



# Climateprediction.net and regional scale climate forecasts

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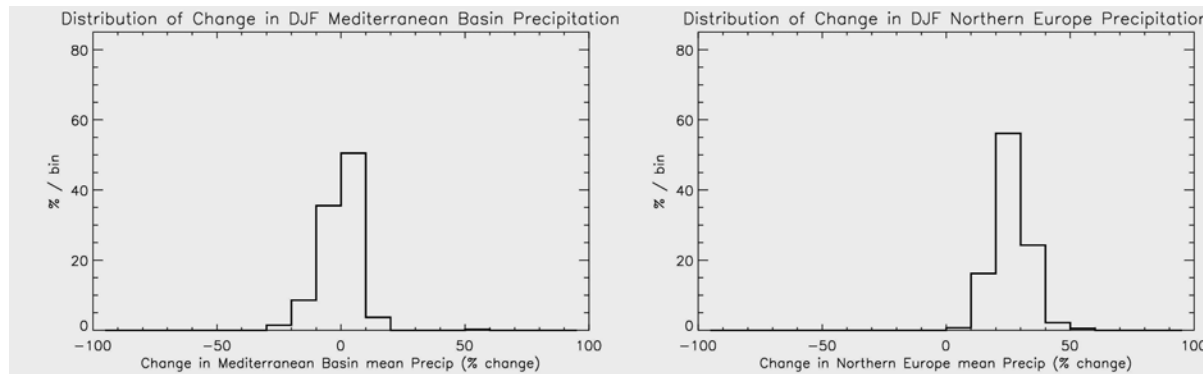
# Regional Behaviour – European Precipitation



