Imagining the Unprecedented: Developing Climate Risk Storylines

Exploring and explaining plausible climatic events in a warming world

UNIVERSITY OF LEEDS

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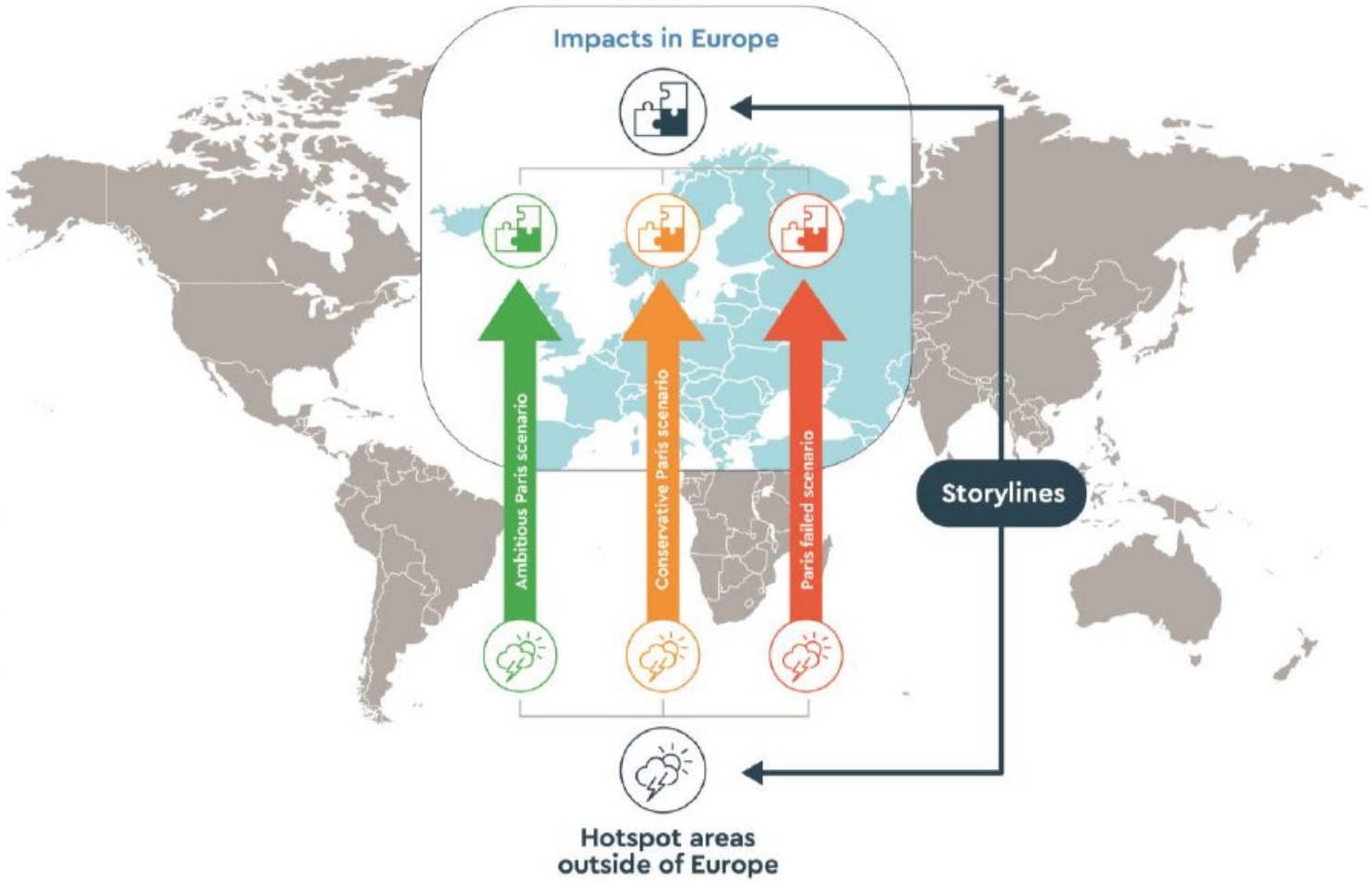
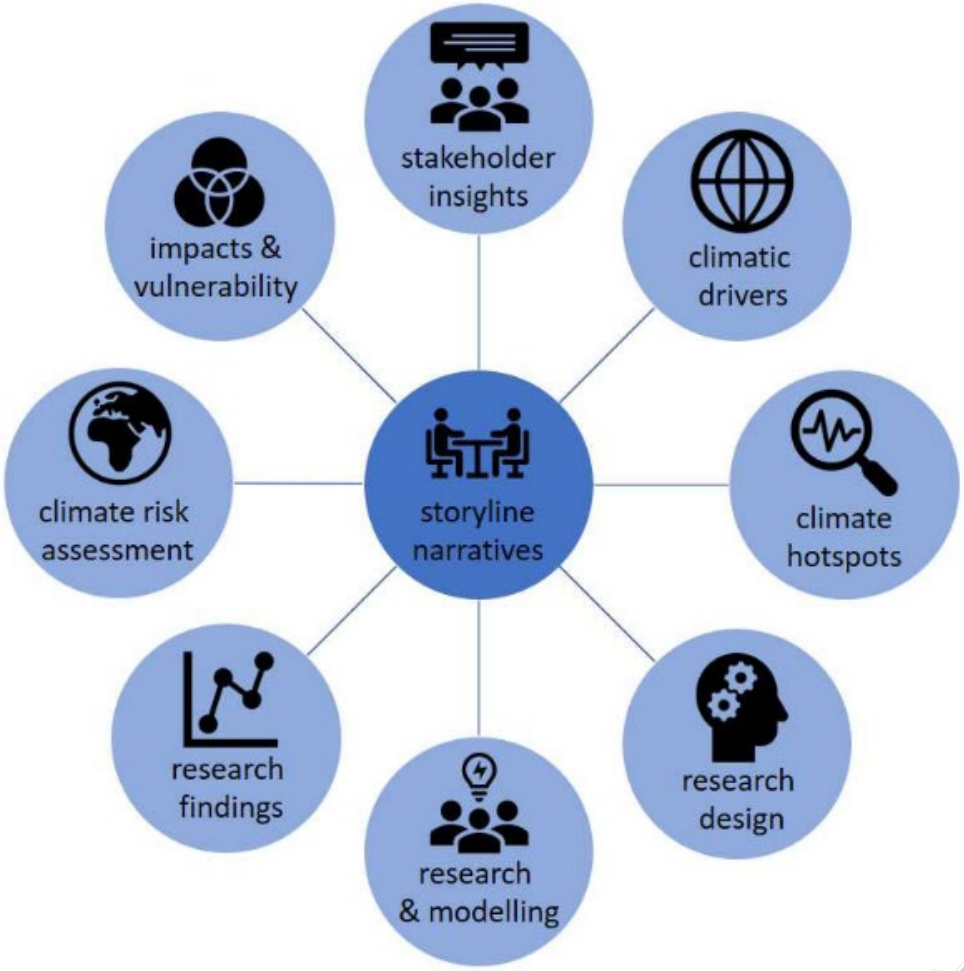
Climate storylines in the RECEIPT project





