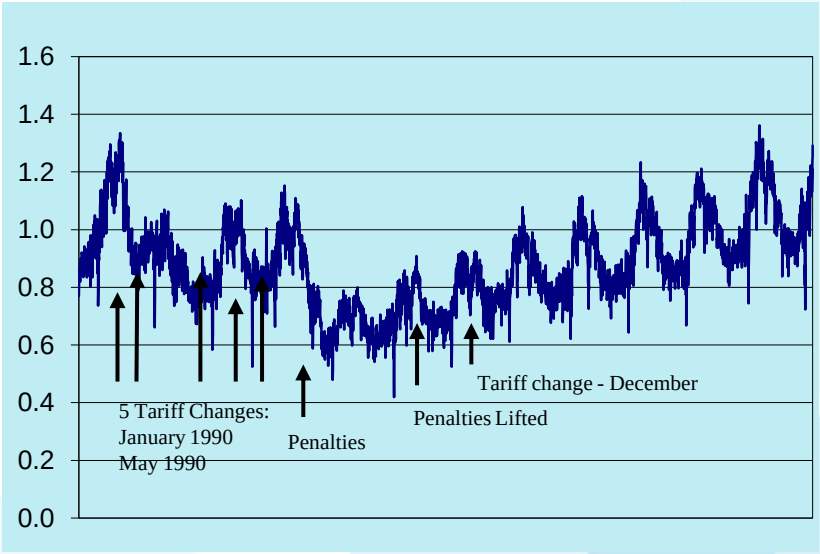
Jerry Knox (Cranfield)

Plan Design Enable

The demand planner is:

- catering for the needs of age cohorts not yet born
- in a climate not yet experienced
- within government policies not yet thought of





Outline of Presentation

CC:DEW study: recap and application of results

What has changed since then?

What are the future challenges?

Gaps for researchers and practitioners: uncertainty in adaptive management

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CC:DeW - recap

Starting point (July 2000):

- Review of Herrington 1996
- UKCIP ’98 climate scenarios
- Environment Agency Foresight-based Demand Scenarios

Components of demand

- Domestic
- Industrial/Commercial
- Agriculture (crop production)

Excluded from ToR

- Leakage
- Peak demands
- Stacking of droughts
- Extreme events

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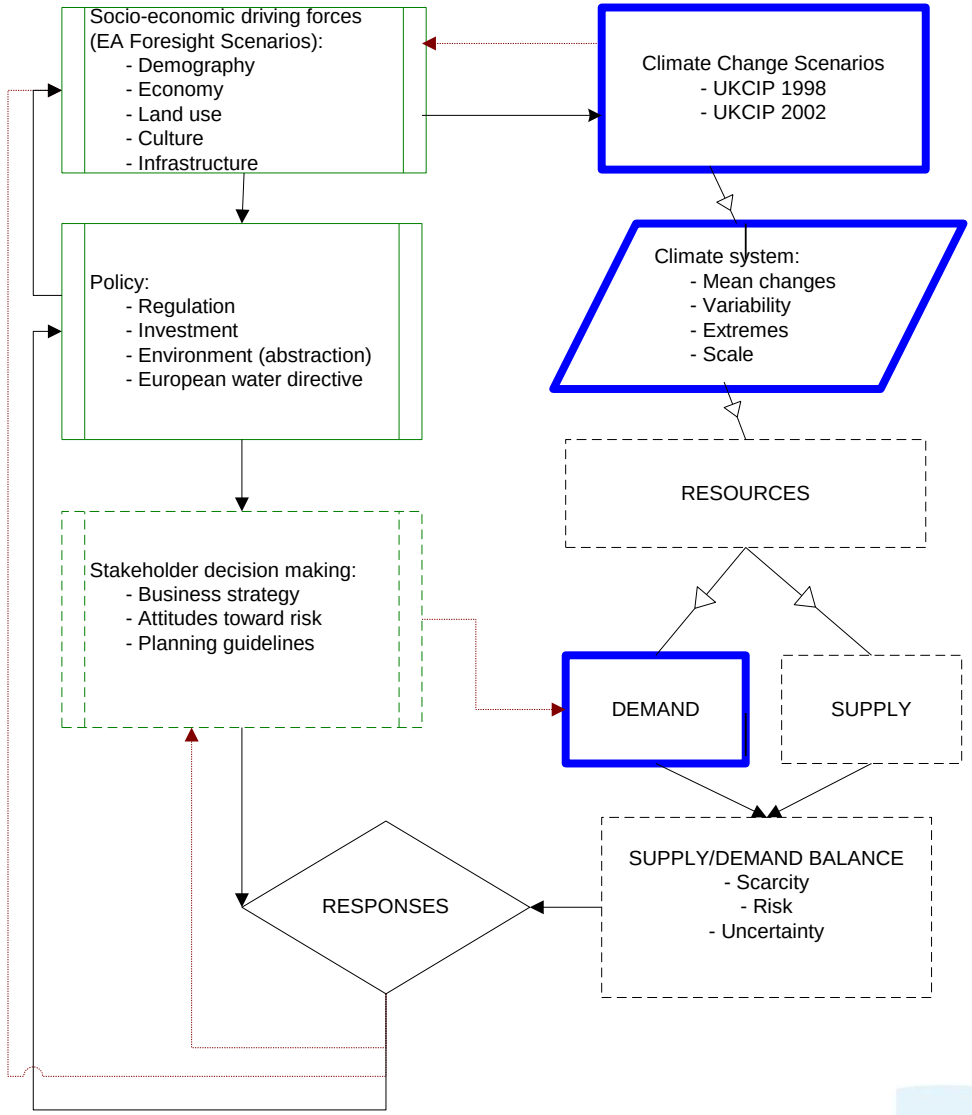
Scope of CC:DeW



