A WRF investigation of 18th December 2010: a disruptive UK snow event during the coldest December for over a century.

Photographer: Ian Nicholson/PA Wire

Trafalgar Square,

London

Dr Clare Allen - MeteoGroup UK

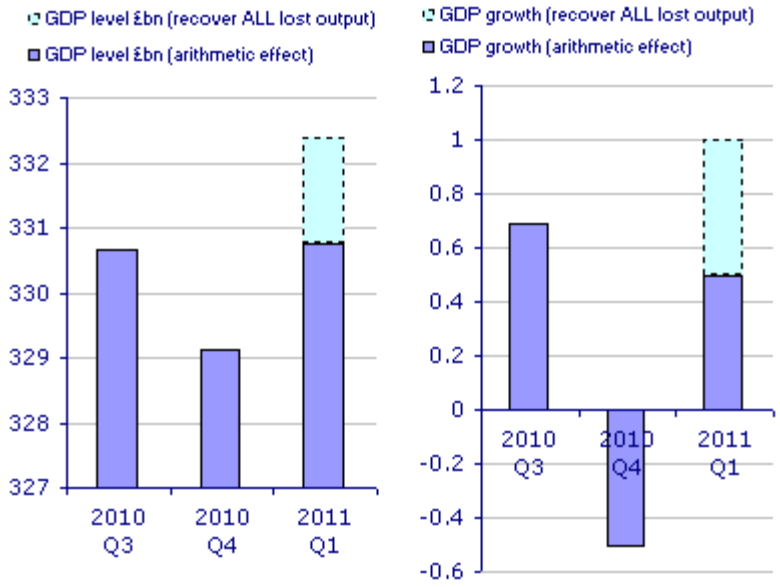
Acknowledge: Daniël van Dijke -MeteoGroup

December 2010: UK

- Coldest December for 120 years
- Coldest individual calendar month since February 1986
- Snow fell widely and heavily on several days, causing disruption to road, rail and air transport
- Mean maximum temperatures were between 3.0 and 5.5ºC below average
- Mean minimum temperatures were between 3.5 and 6.5ºC below average
- Lowest minimum was -21.1°C at Altnaharra
- The lowest daytime maximum was -15.8°C at Altnaharra

December 2010: UK - snow

The Office for National Statistics estimated that the widespread snow in December depressed the level of Gross Domestic Product by approximately 0.5% in the fourth quarter of the 2010



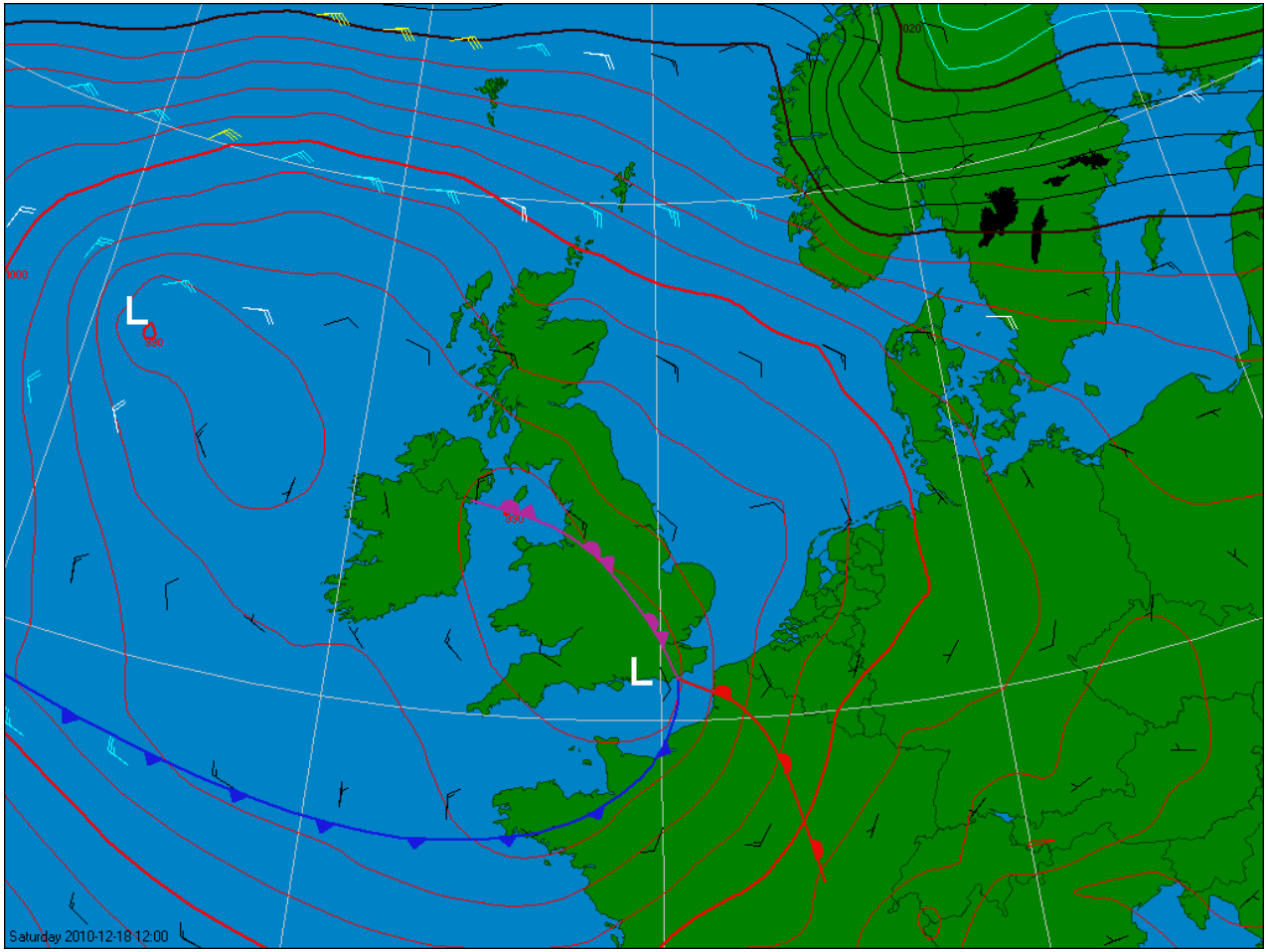
18th December 2010 - snow

- Many shops closed
  - a popular shopping centre in North London closed, unable to clear the car parks for prospective Christmas shoppers
- Motorways were closed for many hours in places
  - Hundreds of drivers were stranded on the M6 in Lancashire for up to seven hours
- London Heathrow airport received about of 9cm of snow
  - 7cm of snow fell between 11UTC and 12UTC
  - over 4000 flights were cancelled

