

HydEF Research Progress

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18th January 2012

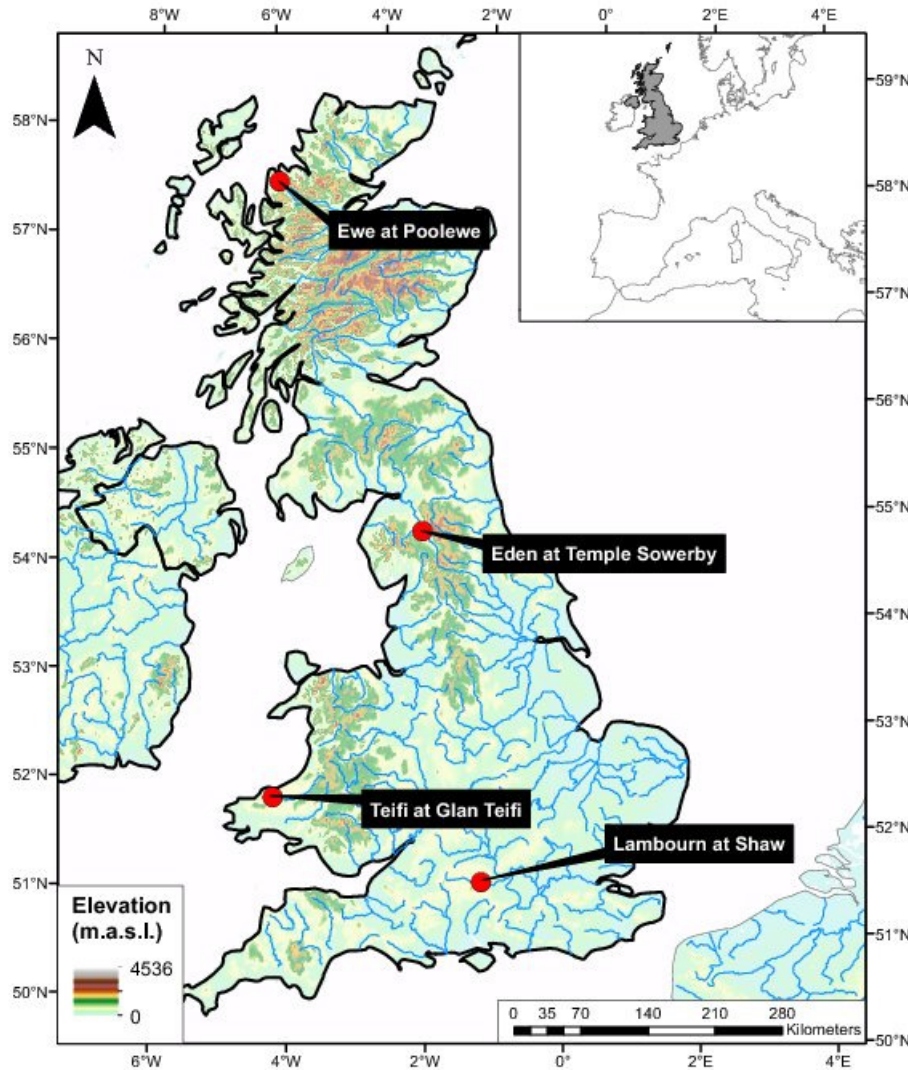
- Improve process understanding of atmospheric drivers of UK flooding.
- This better informs GCM downscaling for hydrological applications / future flood projections.

- Atmospheric Rivers (ARs).
- UK floods and links with ARs.
 - November 2009 Cumbrian flood.
 - Top 10 floods in four British basins.
- Screening for ARs in climate model datasets.
- Preliminary CMIP5 model results.
- Conclusions.

Atmospheric Rivers (ARs)

- ARs are regions where moisture travels from the subtropics to the mid-latitudes.
- Located within warm sector of extra-tropical cyclones.
- Most AR-flood research undertaken in western North America.