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CC:DEW results

Uptake

- Water Resource Plans
- Periodic Reviews: PR04, PR09
- EA Water Resource Planning Guideline open to different interpretations
- Guided agricultural water resources management

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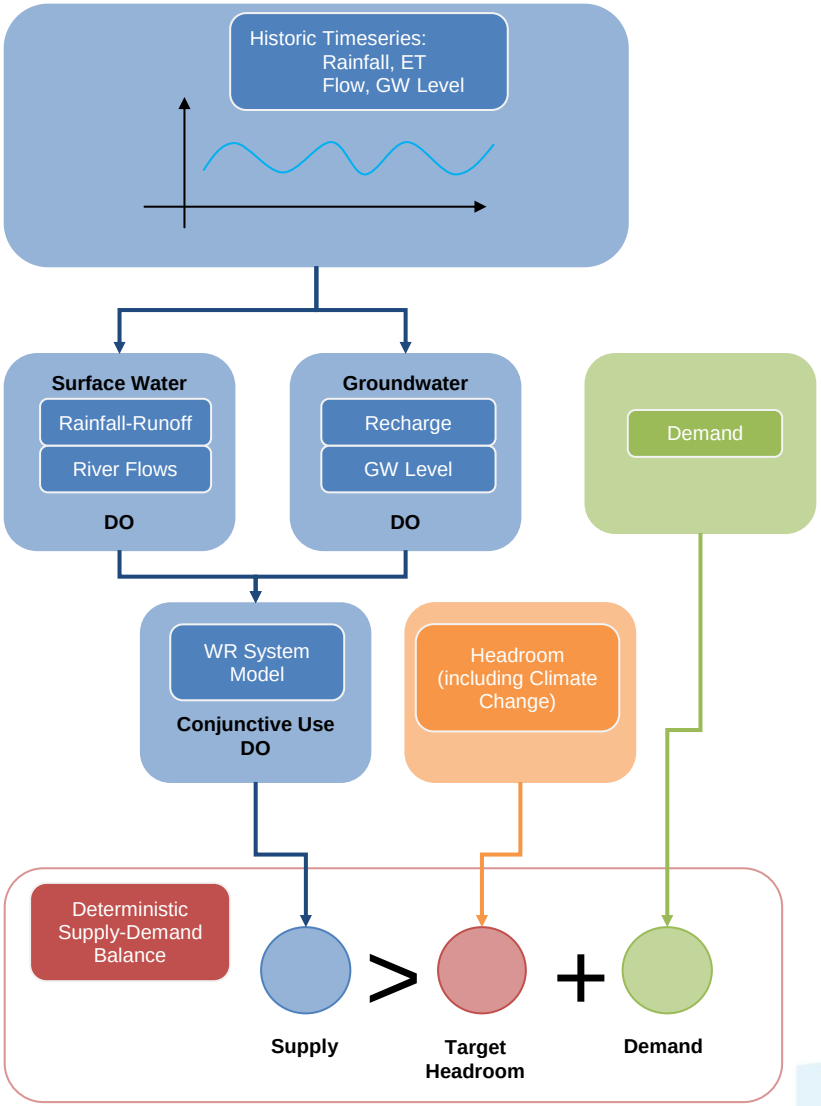
Traditional approach