Photographer:David Davies/PA Wire

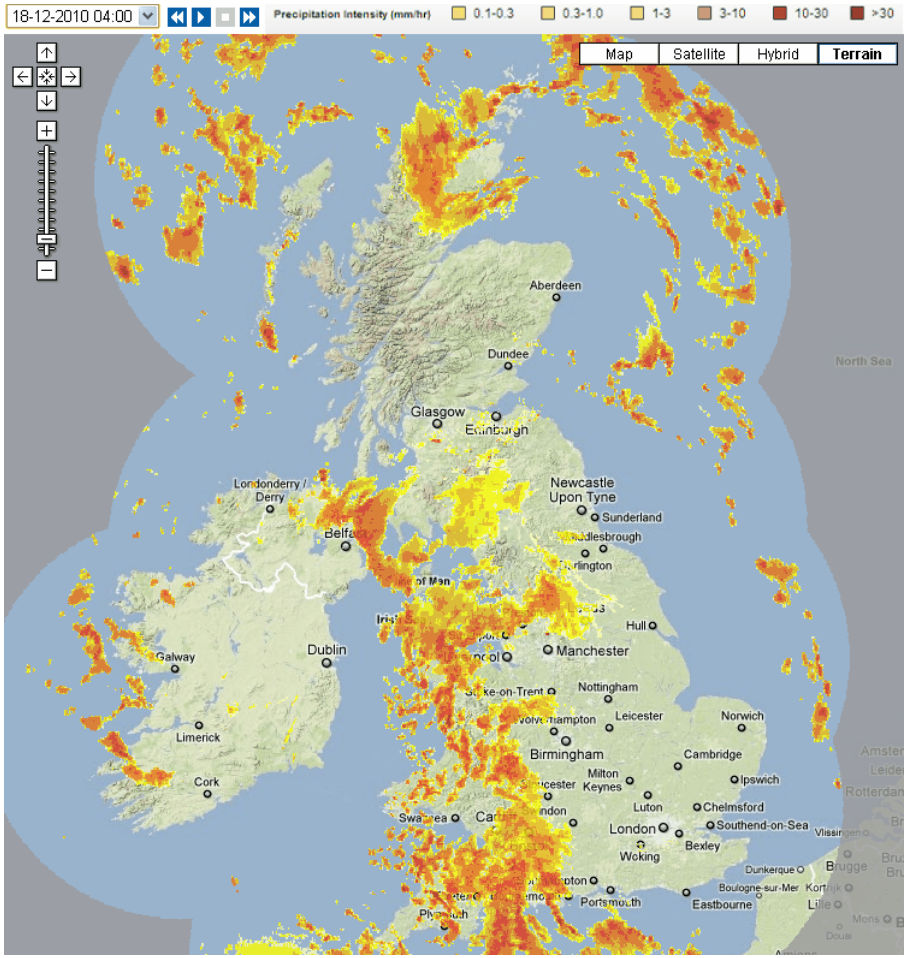
ECMWF synoptic chart

18-12-2010 12UTC



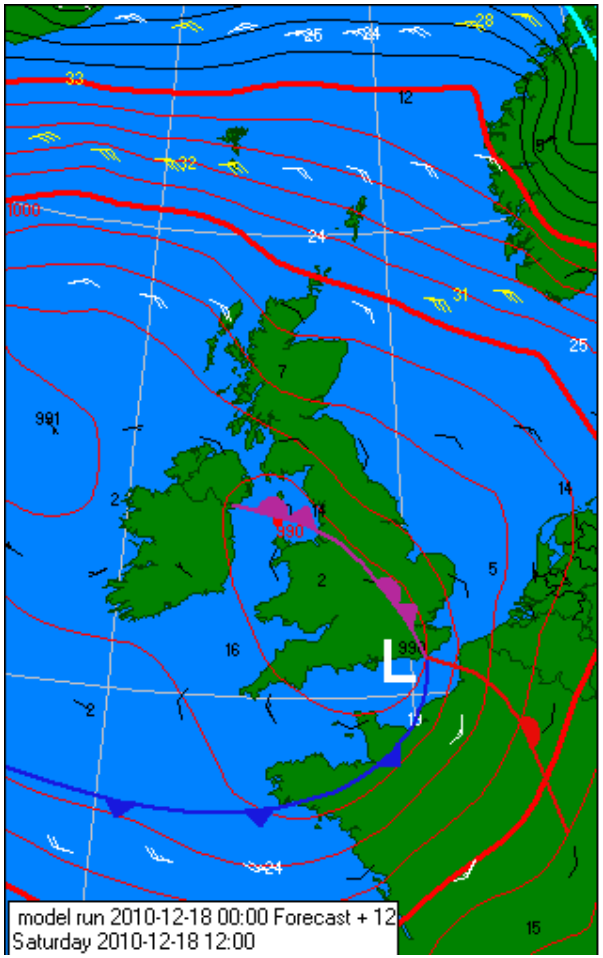
Radar


RainToday?
premium


18-12-2010 04:00
Precipitation Intensity (mm/hr)
0.1-0.3
0.3-1.0
1-3
3-10
10-30
>30
Map
Satellite
Hybrid
Terrain
Aberdeen
Dundee
Glasgow
Edinburgh
Londonderry / Derry
Belfast
Newcastle Upon Tyne
Sunderland
Hull
Manchester
Dublin
Galway
Limerick
Cork
Nottingham
Leicester
Norwich
Birmingham
Cambridge
Milton Keynes
Ipswich
Luton
Chelmsford
Southend-on-Sea
London
Bexley
Woking
Portsmouth
Eastbourne
Dunkerque
Boulogne-sur-Mer
North Sea

