

# Dealing with uncertainty

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# Uncertainty



- To assess how much a customer/viewer/listener can rely on the forecast to make decisions, we need to decide how much uncertainty there is
- What do we mean by uncertainty?
- What does the public/customers mean when we talk about uncertainty?

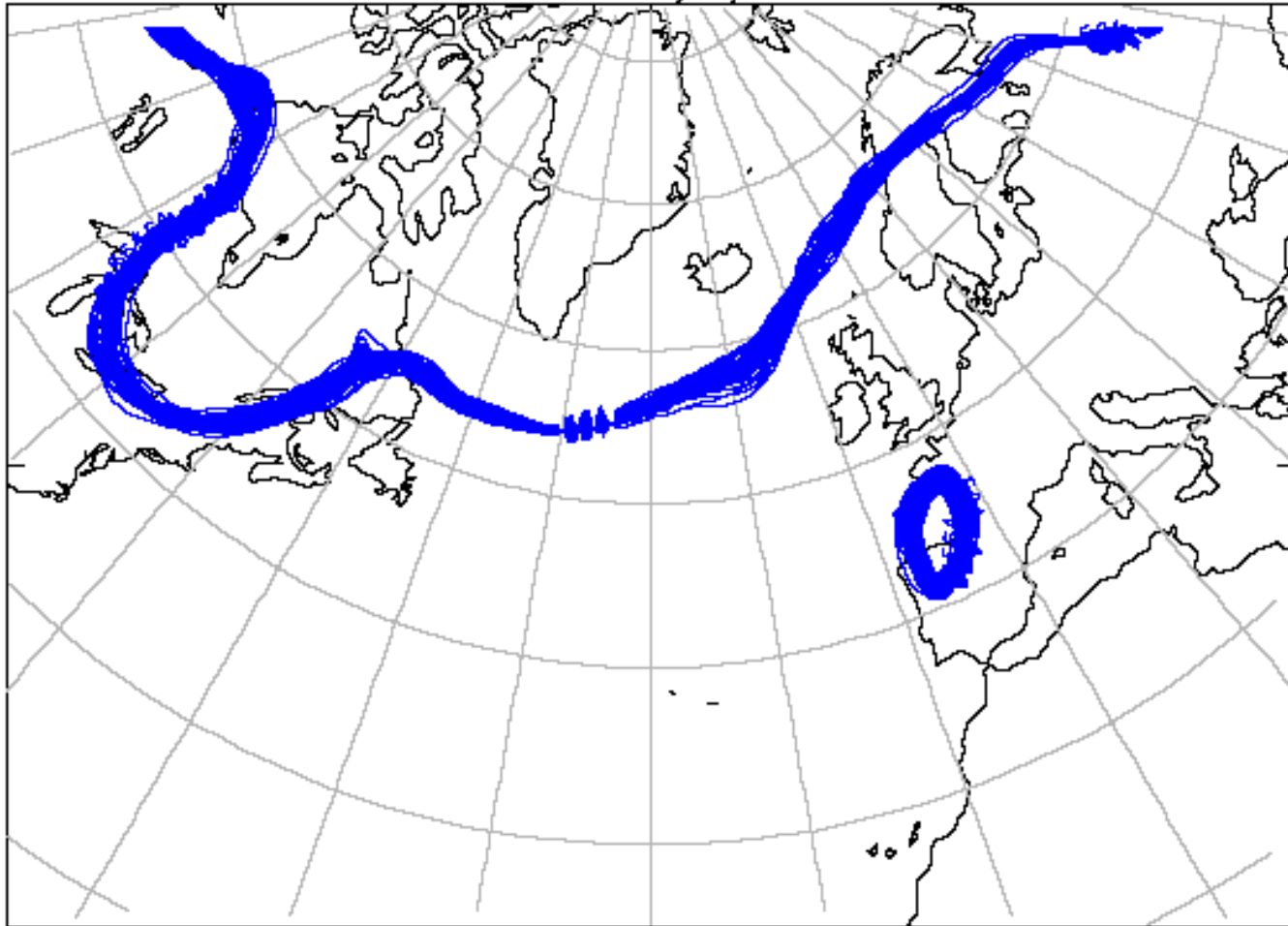
# Where does uncertainty come from?