River basin locations / Methods

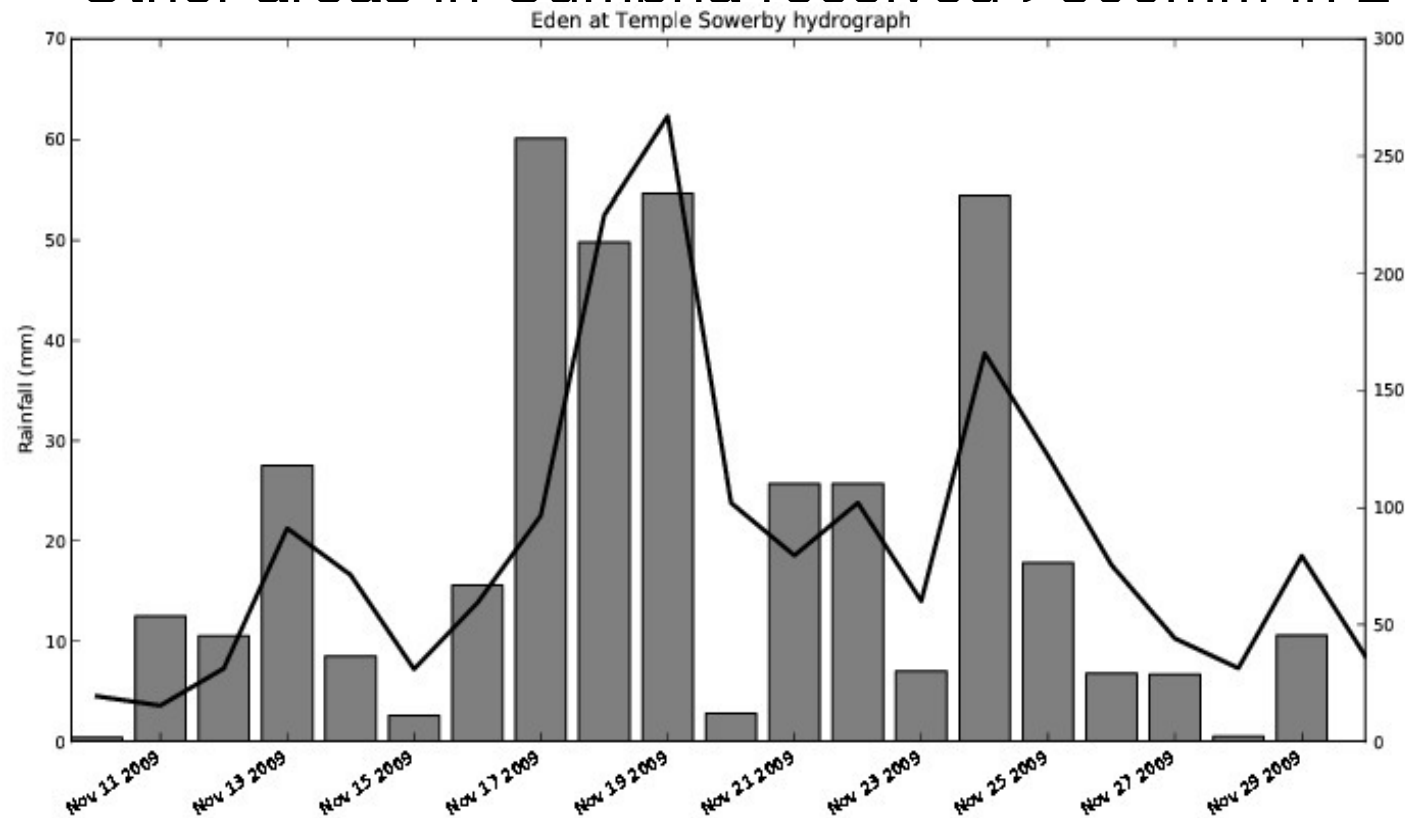


Methods

- 1). Floods identified using a winter maximum series (WMS) over 1970-2010.
- 2). For three days up to flood event the 900 hPa specific humidity and wind fields analysed; satellite data also retrieved.