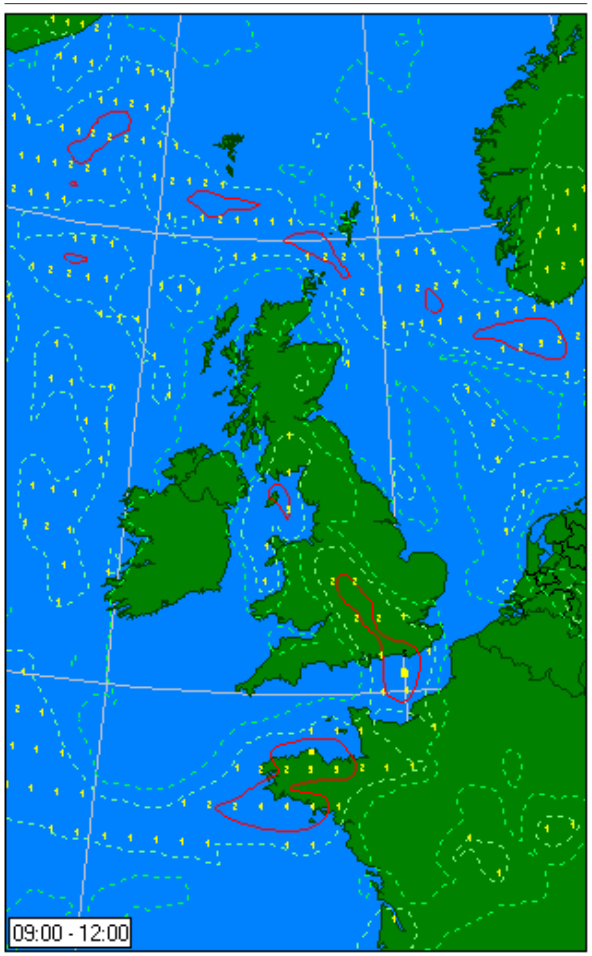
ECWMF forecast

18-12-2010 12UTC



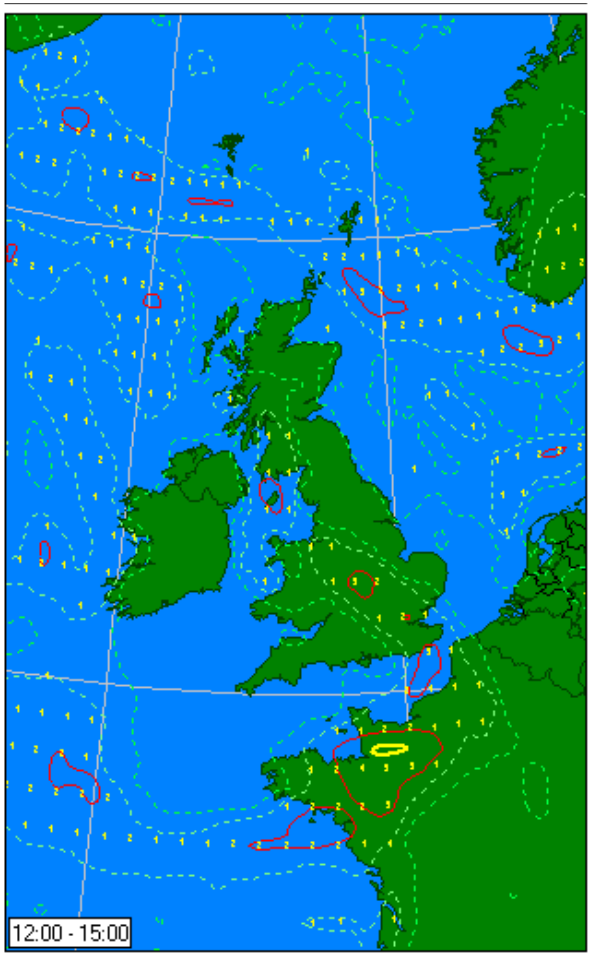
ECMWF precipitation amount

9UTC-12UTC



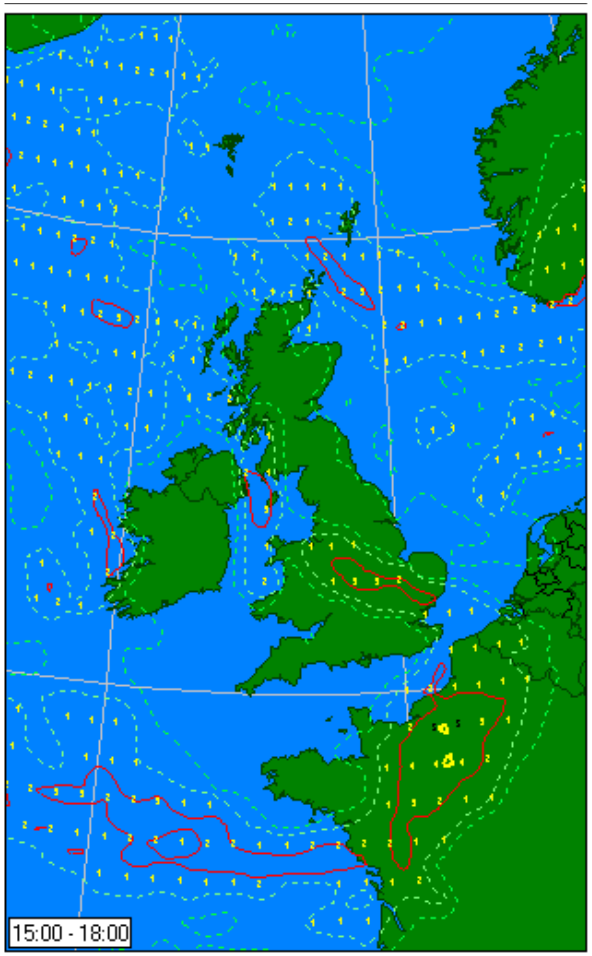
ECMWF precipitation amount

12UTC-15UTC

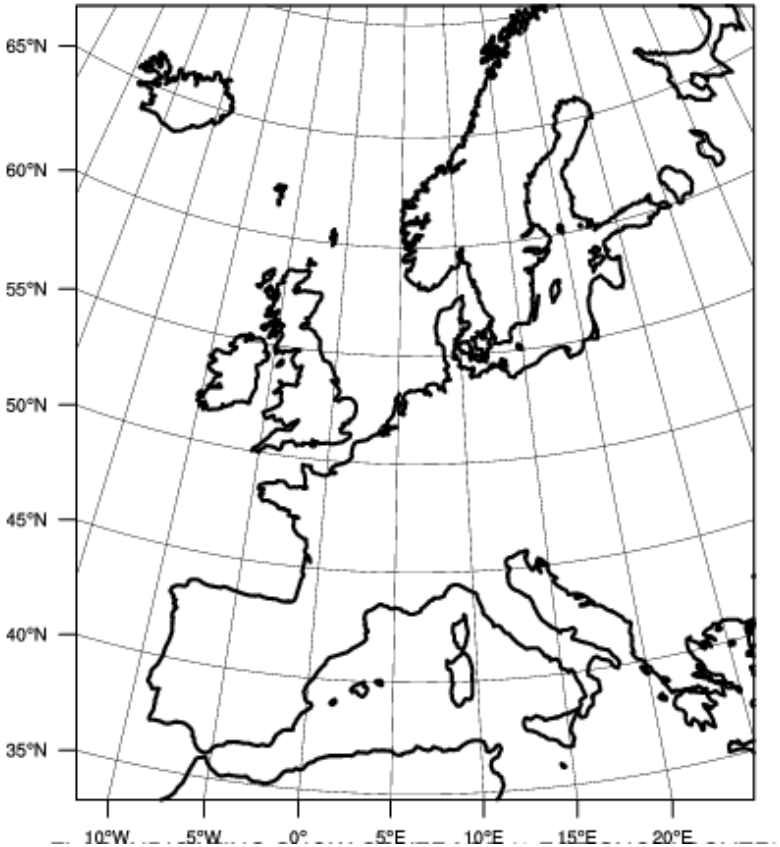


ECMWF precipitation amount