- Differences between model solutions
- Differences between the model and observations
- There is not sufficient skill in the model to pinpoint some details (*butterfly effect?*)
- Uncertainty in turning scientific understanding into concise, plain language
- Uncertainty in how this will be interpreted by the customer



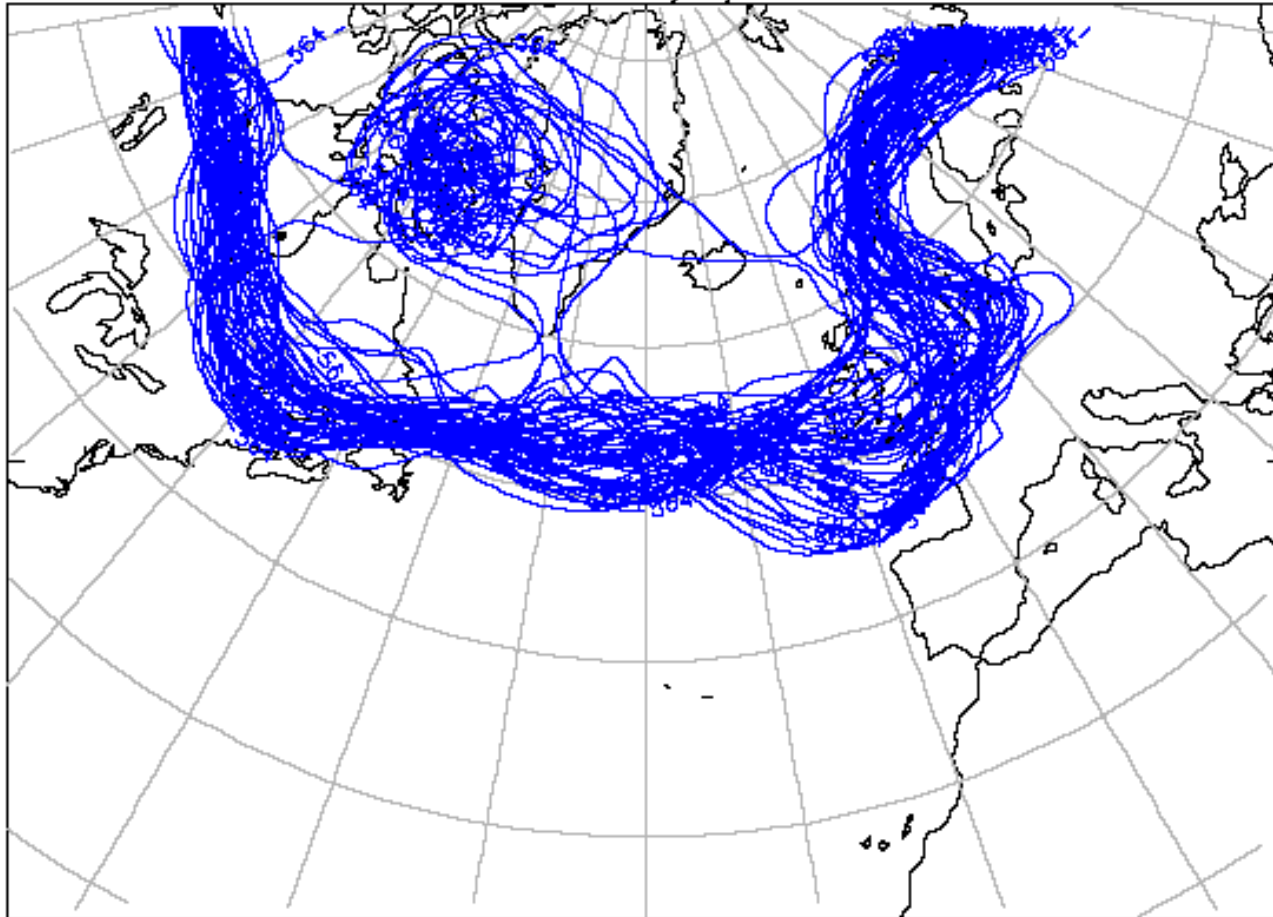
# Ensembles seven-day sequence

ECMWF ENSEMBLE FORECAST 5/ 7/2001 12z.  
SPAGHETTI CHARTS. 500 hPa height of 564.0Dm  
T+ 12 Valid at 6/ 7/2001 0z