November 2009 Cumbrian flood

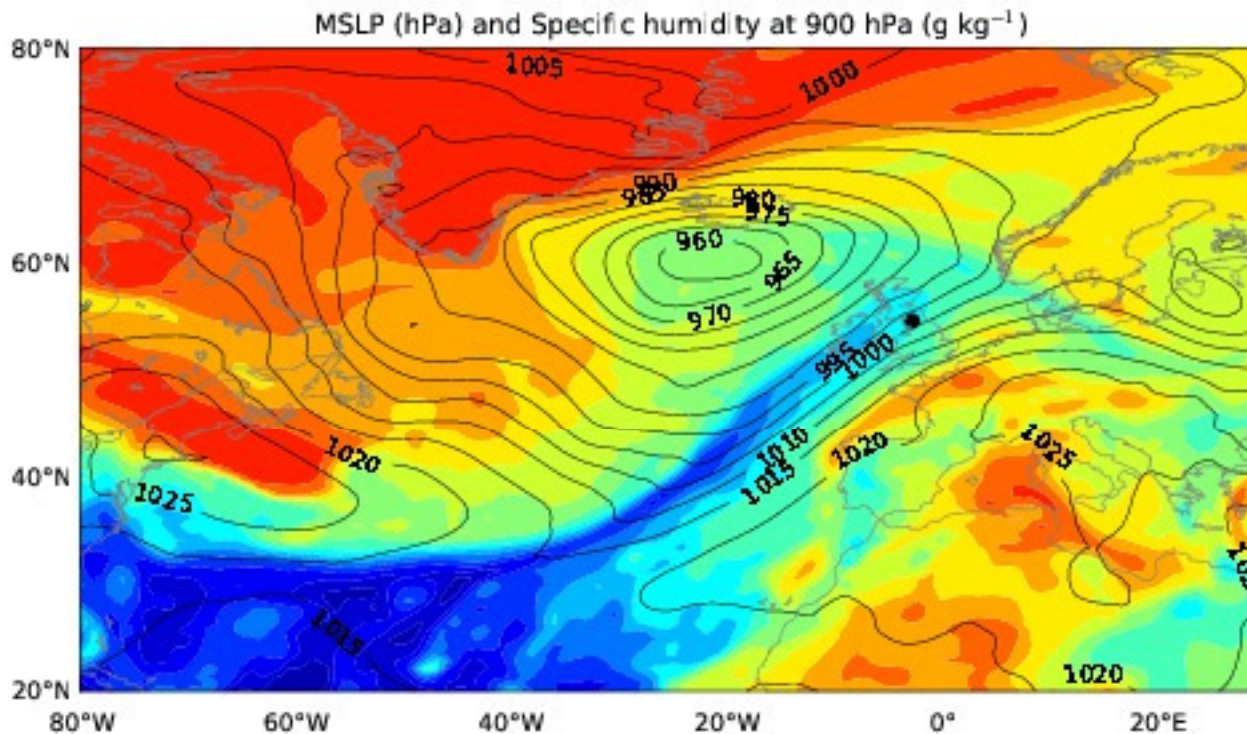
- Mean daily flow in Eden (Temple Sowerby) was $267\text{m}^3/\text{s}$ on 19 Nov 2009; 3 day rainfall total of 164.5mm near gauging station.
- Other areas in Cumbria received $>300\text{mm}$ in 24 hours.



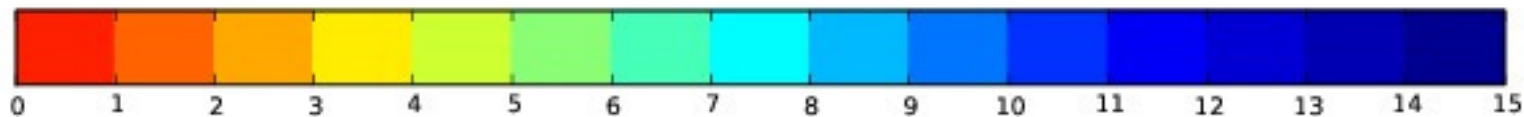
Cumecs (m^3s^{-1})

Data source:
UK National
River Flow
Archive /
UKMO
MIDAS.

