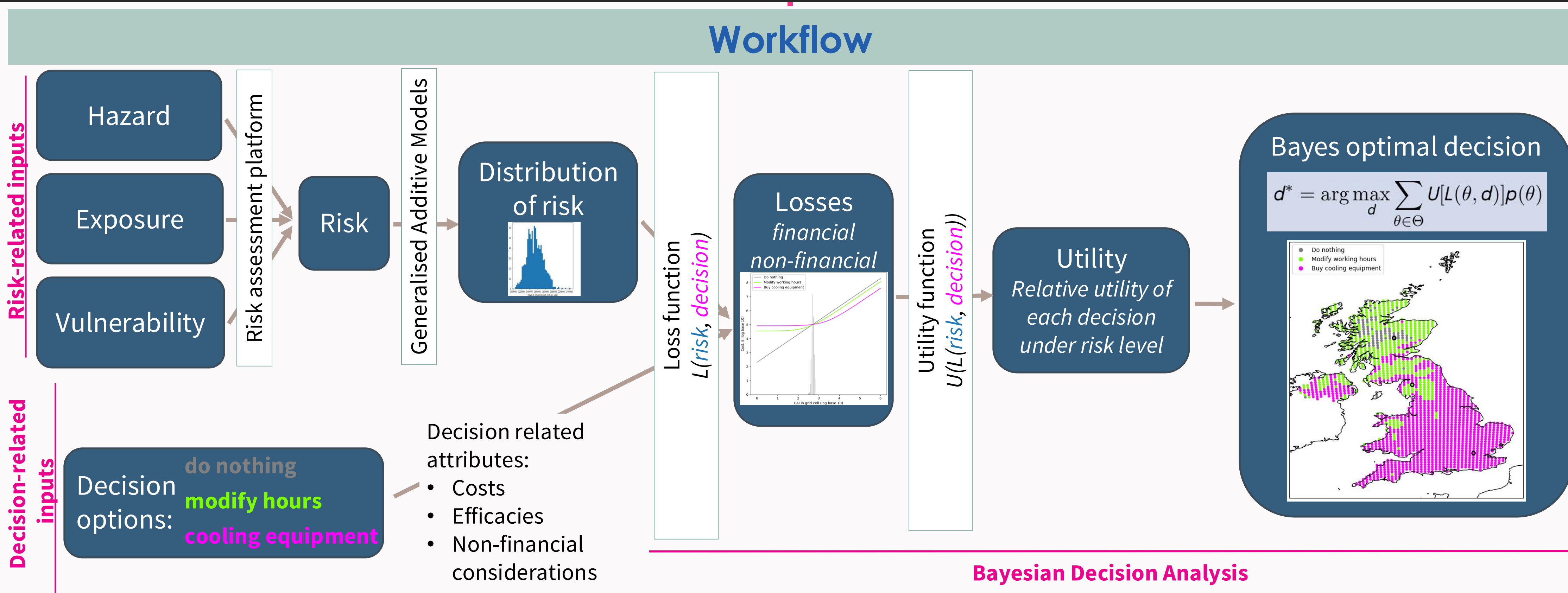


# From risk to action: Climate adaptation decision robustness under uncertainty

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## How can we make robust climate adaptation decisions given uncertainty in climate risk and decision attributes?



### Uncertainty analysis

- Select plausible values for risk-related inputs such as hazard, exposure, vulnerability (162 combinations)
- Select range of plausible values for decision-related inputs such as costs, efficacies, etc. (200 samples)
- For all 32,400 combinations of input values, generate the Bayes optimal decision in each location
- Analyse the uncertainty of the optimal decision, compared to uncertainty in climate risk

**Varying all risk-related inputs, how uncertain is...**

**Also varying decision-related inputs...**

the predicted risk?