## Mediterranean Basin

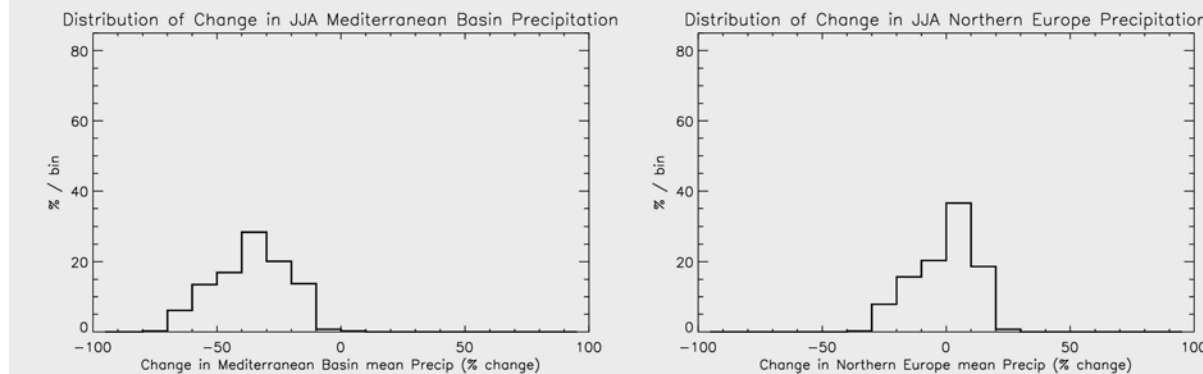
## Northern Europe

Winter



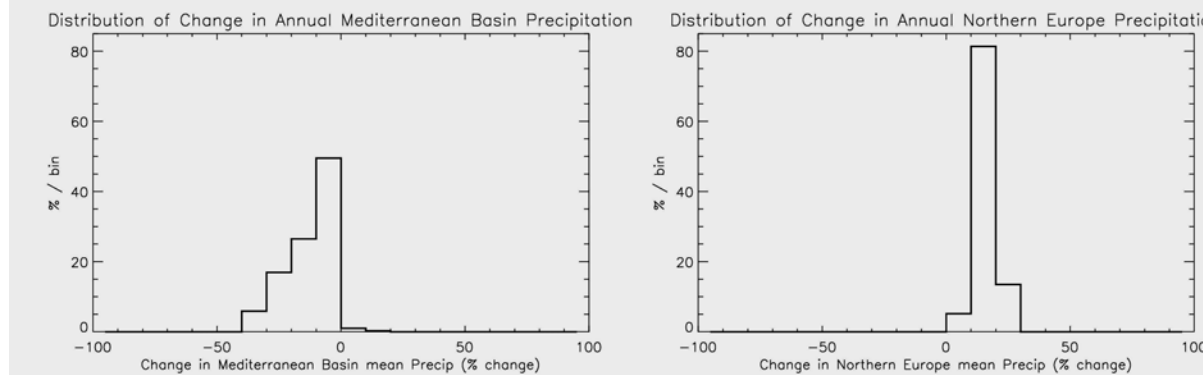
Winter

Summer



Summer

Annual



Annual

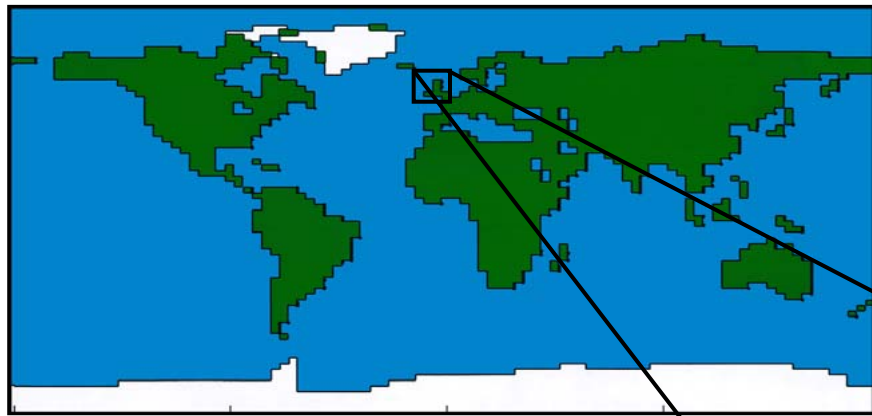




## Why we need high resolution information

- Global model predictions lack skill at fine spatial and temporal scales
- Regional or local impacts will often results from changes at these scales





19 levels in atmosphere

2.5 lat

3.75 long

20 levels in ocean

1.25

1.25

-5km





You can only meaningfully say  
something about the average of  
10 grid boxes

So why can't we make the grid  
boxes smaller?





## GCM of the Atmosphere:

3 Equations of Motion  
Equation of State  
Energy Equation  
Mass Conservation



3D wind field  
Temperature  
Pressure  
Density

The Model also includes:

- Convection scheme
- Cloud scheme
- Radiation scheme
- Sulphur cycle
- Precipitation
- Land surface and vegetation
- Gravity wave drag scheme

Each of these equations is evaluated in each grid box in the model  
[96 longitudes by 73 latitudes by 19 vertical levels] every half hour  
timestep





# Time v. Space

The finer the horizontal resolution, the longer it takes to get a forecast

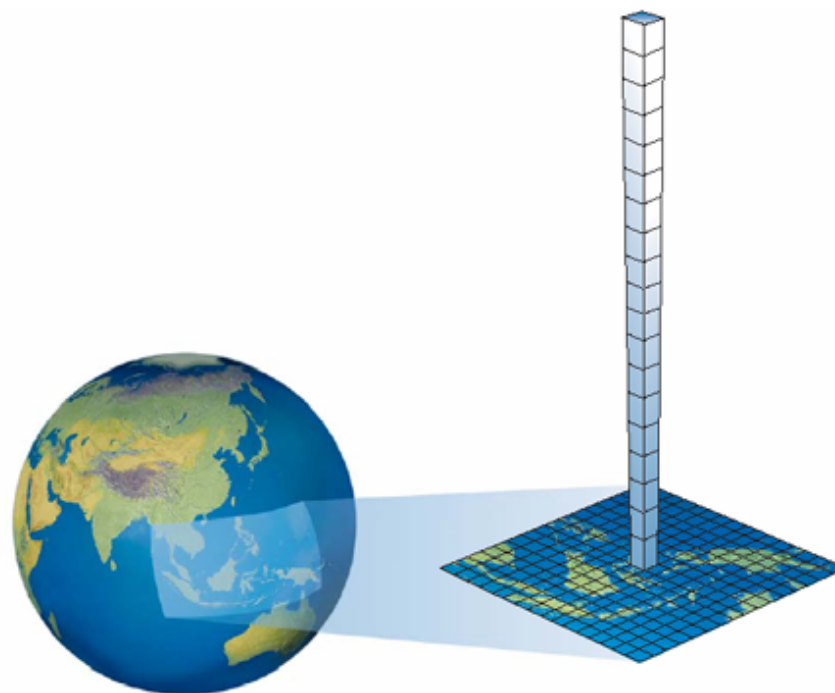
- Climate resolution  $2.5^{\circ} \times 3.75^{\circ}$
- Resolution for BBC weather forecast  $0.56^{\circ} \times 0.375^{\circ}$

You have to simulate the whole Earth, as many processes are global, e.g. the transport of heat from the tropics to the poles by the large scale winds, storms and ocean circulation.