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CC:DEW results

Shortcomings

- Only covered average demands, not peak
- Considered by practitioners to be relatively crude derivation and application of factors
- Low spatial resolution
- Covered England & Wales
- Ignored CO_2 impacts on crop production

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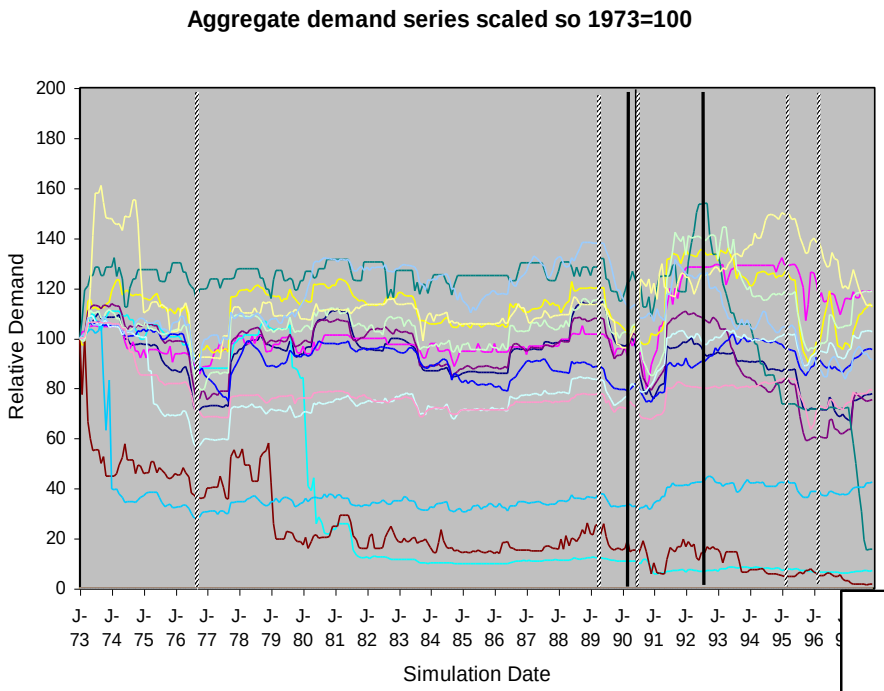
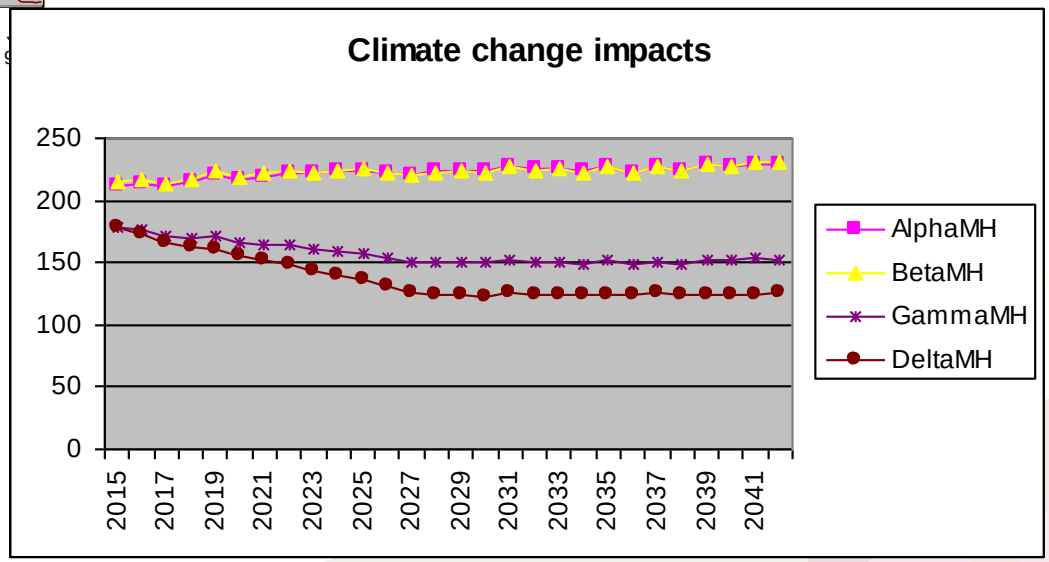
CC:DeW - Agent based modelling