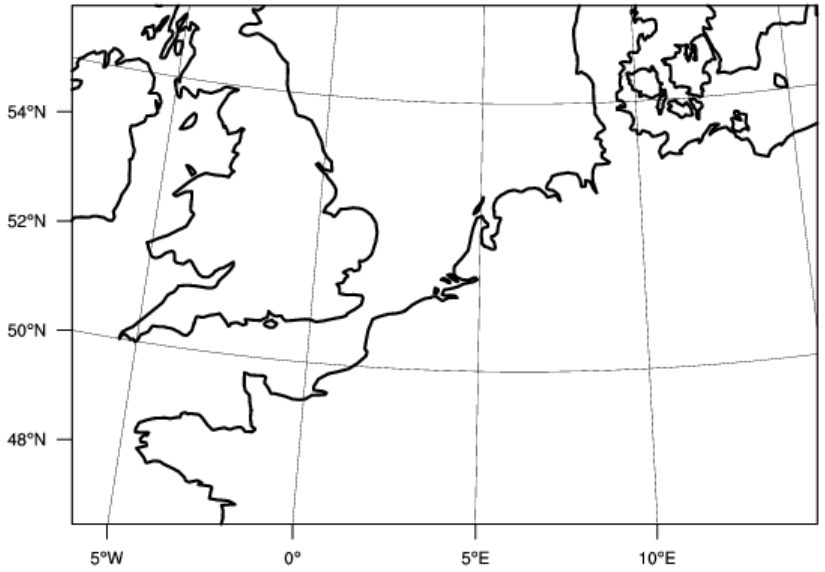
15UTC-18UTC



WRF setup



9 km horizontal resolution



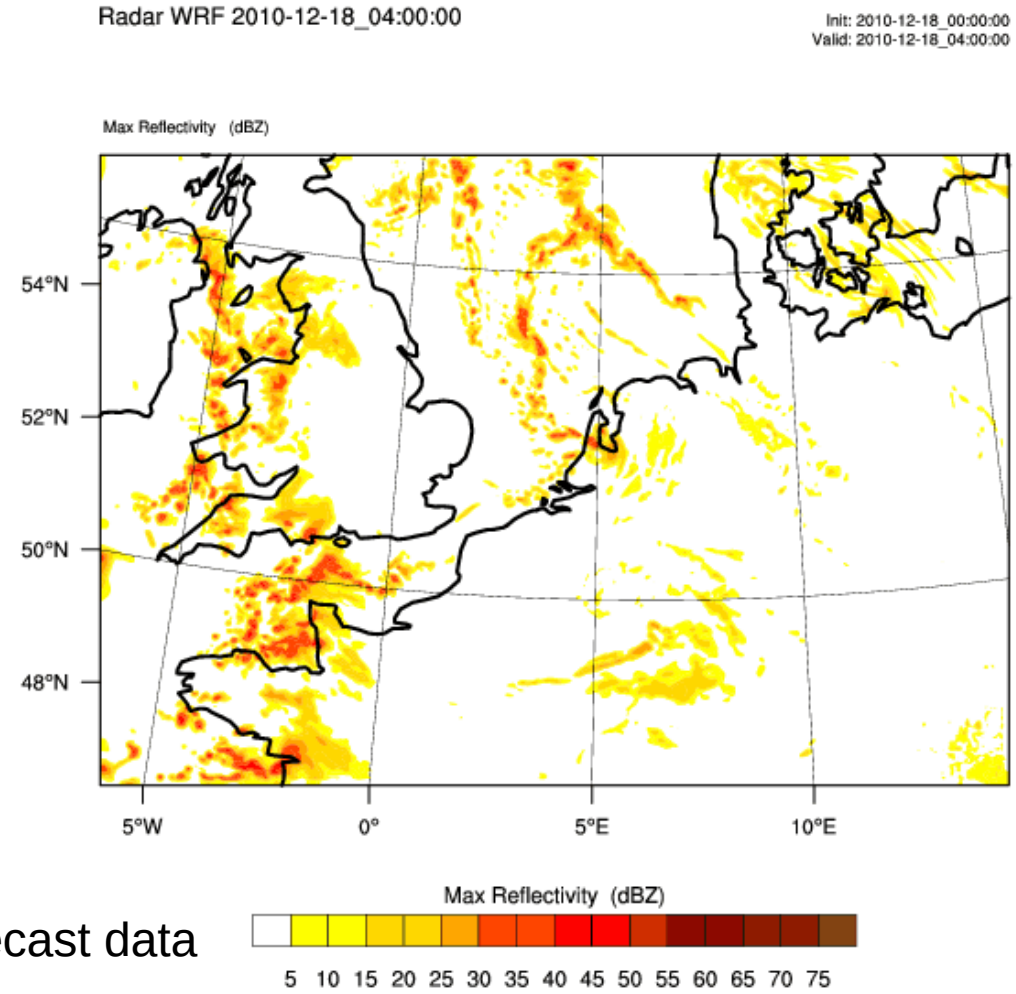
3 km horizontal resolution

WRF setup

- Input: ECWMF forecast data
- 39 vertical levels
- 12 hour spinup assimilating surface observations
- Landuse GlobCover (European Space Agency)
  - 115 land use categories