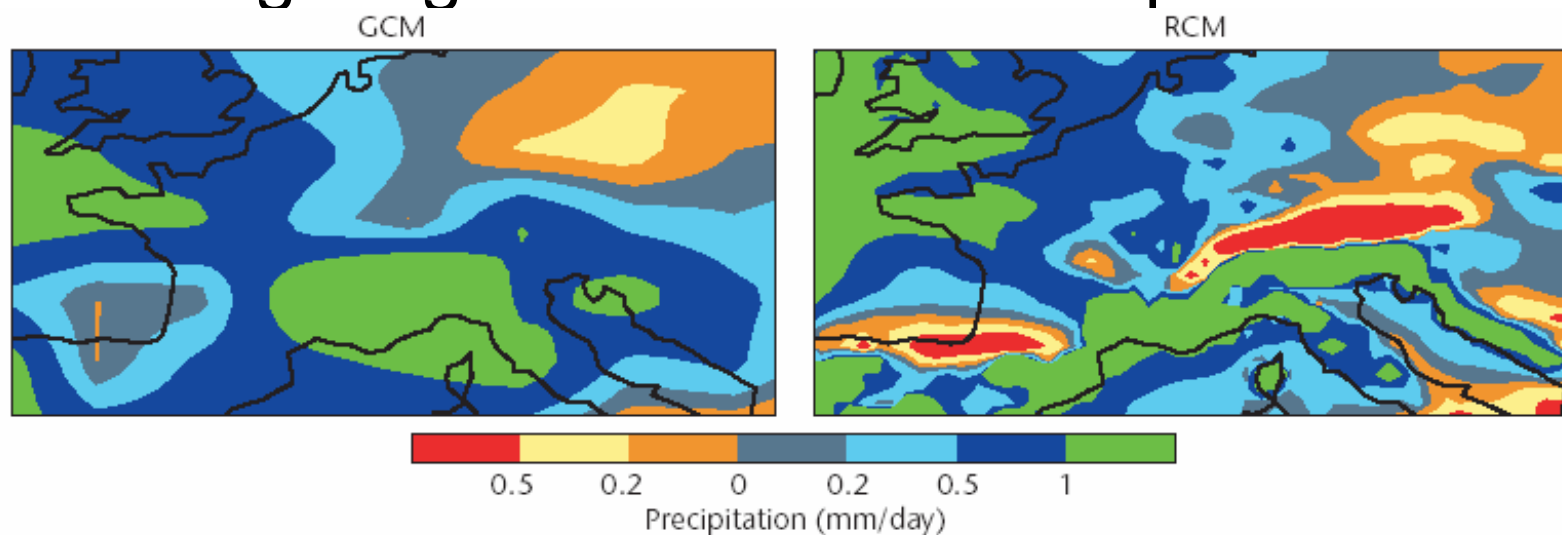
# Regional Climate Models





# PRECIS

## Providing **REgional** **Climates** for **Impacts** **Studies**



*Predicted changes in winter precipitation over central/ Southern Europe between the present day and 2080.*

- *The regional model (RCM) predicts large reductions over the Alps and Pyrenees predicted*
- *The large scale general circulation model (GCM) does not*





- Regional climate models (RCMs) can add skilful detail to global model predictions
- Regional predictions sampling full range of uncertainty are thus required





## Strategy for detailed climate prediction

Use coupled models to provide credible predictions at the global and continental scale

Build regional models to provide consistent large scale predictions and add skilful fine-scale detail such as:

- Fine spatial scale information resulting from medium scale forcings (e.g. topography, coastline, in land waters) which are not resolvable in coarse resolution GCMs
- Fine temporal scale information resulting from the inherent disaggregation of grid box mean values and from the more highly resolved atmospheric motions