Fields at 0600 UTC 19th Nov 2009

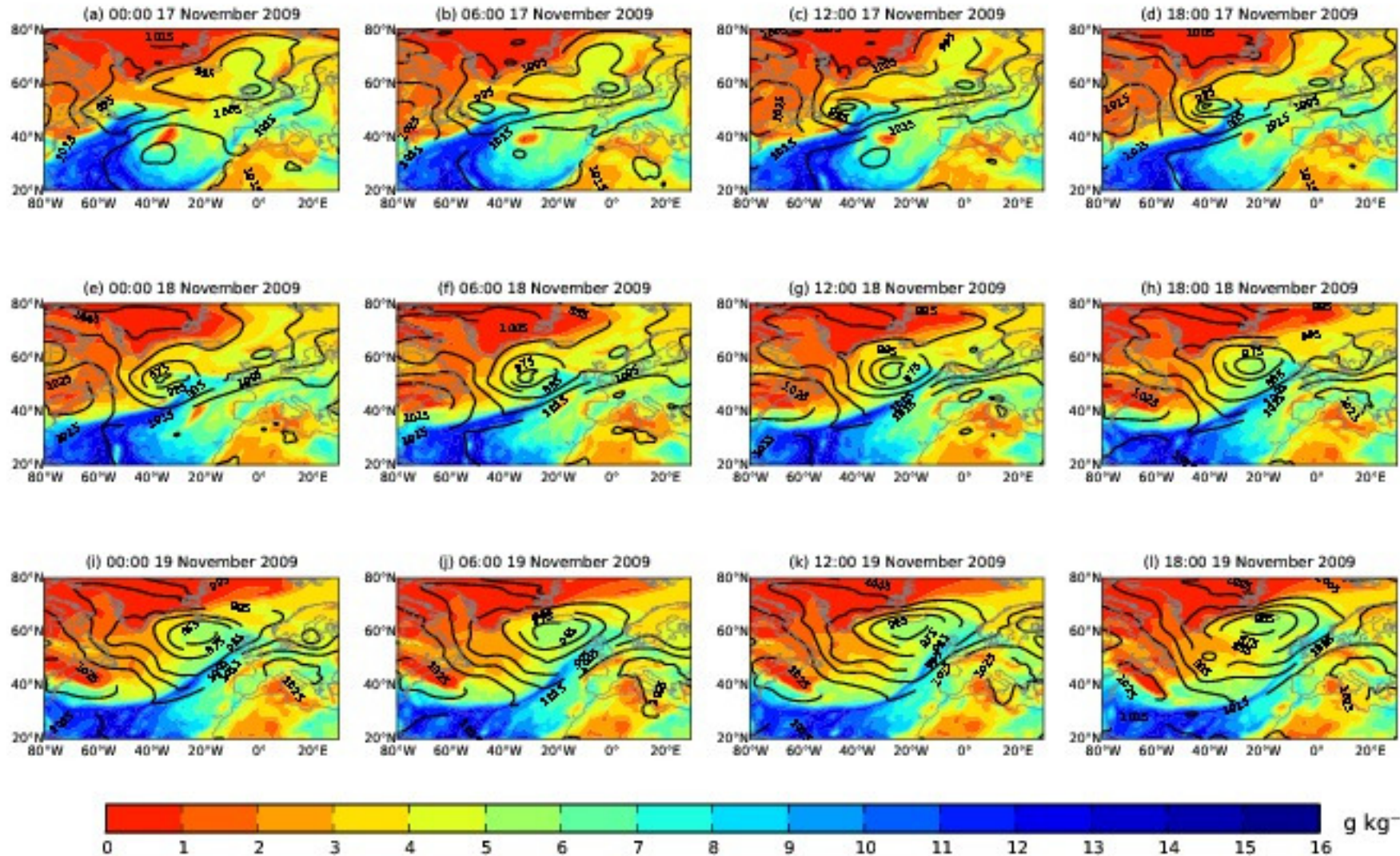


Data source:
ECMWF ERA-
Interim
reanalysis.
SSM/I F16
retrieval of
column
IWV