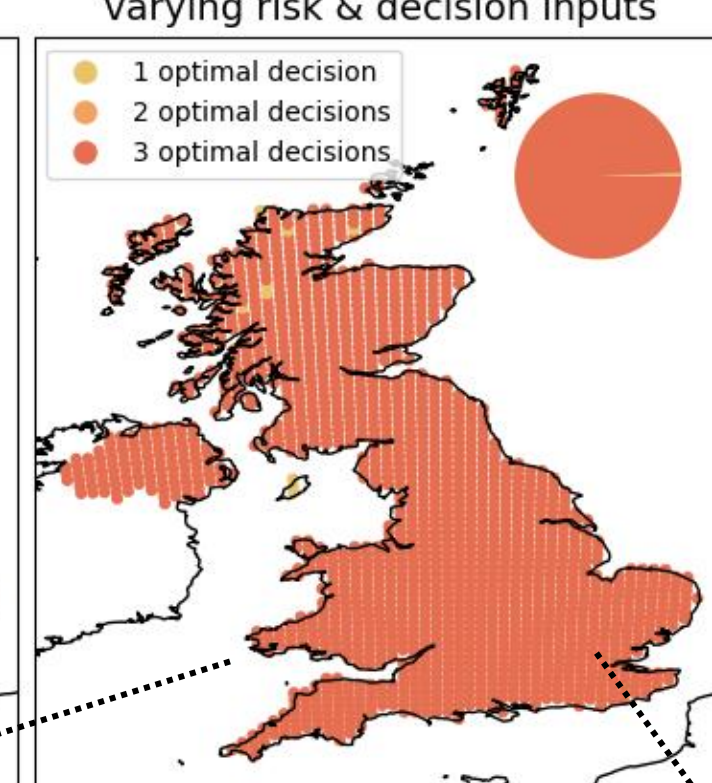
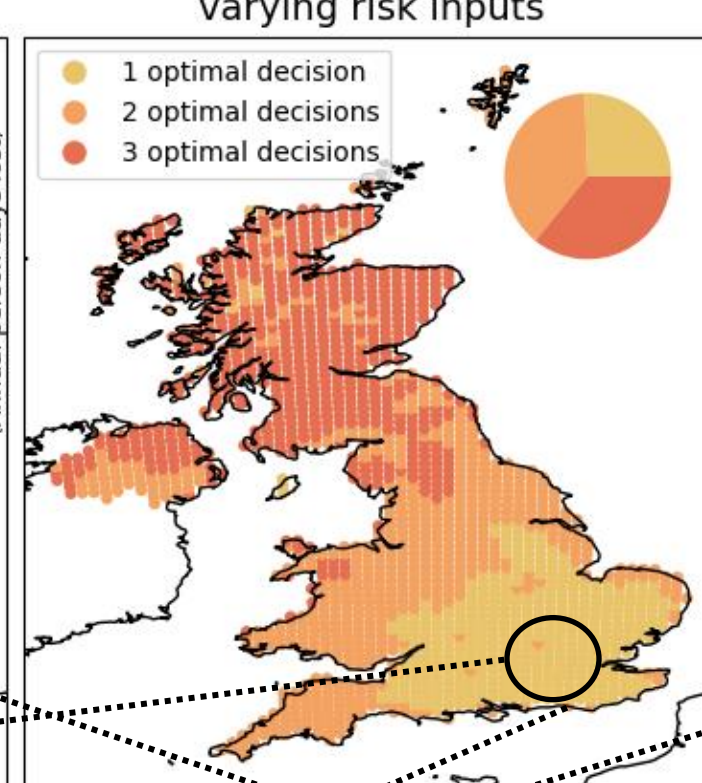
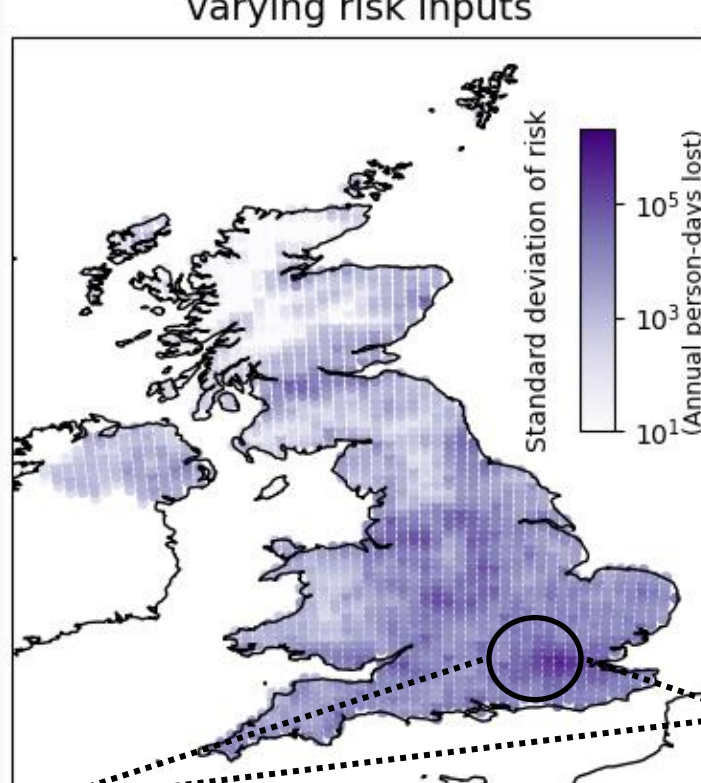
the optimal decision?

how does decision uncertainty change?