Storylines are central to the RECEIPT project.

Climate storylines in the literature

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Climate storylines have already addressed:

Coastal Infrastructure linked to:

- **Sea level rise:** Hazeleger et al., (2015) and Duvat et al., (2017)

Financial systems and international relations linked to:

- **Rain:** de Bruijn et al., (2016) and Dessai et al., (2018)
- **Storm:** Zappa & Shepherd, (2017) and Zscheischler et al., (2018)
- **Flood:** Keller et al., (2018) and de Bruijn et al., (2019)

Food systems and manufacturing linked to:

- **Drought:** Zappa (2019) and Dosio et al., (2020)
- **Heat:** Hegdahl et al., (2020)
- **Extinctions:** Kump (2018) and Fajardo et al., (2020)

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Explore and Explain

Climate storylines can both

- Explore potential or counterfactual climatic events in a warming world and
- Explain what those causal chains describe, including some of their consequences.

American Museum of Natural History: Exhibition visitors interact with the before and after slider feature. Photo: AMNH/D. Finnin

Exploring and explaining enable climate storylines to:

- link across temporal and spatial scales,
- help to manage uncertainty and
- guide co-production.

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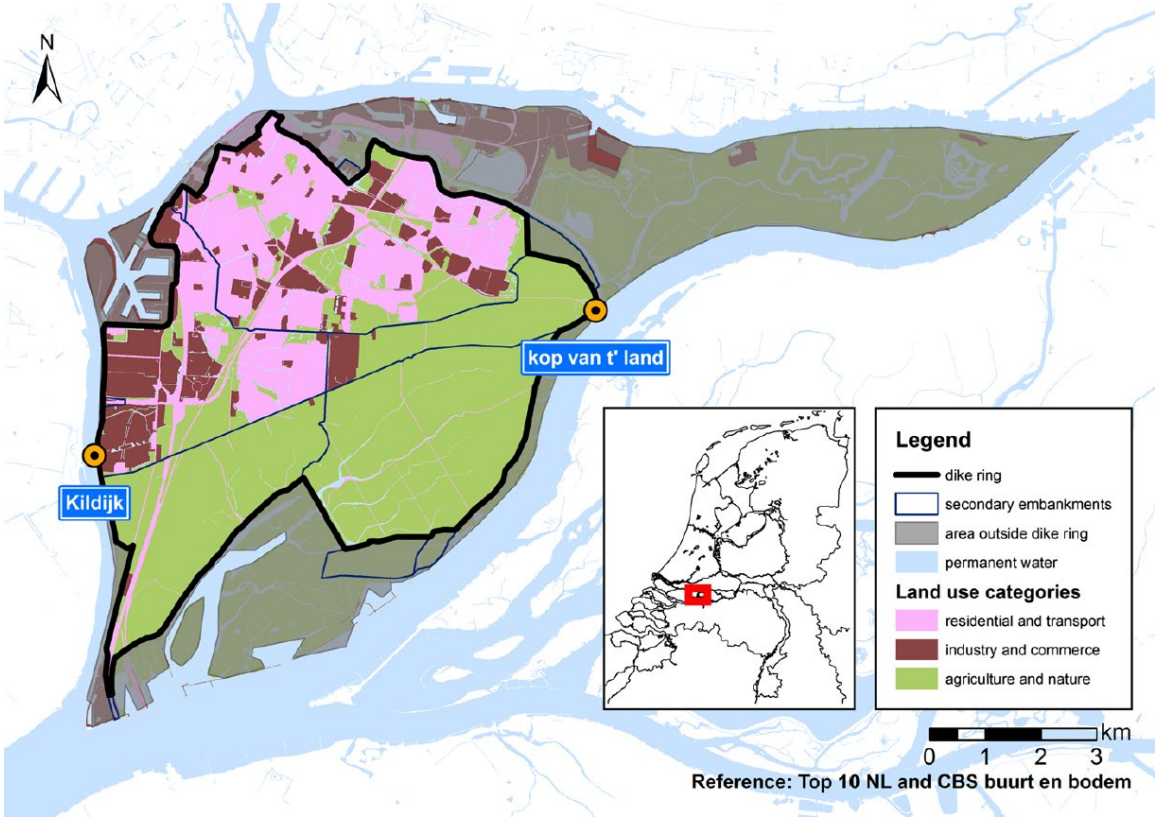
Climate Storyline: Flood event in Dordrecht

de Bruijn, K., Lips, N., Gersonius, B., & Middelkoop, H. (2016). The storyline approach: a new way to analyse and improve flood event management. *Natural Hazards*, *81*(1), 99-121. https://doi.org/10.1007/s11069-015-2074-2



Case study area 'Island of Dordrecht' from de Bruijn et al., (2016)

Temporal Scales: hours to days, and months

Spatial Scales:

global & regional model outputs, local vulnerability

Uncertainty approaches:

- analysed interdependencies between critical infrastructure networks;
- used rough general assumptions to generate possibilities;
- preventative actions included in one storyline reduced some uncertainty;
- storylines regarded as examples, not as predictions.

Co-production:

- stakeholder input led to additional storyline;
- flood event modeling included climate impacts and human behaviour.

Linking scales

Climate storylines make flexible links across multiple scales in time, space and climatic intensity.

Case study area 'Island of Dordrecht' from de Bruijn et al., (2016)

Storyline Focus	Temporal Scale	Spatial Scale	Climatic Scale	Metrics (e.g.)	Impacts (e.g.)	Societal Application
Proximate	day-week	local	hydro-meteorological	Rainfall Intensity-Density-Frequency (IDF)	Flood, drought	Urban and local planning
Emergent	year-decades	regional	severe storms, aridification	Wind speed, soil moisture	food security, migration	National planning
Remote	Multi-decadal	global	compound cyclonic events	Cyclone (hPa) & Heat Index	system change, loss of life	International planning