Agent based:
→Discontinuities
→Large range of results

Dynamic simulation:
→Smooth scenarios
→Modest range



Next steps – articulated at end of CC:DEW

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Limitations

- Variability and drought risk
- Low confidence in scenarios for 2020s
- Present data sets
- Behavioural change: technology, demand management

Toward the next assessment

- Integrate supply/demand balance
- Incorporate human behaviour in dynamic scenarios
- Continue data collection and monitoring
- Probabilistic scenarios of climatic risks
- Incorporate uncertainty into demand projections
- Consider CC impacts on resource availability

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Recap on UK Water Industry Research

AMP Period	Period covered	Climate change scenarios	Notes
1	1990-1995		Generally not considered
2	1995-2000	UKCIP98	UKWIR CL04 1997
			Recalculation of flow factors
			Herrington
3	2000-2005	UKCIP02	UKWIR CL04 2002
			EA WRPG Ver 3.3 (2003)
			CC:DEW
4	2005-2010		Catchment level assessments
			CC uncertainty in WR Planning
			Trends in UK River Flows
			Strategy for evaluating uncertainty in assessing CC impacts on Water Resources
			Interim report on R-Q modelling
5	*2010-2015*	UKCP09	New methods based on UKCP09

Future challenges

Scenarios of water risk

Demand analysis

Integrating supply and demand

Behavioural responses

Spatial scale of influences on demand

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Scenarios of risk need to capture the uncertainty in water planning

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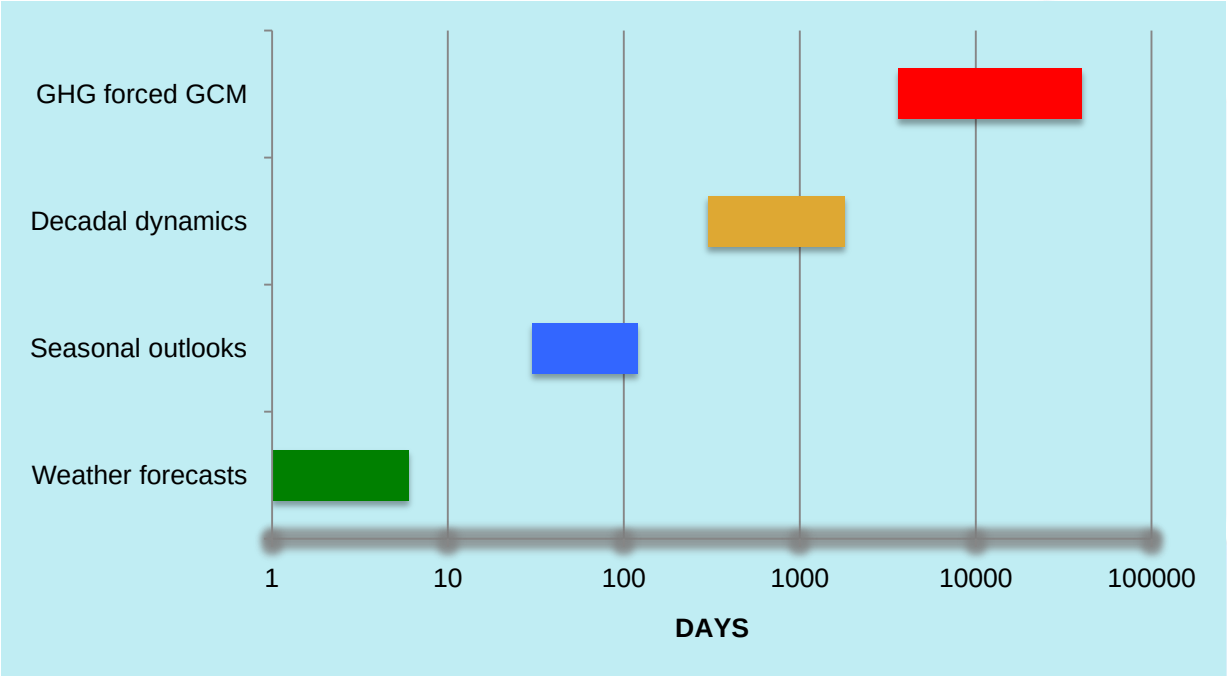
Define relevant climate variables and parameters: problem of joint distributions