Microphysics	WRF Single Moment 6-Class Scheme
Shortwave radiation	Goddard
Longwave radiation	RRTM
PBL	YSU

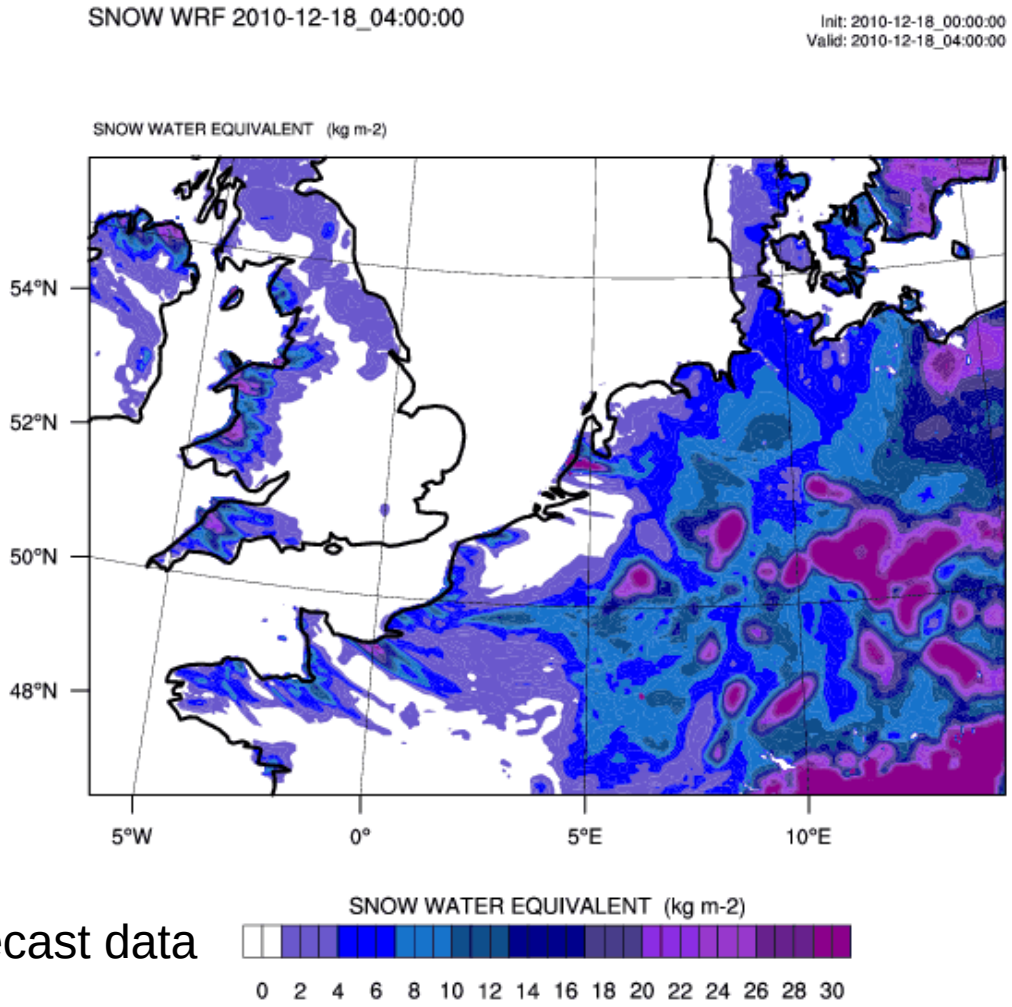
WRF forecast – simulated radar



-Using ECMWF forecast data

-WRF Single-Moment 6-class scheme

WRF forecast – snow water equivalent



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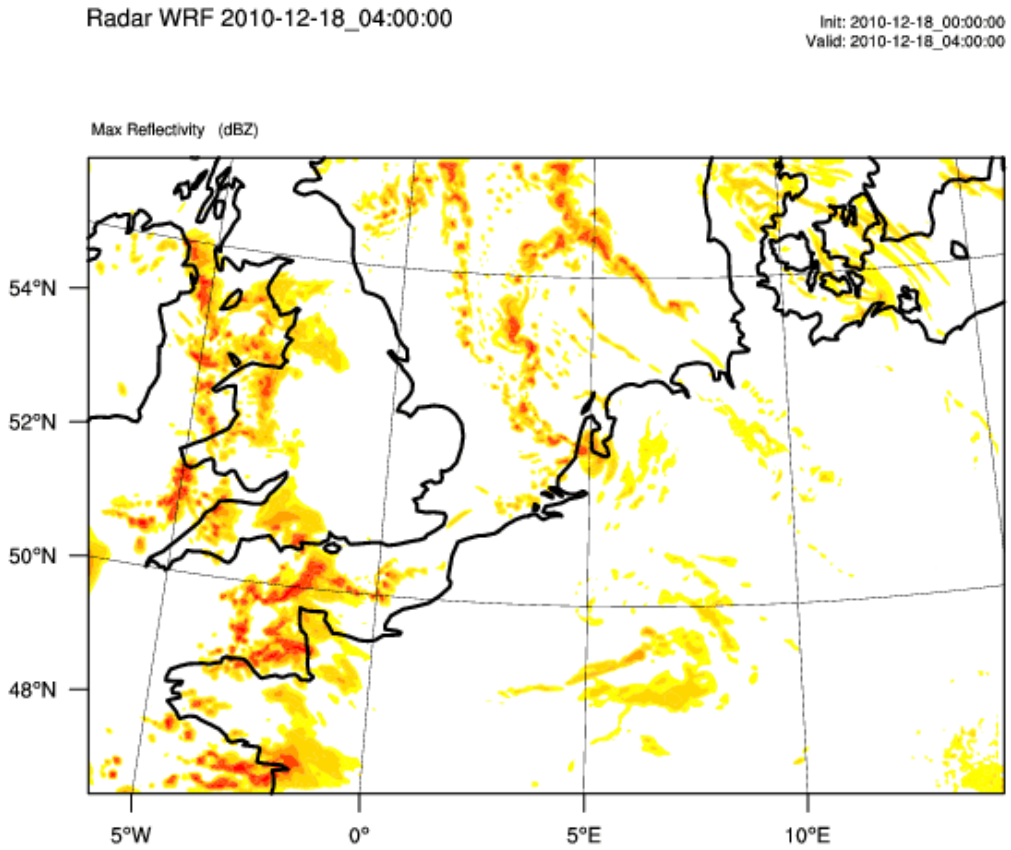
-WRF Single-Moment 6-class scheme