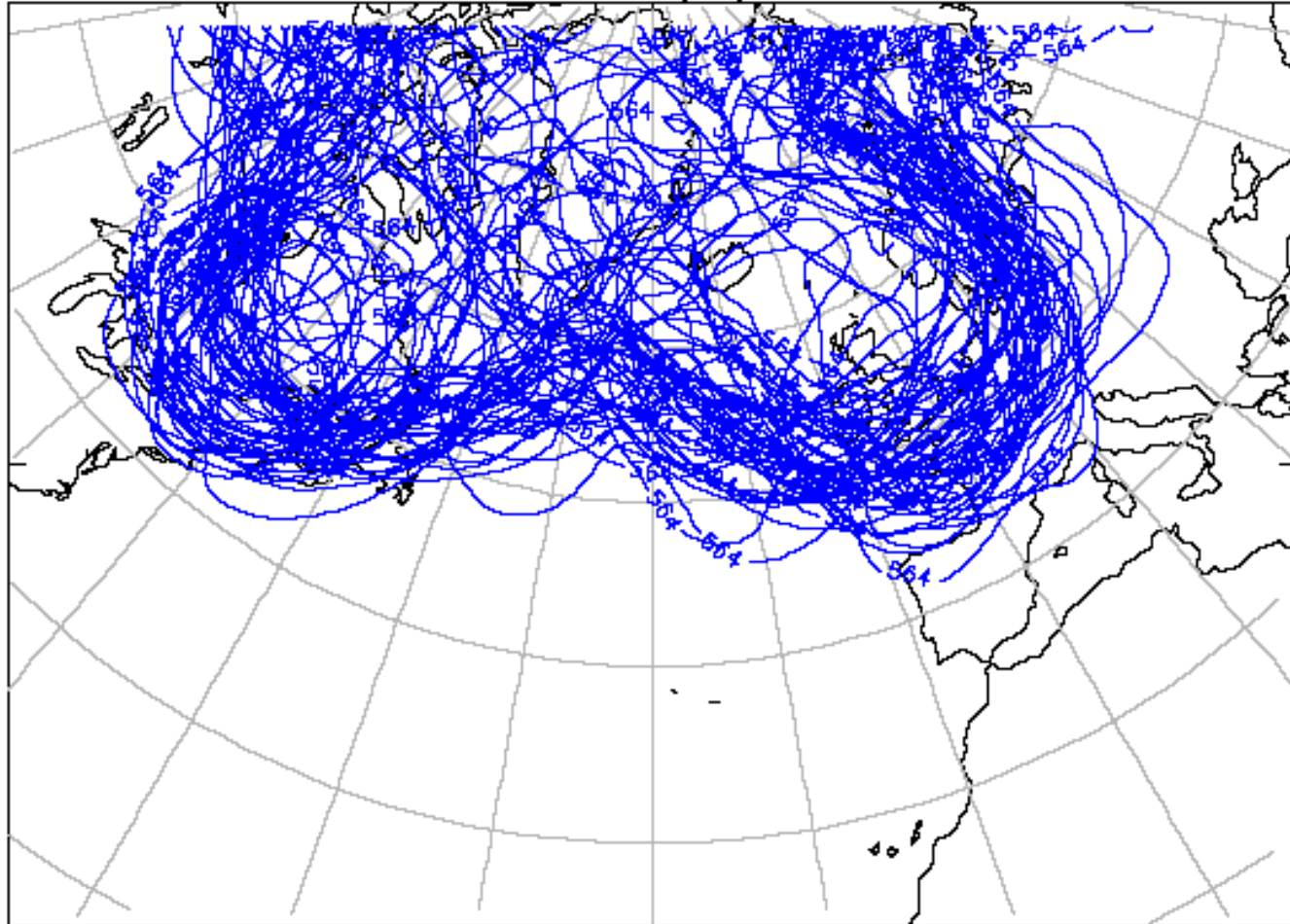
# Day three

ECMWF ENSEMBLE FORECAST 5/ 7/2001 12z.  
SPAGHETTI CHARTS. 500 hPa height of 564.0Dm  
T+ 84 Valid at 9/ 7/2001 0z



# Day seven

ECMWF ENSEMBLE FORECAST 5/ 7/2001 12z.  
SPAGHETTI CHARTS. 500 hPa height of 564.0Dm  
T+180 Valid at 13/ 7/2001 0z