Include worst case ‘what if’ futures

Unpack confidence in various time scales



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Demand-side analysis lags behind supply-side analysis

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Very few recent articles

- Vorosmarty et al. 2000: global non-climate demand
- Dessai and Hulme 2007: climate focus, not demand
- Wilby et al. 2006: supply focus, gaps identified
- Subak, 2000: managers' perceptions, supply focus

Retrospectives of past events – response to 2005-2006 drought in SE England

Should be more data available, and accessible to explore sensitivity of demand to climate variations

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Integrating supply and demand to develop robust response strategies

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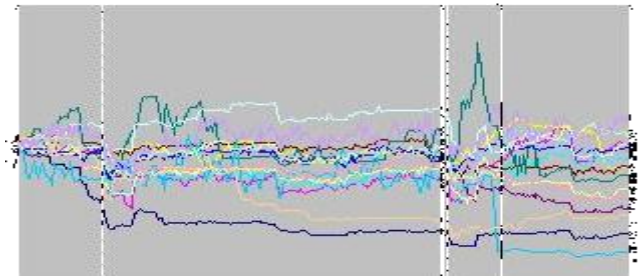
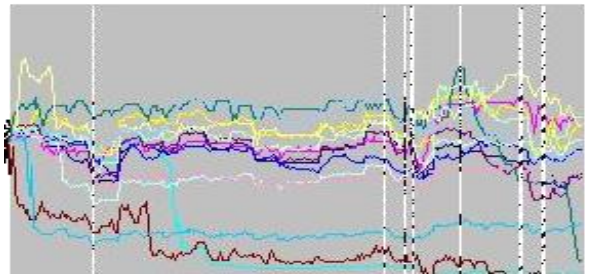
- Supply-demand balance rather than separate assessments
- Presenting complex information to stakeholders for public understanding

Responses on the time scale of climate change are essentially behavioural

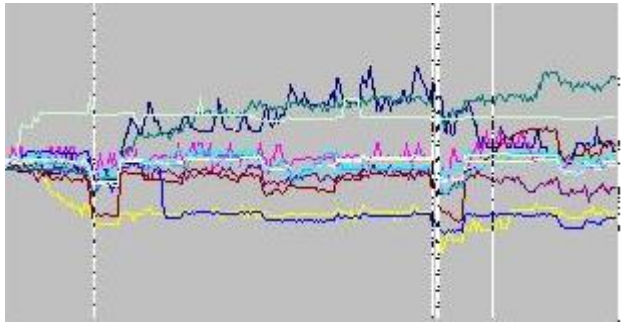
Reference runs | **MH climate change**

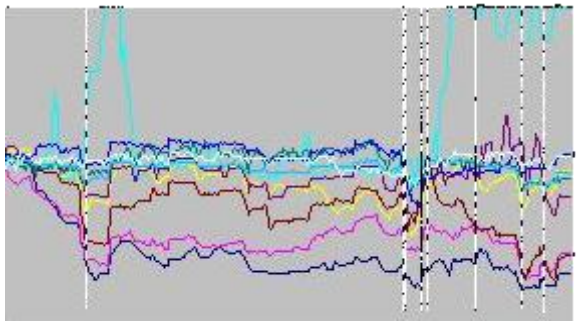
Individual





Social





CCDew looked at how behaviour might change along with climate change. Results of an agent-based social simulation model show the diversity of water demand scenarios. The model compares the role of social pressure compared to individual decision making (top and bottom) and with and without climate change (left and right). The scenarios broadly correspond to the earlier EA reference scenarios: individual (alpha and beta); social (gamma and delta).