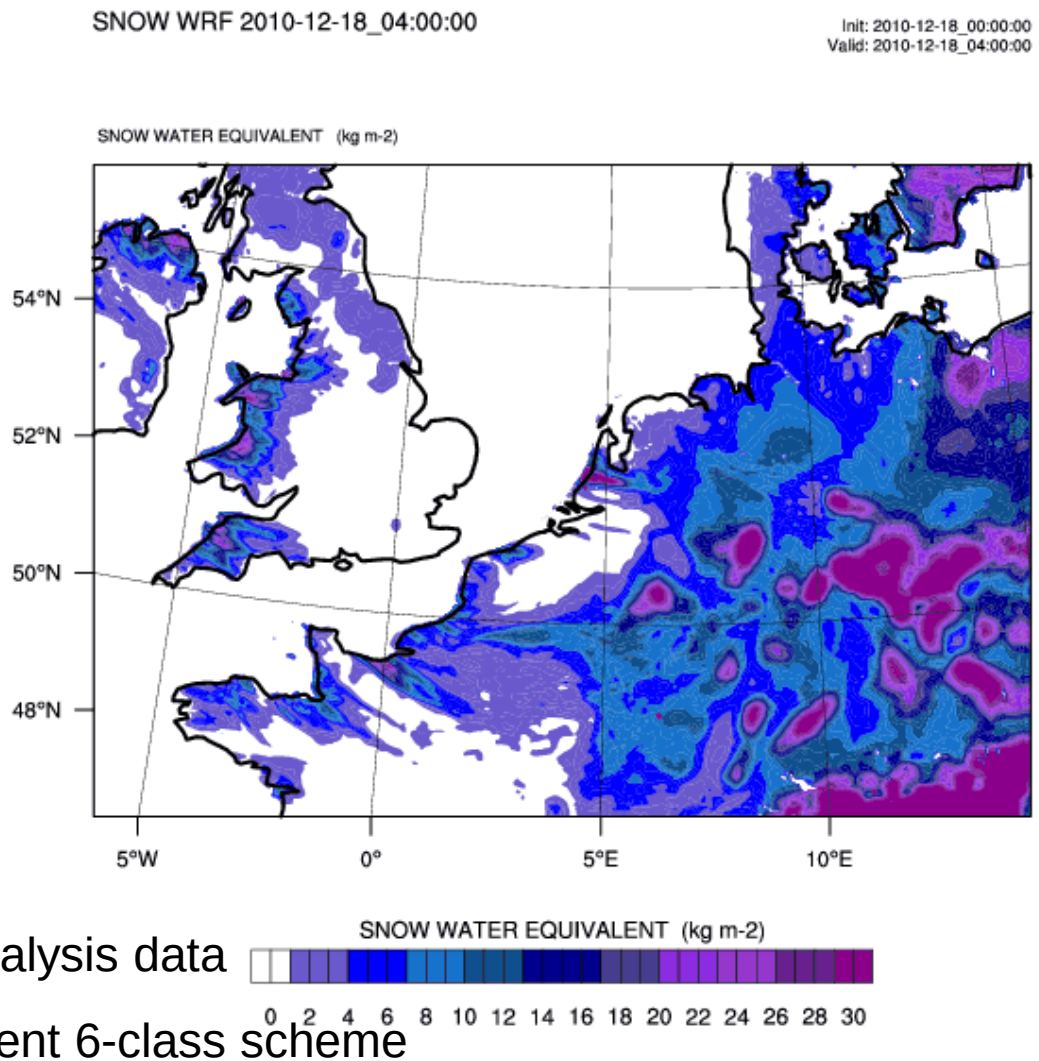
WRF – simulated radar



-Using ECMWF analysis data

-WRF Single-Moment 6-class scheme

WRF – snow water equivalent