# Ensembles...

Initial Condition

Uncertainty



Forecast uncertainty

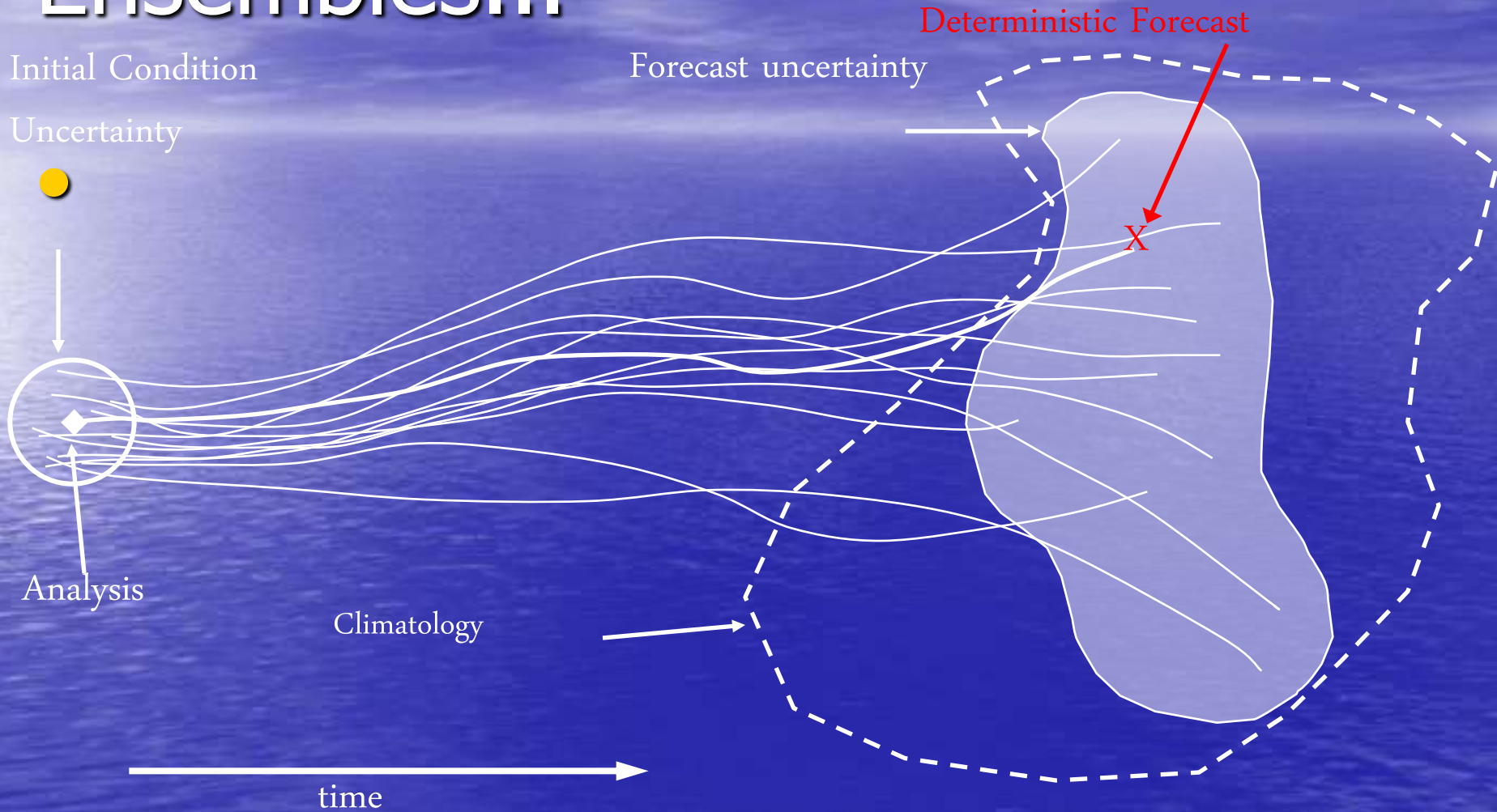
Deterministic Forecast

X

Analysis

Climatology

time



# Can we use low probabilities?

Most extreme events are inherently improbable - how should we respond to low probabilities?

Event probability must be related to "climatology" for decision-making, eg.