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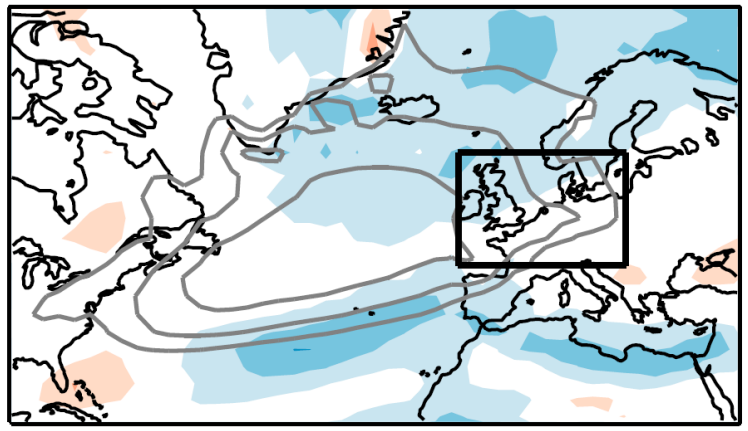
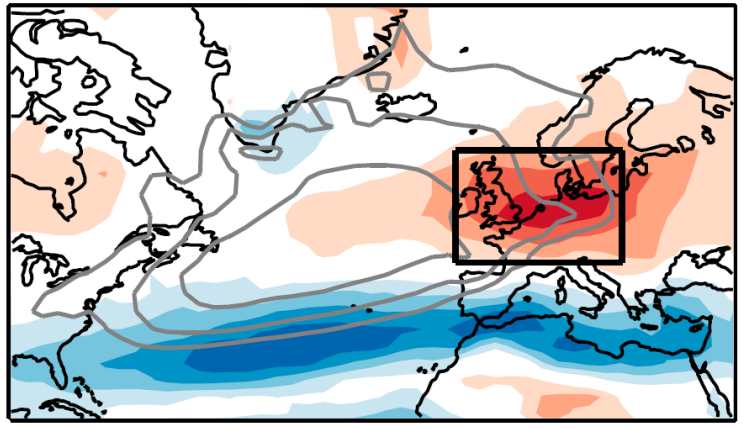
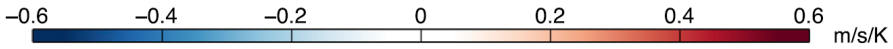
Weak vortex storyline



Strong vortex storyline





storylines characterizing a range of plausible scenarios for two impact-related aspects of European climate:
cold-season Mediterranean precipitation and central European windiness.

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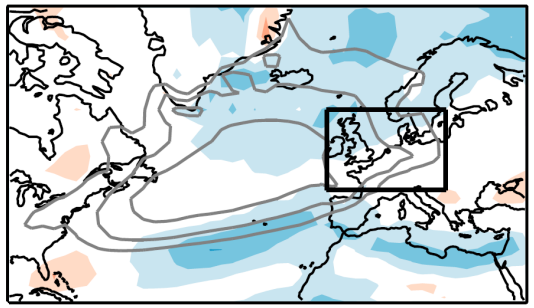
Weak vortex storyline



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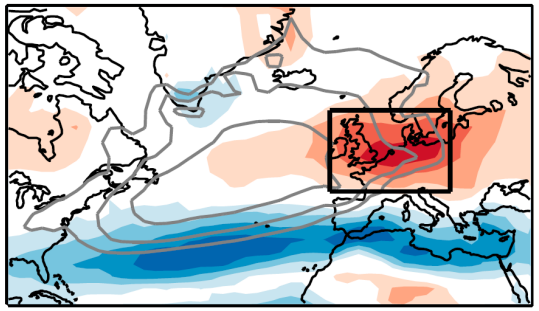

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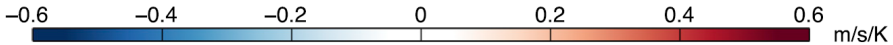

Euro-Atlantic windiness response per degree of global warming ($ms^{-1}K^{-1}$)