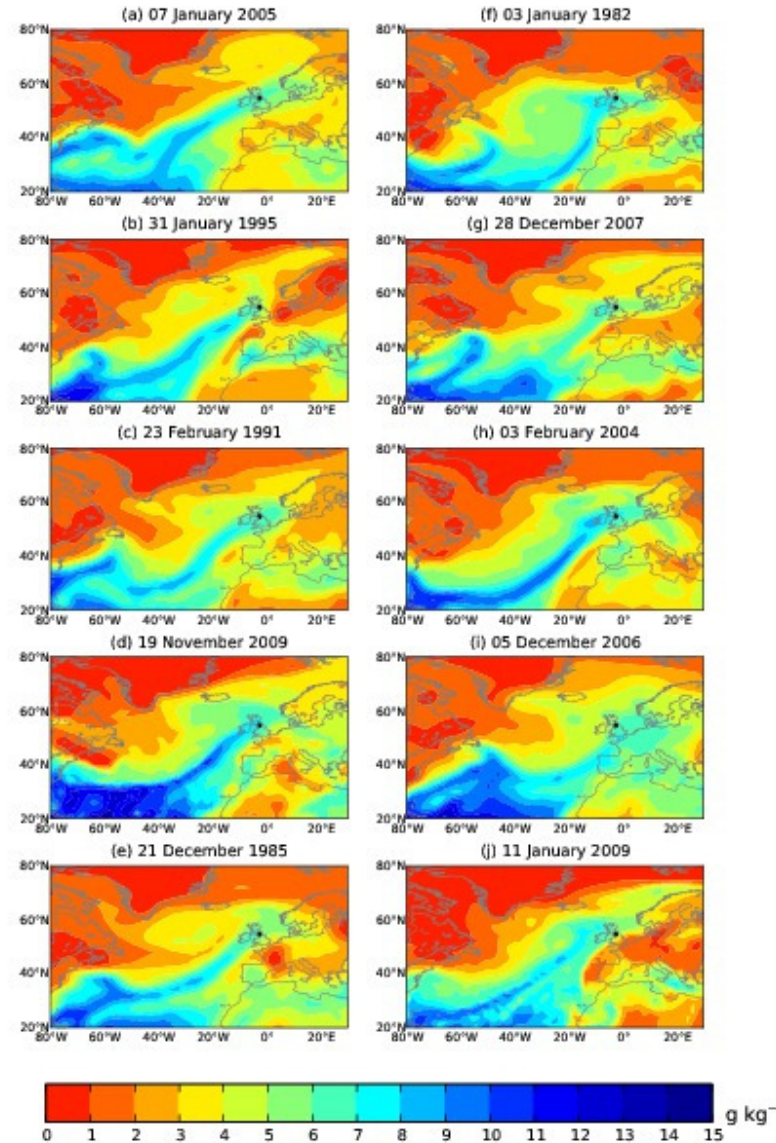
units: ms^{-1}

Evolution of 900 hPa specific humidity and MSLP



Data source: ECMWF ERA-Interim reanalysis.