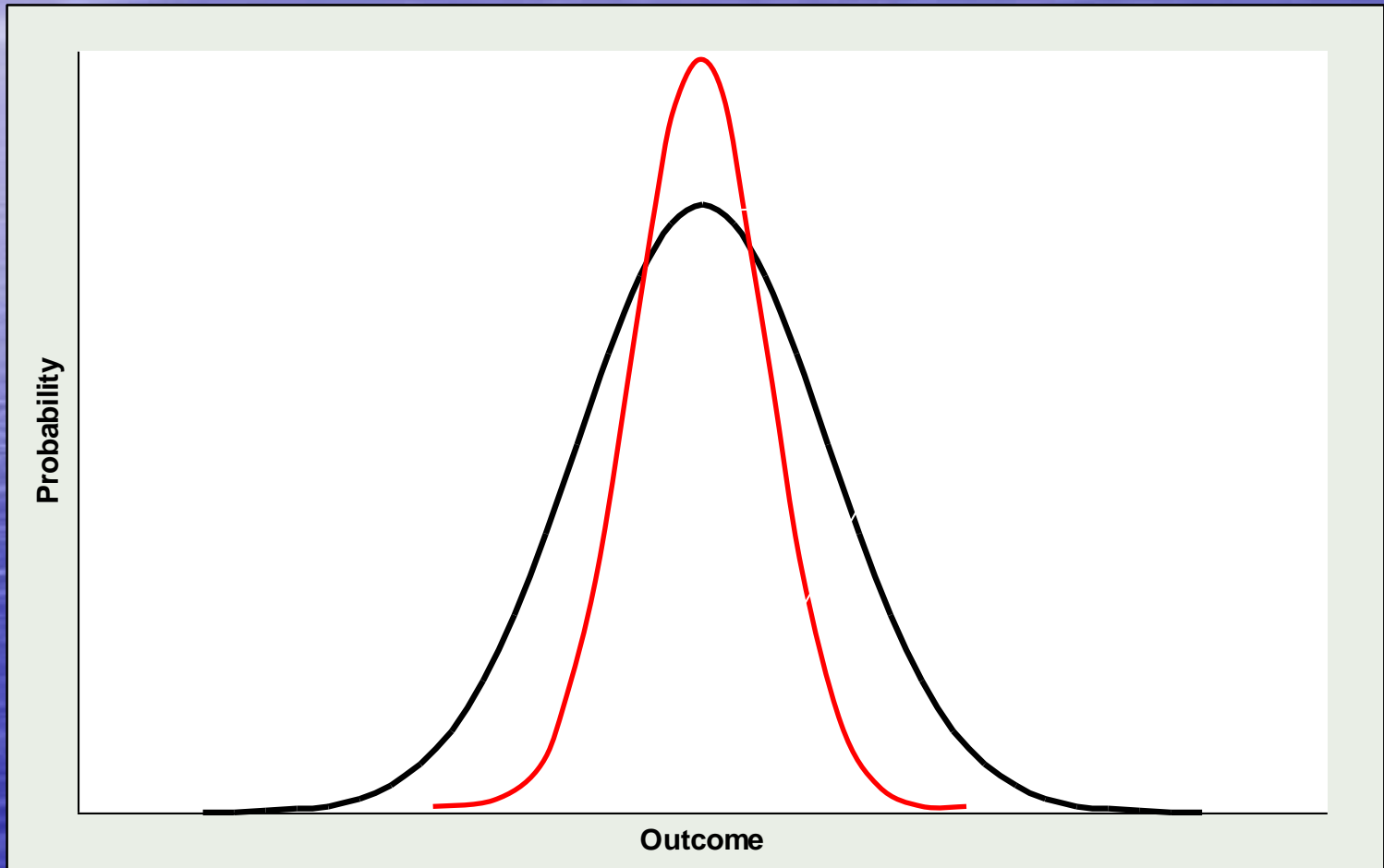
- 5% risk that a plane will crash - ***would you board it?***
- 5% risk of rain – ***would you play golf?***
- 50% prob of heavy snow in London tomorrow