Future agricultural demand

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Projections influenced by assumptions regarding population growth, food demand and patterns of food consumption

In reality, future demand will be influenced by actual water availability and allocation policy

New cultivars, genetic improvements, and effects of elevated CO_2 could significantly offset future increases in water demand

But the regulator and consumers (supermarkets) will demand better management, uptake of new technologies and innovative approaches to water scarcity (such as water trading)

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Adaptation in agricultural irrigation

There will be some autonomous adaption but growers will need to build adaptive capacity to cope with extremes and uncertainty

Many potential adaptations (e.g. reservoirs) are ‘no regret’ - they already make sense by solving existing water resource issues, which then contribute to a farms future adaptability

But most growers remain more concerned about ‘non-climate’ risks particularly very high degree of short- to medium-term uncertainty in agricultural policy and markets

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Return to UK PWSPlanning

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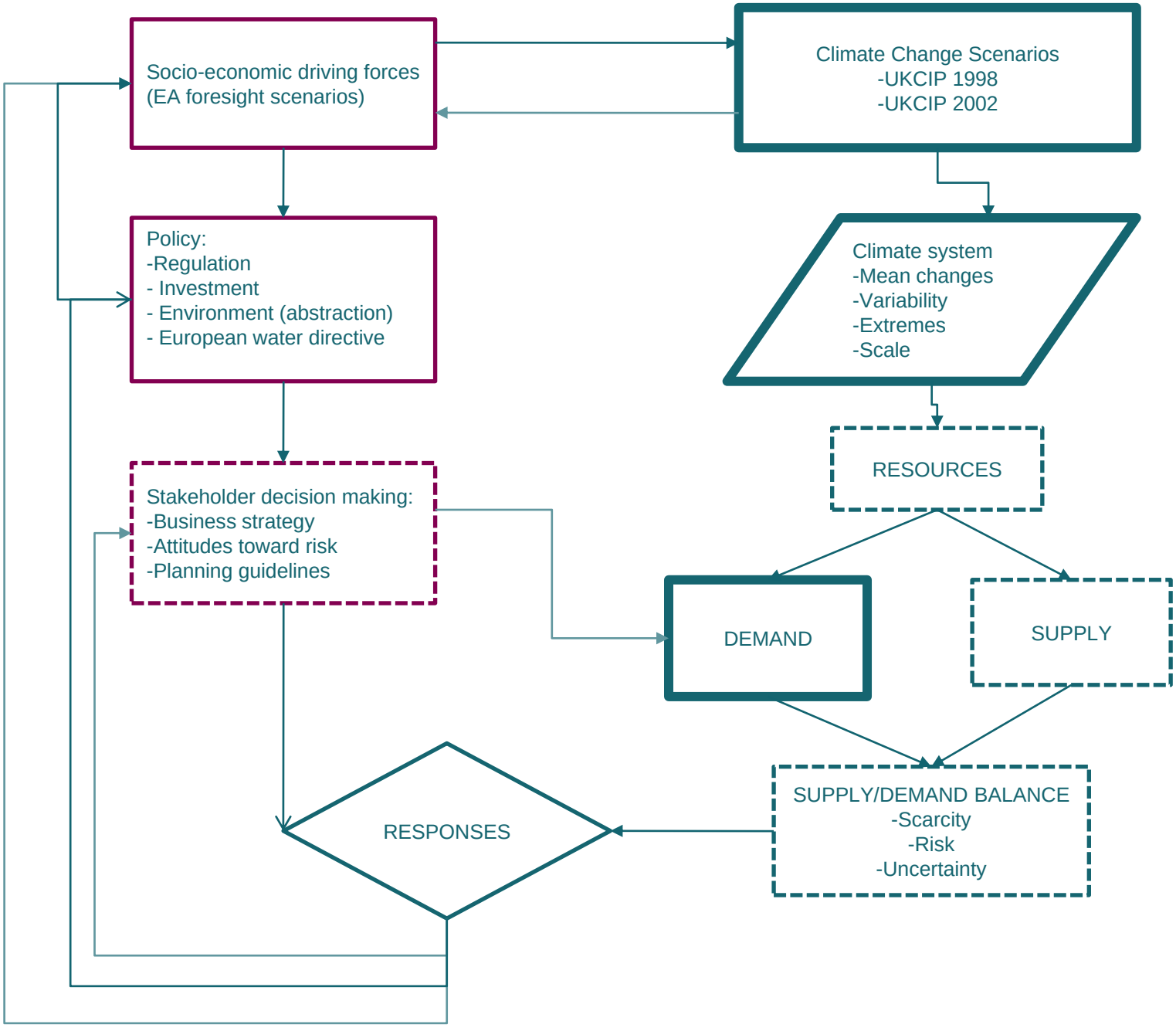
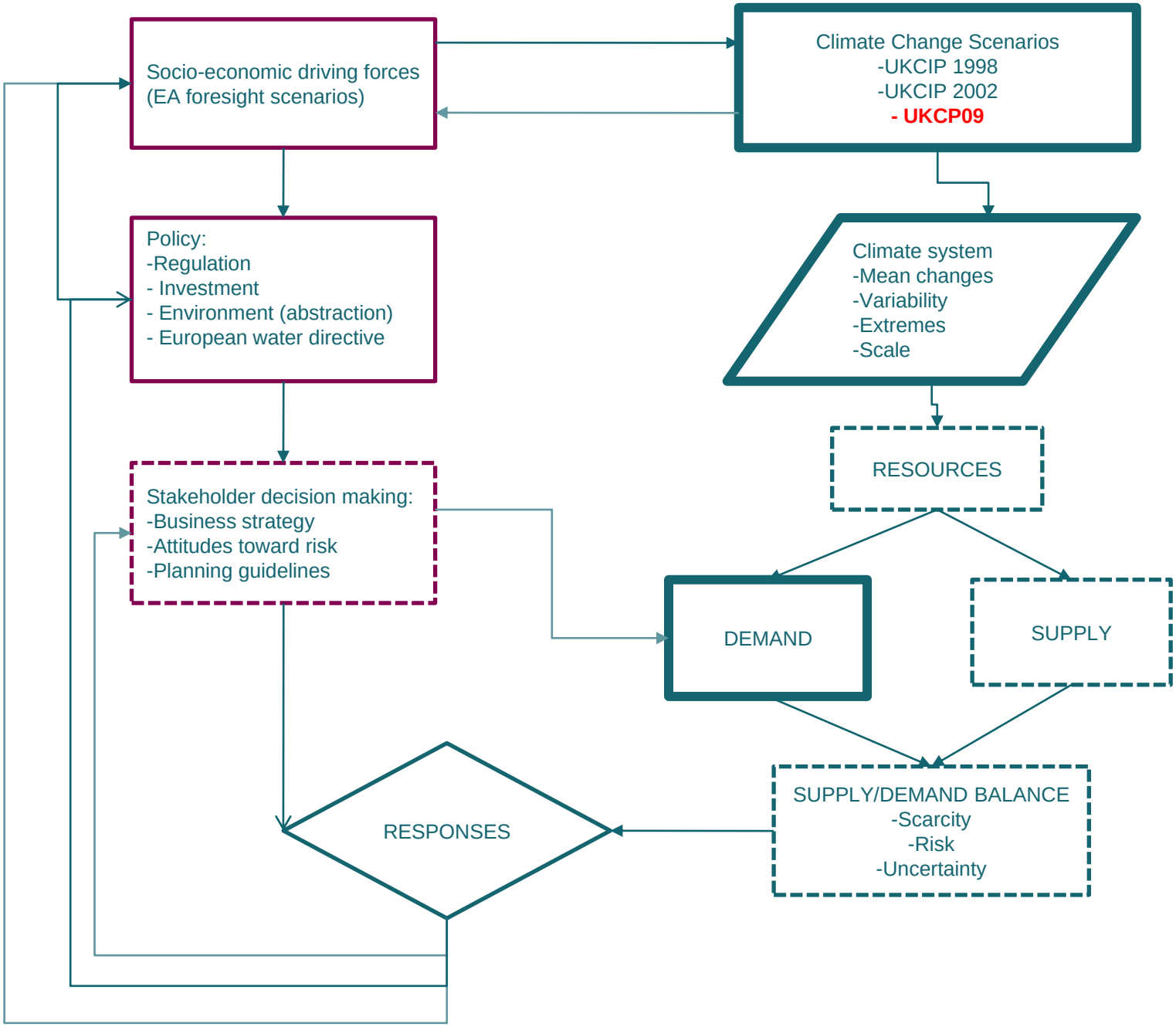
- 5 year cycle of Periodic Review focussed on public water supply
- Analysis has tended to be limited to the boundaries of individual Water Resource Zones, but increasing interest in cross WRZ transfers
- Uncertainty and risk tend to have been treated as add-ons in supply-demand balance analysis
- Impacts on agriculture sector not just on irrigation water requirements, but also on food security