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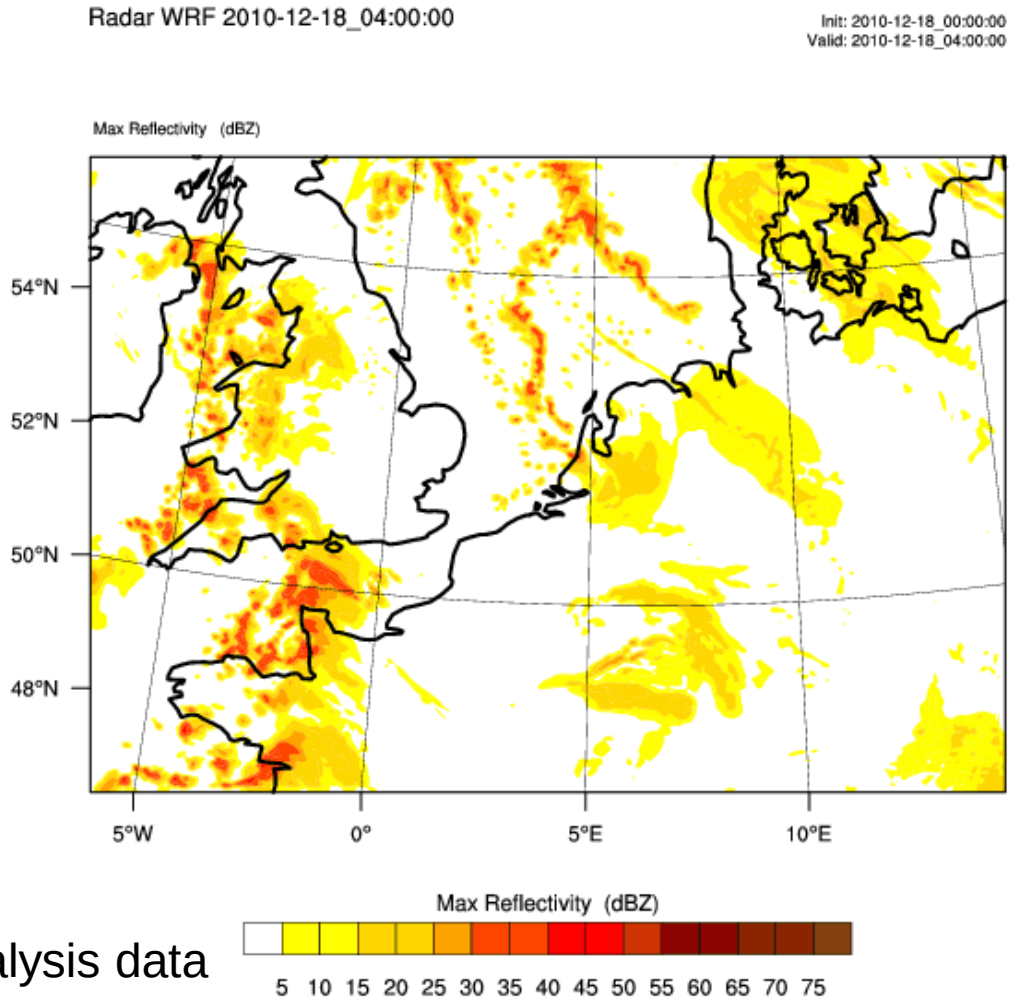
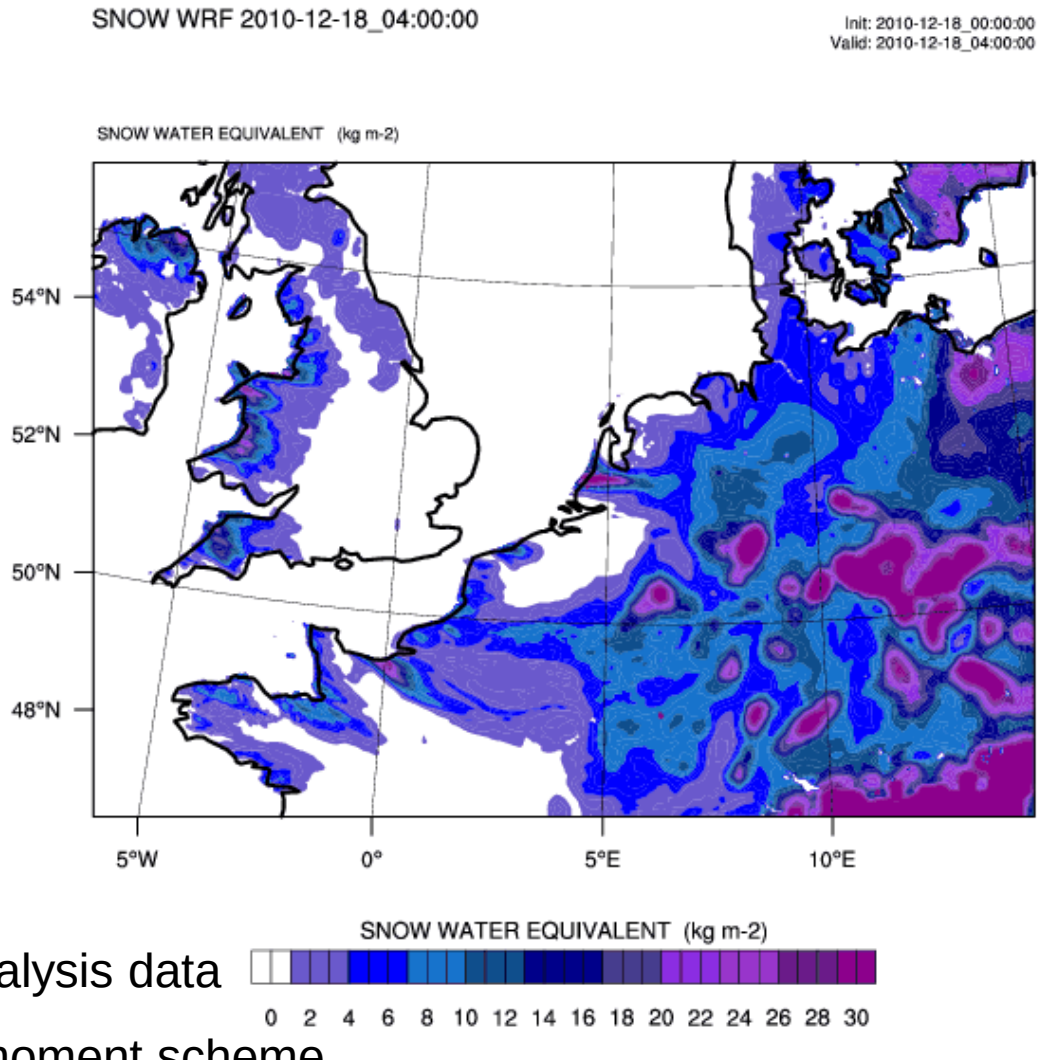
WRF – simulated radar