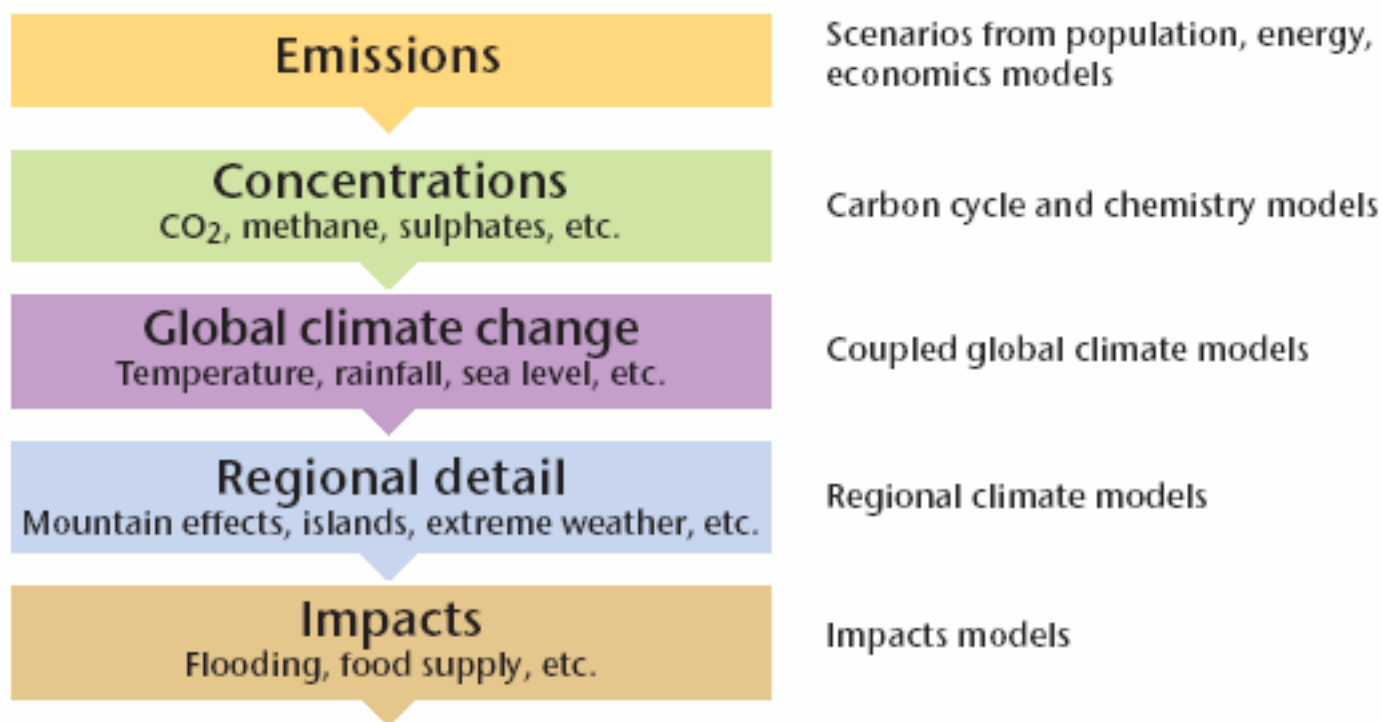
## The Computational Balance:

- Limited computational resource requires competing requirements to be balanced:
  - Global resolution.
  - Probabilistic resolution.
  - Regional resolution.
  - Range of processes to include. E.g. Fully dynamic ocean? Carbon cycle? Atmospheric chemistry? A stratosphere?
- Large supercomputers (e.g. the Earth Simulator) are carrying out very high resolution global simulations of short periods.
- Distributed computing is allowing us to access the degrees of computing power required to explore probabilistic, climate timescale, forecasts.





# The Accumulation of Uncertainty



# The NERC Knowledge Transfer Project



- Building the Met Office regional scale model into *climateprediction.net*
- Developing a 4 module e-learning resource on probabilistic, regional scale climate forecasting
  - - What is climate prediction?
  - - Introduction to climate prediction.
  - - Guide to the use of climate prediction models, and the appropriate interpretation of their results.





# Plans for the Future

- The DEFRA proposal
- The DFID proposal