Socio-economic driving forces
(EA foresight scenarios)
Climate Change Scenarios
-UKCIP 1998
-UKCIP 2002
Policy:
-Regulation
- Investment
- Environment (abstraction)
- European water directive
Climate system
-Mean changes
-Variability
-Extremes
-Scale
RESOURCES
Stakeholder decision making:
-Business strategy
-Attitudes toward risk
-Planning guidelines
DEMAND
SUPPLY
SUPPLY/DEMAND BALANCE
-Scarcity
-Risk
-Uncertainty
RESPONSES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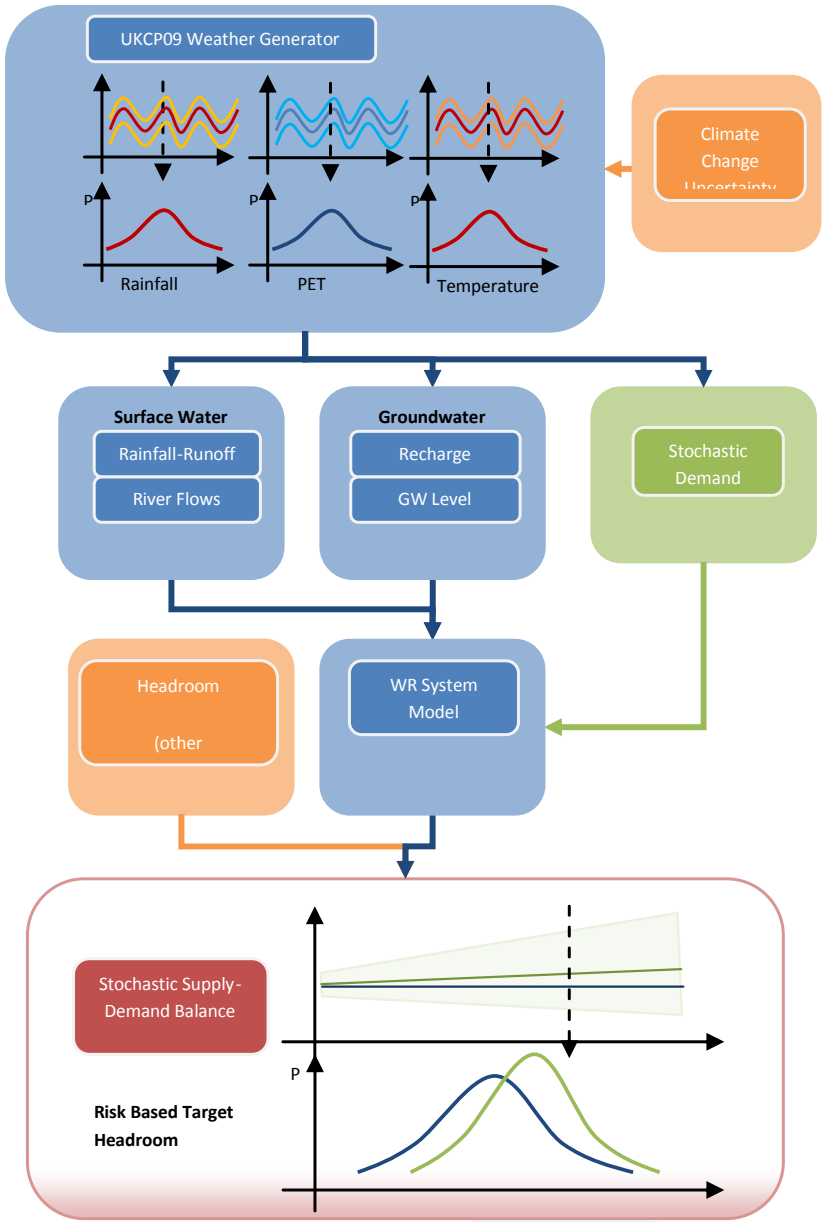
RESPONSES

Need for more integrated approach?



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Discussion

Research Agenda

Development of “Best Practice” approach, acceptable to water utilities, regulators, customers, and other stakeholders

Extreme events

Next planning cycle coming soon

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