Uncertainty of risk: varying risk inputs

Uncertainty of decision: varying risk inputs

Uncertainty of decision: varying risk & decision inputs



**Greatest uncertainty in risk, but only one optimal decision**

Now **any decision** could be optimal in most locations

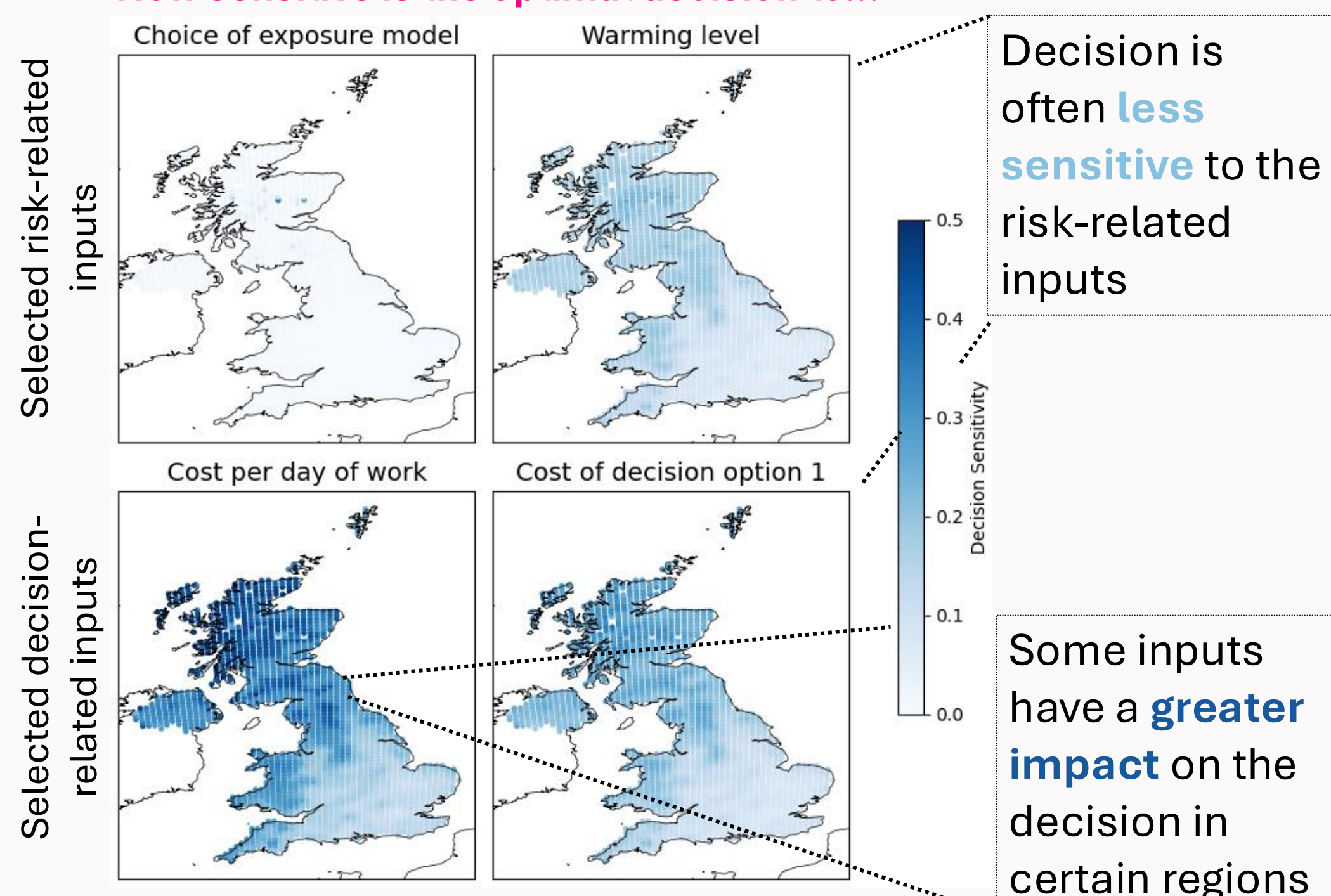
The decision can be robust when risk is uncertain, and vice versa: uncertainty & sensitivity analysis should be carried out on the optimal decision.

### Sensitivity analysis

**Modified PAWN method:** compare the unconditional PMF  $f_d(d)$  of the output decision  $d$  with the conditional PMFs  $f_{d|x_i}(d)$  of  $d$  conditioned on the inputs  $x_i$

$$S_i = \text{mean}_{x_i} \left[ \max_d |f_d(d) - f_{d|x_i}(d)| \right]$$

**How sensitive is the optimal decision to...**



The decision is often more sensitive to decision- rather than to risk-related inputs: sensitivity analysis helps prioritise where uncertainty needs to be reduced.

Decision sensitivity varies spatially: decision-makers need to consider what influences the optimal decision on a local basis.

**Uncertainty & sensitivity analysis allows us to be as confident as possible in the output decision despite uncertain inputs.**

### What's next?

Apply this decision-making framework to a real-world example to understand uncertainty and sensitivity in a more complex context.