Decisions must be based on user's

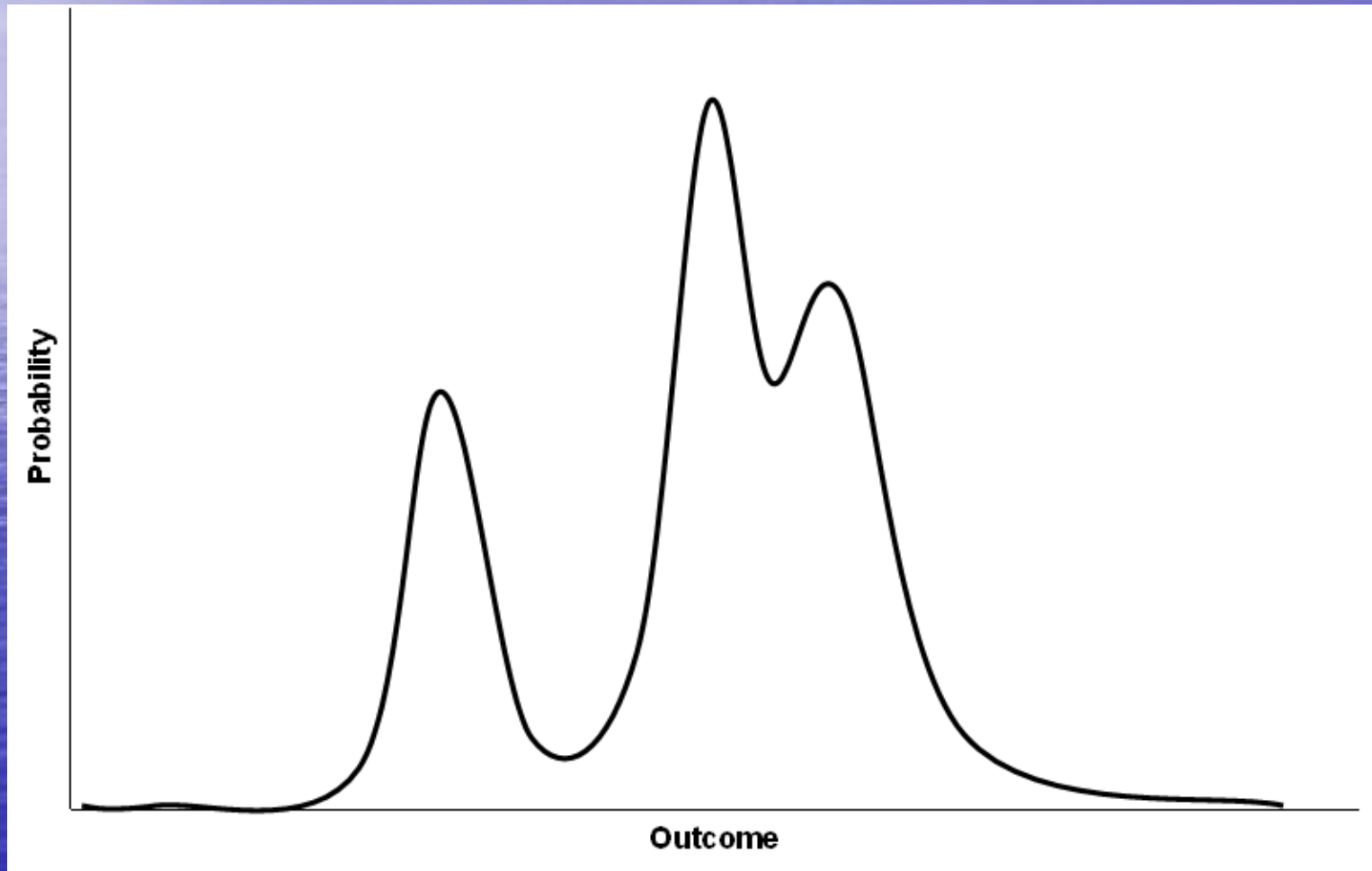
Cost/Loss ratio



# Uncertainty in the model forecast



# Uncertainty in the model forecast



# How to communicate uncertainty

- It actually provides an opportunity to provide useful additional information to your customer (risk, 'what if' scenarios) in a positive way
- It opens the door to understanding how you can help your customer achieve their objectives
- It can have a positive **impact** on the customer's decision making process



# So how can we use Probabilities?

- Forecasters have always dealt with uncertainty.



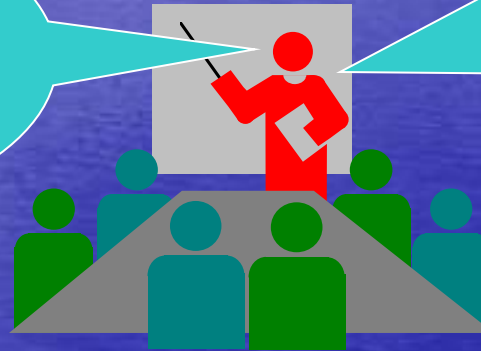
- Uncertainty expressed in many ways , mostly subjective.