-Using ECMWF analysis data

-Morrison double-moment scheme

WRF – snow water equivalent



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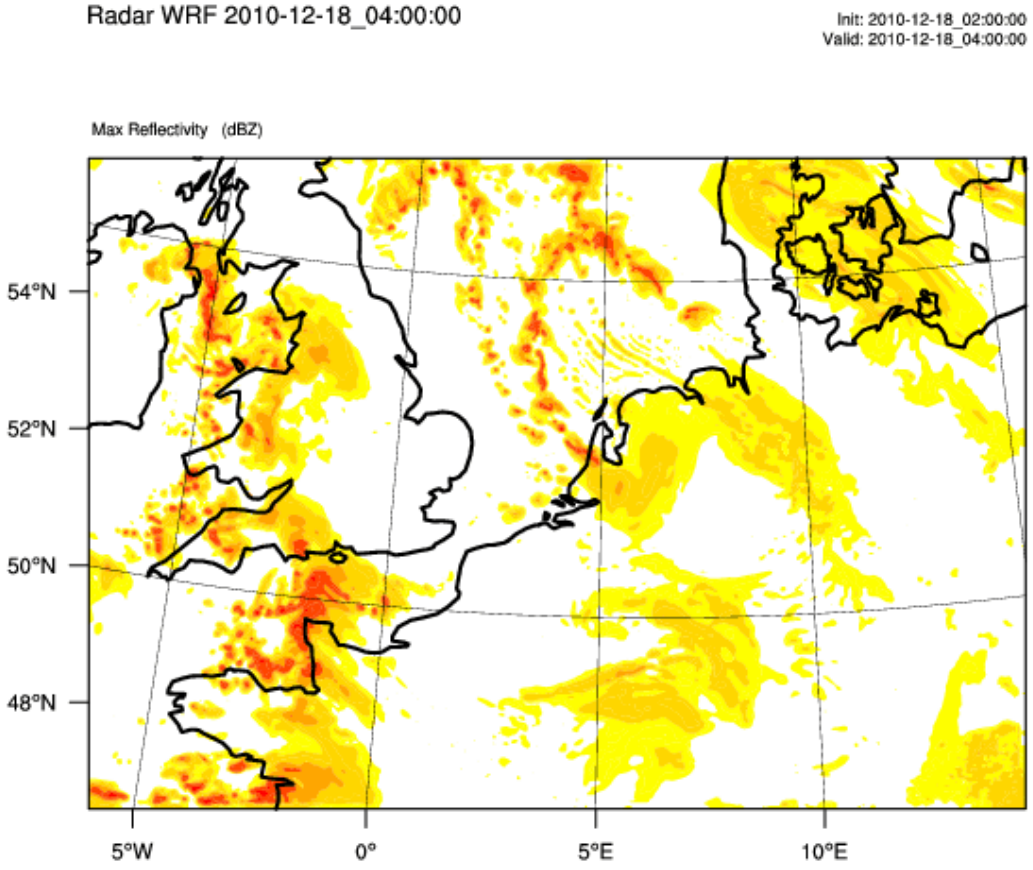
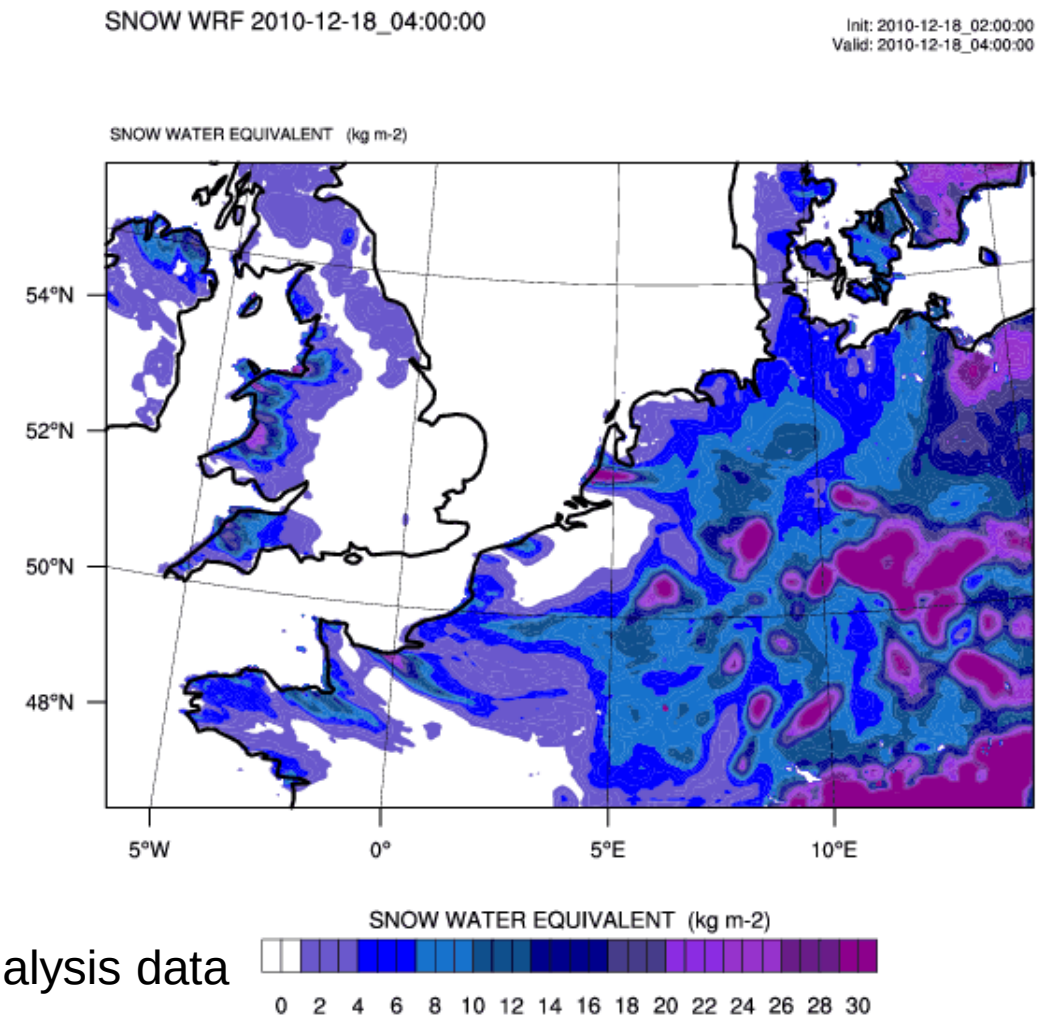
WRF – simulated radar



-Using ECMWF analysis data

-Milbrandt-Yau Double-Moment 7-class scheme

WRF – snow water equivalent



-Using ECMWF analysis data

-Milbrandt-Yau Double-Moment 7-class scheme

Summary

- All of the runs gave a good forecast of the snow in the south-east of England
- Single moment scheme would have under forecast the snow in the West Midlands
- Double moment schemes gave better representation of snow for 18th December
- Further investigation required to see how well double moment microphysics scheme perform in:
  - other case studies
  - forecast mode

Thank you!

Photographer: Matthew Baker/PA Wire

Finsbury Park North London

18th December -Meteorology