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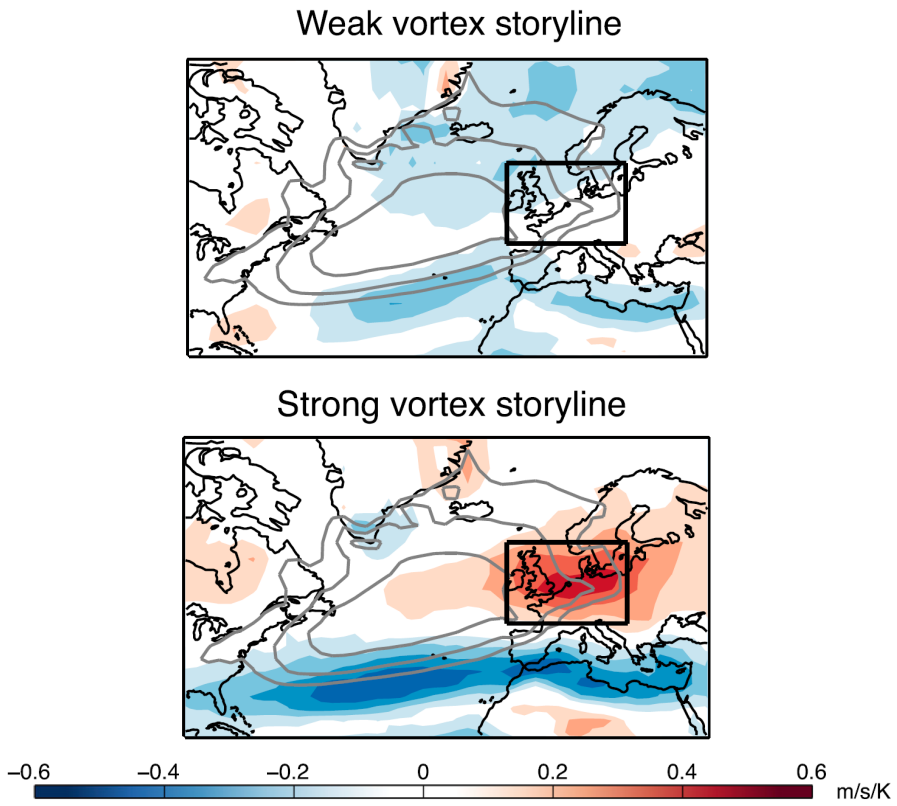
Climate Storyline: Euro-Atlantic windiness

Zappa, G., & Shepherd, T. G. (2017). Storylines of Atmospheric Circulation Change for European Regional Climate Impact Assessment. *Journal of Climate*, 30(16), 6561-6577. https://doi.org/10.1175/jcli-d-16-0807.1



Euro-Atlantic windiness response per degree of global warming ($ms^{-1}K^{-1}$)

Temporal Scales: months and seasons to years

Spatial Scales:

Global to regional - Tropical and polar amplification and stratospheric vortex strength linked to regional European windiness

Uncertainty approaches:

- highlight dependencies between impact-relevant aspects of climate change,
- Compare responses in three remote drivers of climate

Co-production:

- Application suggested for climate services and regional impact assessment

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Linking scales

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Case study of changes in European windiness from Zappa and Shepherd (2017)

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Qualitative Approaches to Uncertainty

The reviewed papers demonstrated multiple approaches to manage uncertainty.

Research Stage	Qualitative Approaches to Uncertainty
Research Design	Question Assumptions
	Make Documentation Transparent
	Invite Expert Knowledge

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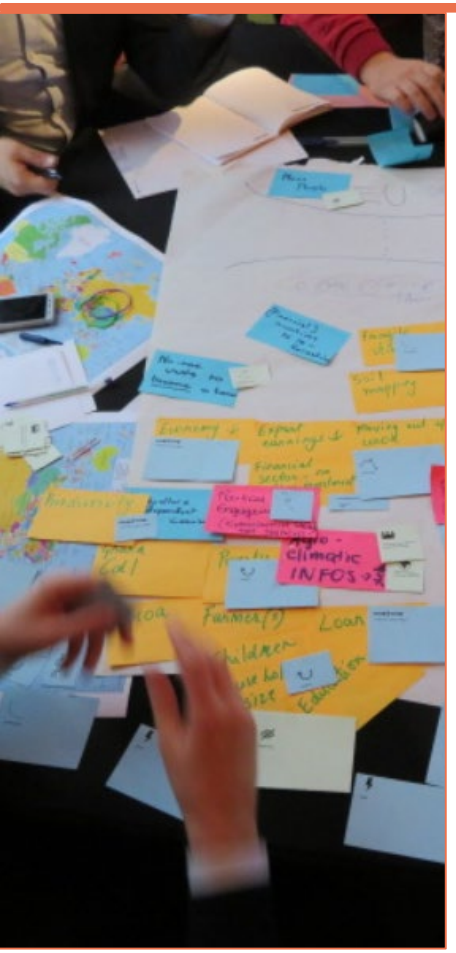
Co-production



Stakeholders can inform research questions to co-produce new knowledge.

When focused on rare or unprecedented events, imaginative stakeholders can identify surprises they consider relevant for planning and risk reduction.

Societal partners:

- can draw on past experience,
- may be asked to imagine hazards they have not already faced, and
- consider risks of event intensity, duration and frequency outside of their experience.

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Climate storylines and adaptation pathways

Climate storyline and adaptation pathways approaches both feature:

- multiple lines of plausible evolutions,
- independence from calculating probabilities and
- flexibility to reconfigure with new information.

Exploring and explaining climatic events in a warming world, climate storylines can inform adaptation pathways to consider plausible rare or unprecedented climate impacts that might otherwise be missed.

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