# Probabilities - getting quantitative

## How can we improve on subjective

description?

People in London have a 50% chance of seeing a light shower this afternoon...

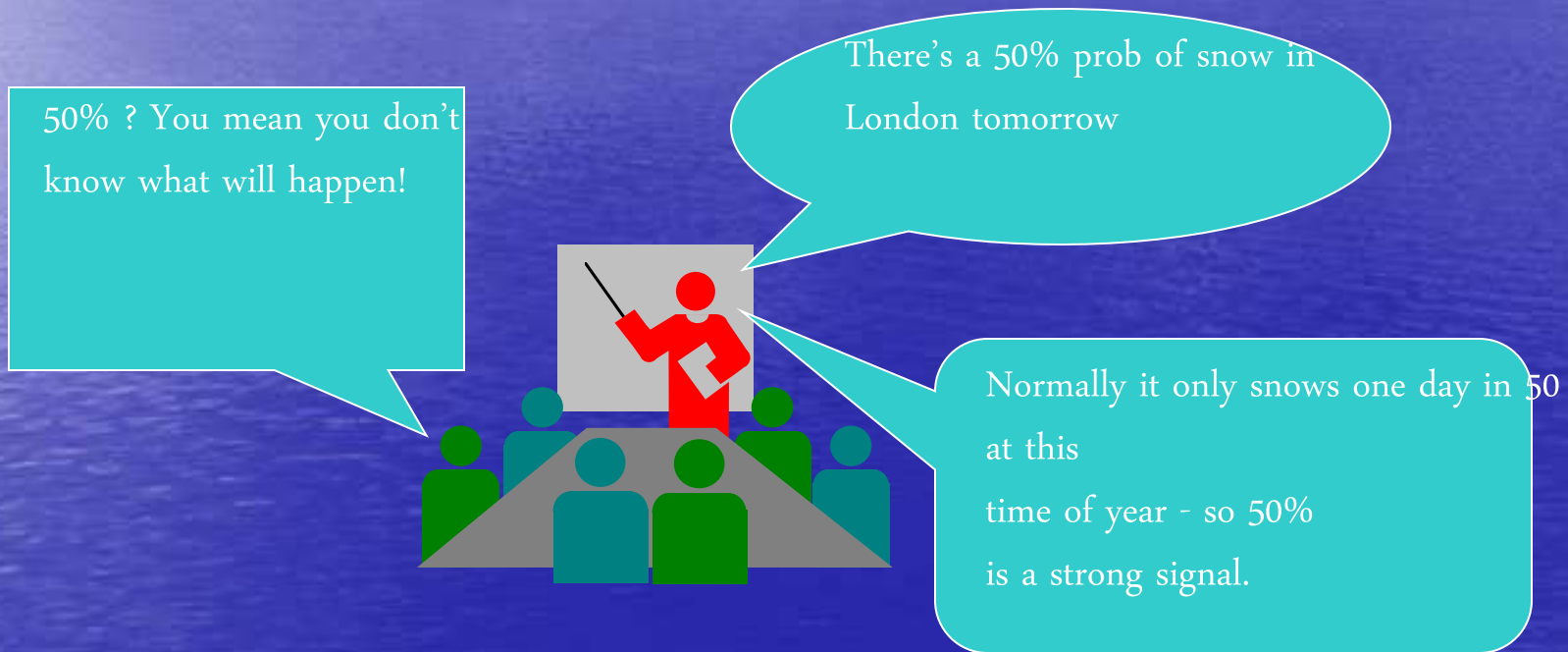


...but in the NW you have an 80% risk of a shower with a 20% chance of over an inch

This is much more informative, but only if the figures are meaningful!

# Probabilities in Context

- Sometimes probabilities need to be compared to climatology to be properly understood.





# Summary

- Judgement call: depends on customer/audience
- 'Intelligent' planner, can handle risk with scenarios
- Military 'give us your best shot'
- Public ---- numbers may be meaningless if not defined  
---- subjective (words) perhaps better

Uncertainty can provide useful additional information

*Dangers in turning probabilistic information into deterministic output*