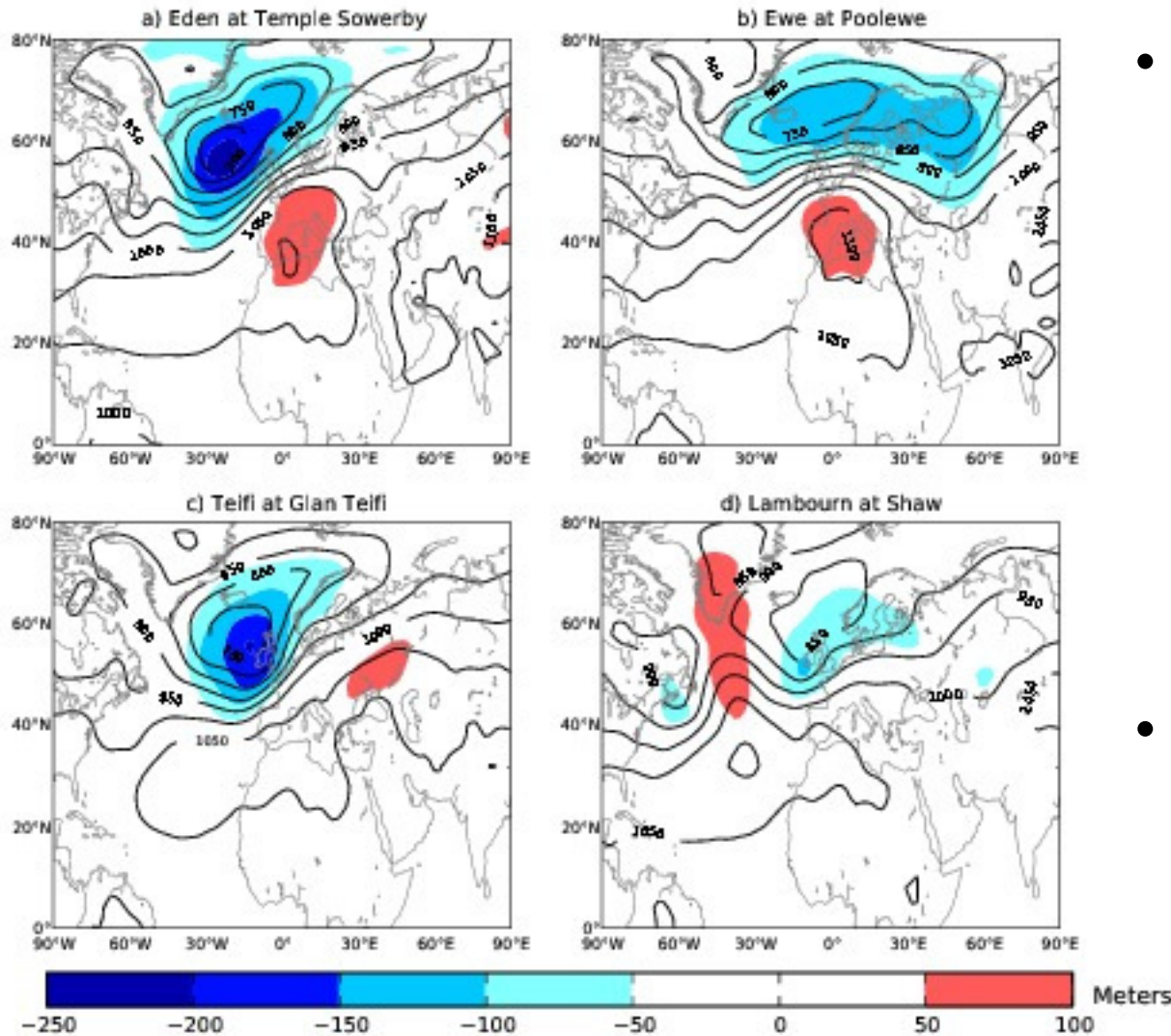
Top 10 winter floods (in WMS) in Eden



- ARs located over basin in these floods.
- ARs have consistent location and orientation.

Data source: 20th Century / ECMWF ERA-Interim reanalyses.

Atmospheric Circulation



- Tilt in 900 hPa geopotential field leads to poleward and upward movement of moisture-laden air in warm sector of extra-tropical cyclones.
- Most recognisable in fast-responding river basins (west Britain).

Data source: 20th Century / ECMWF ERA-Interim reanalyses.

Conclusions

- Damaging UK flood (November 2009) linked to persistent AR event.
- Ten largest winter floods in a range of UK river basins were connected to ARs.
- ARs were particularly recognisable during winter floods in fast-responding basins; permeable basins require a series of storms to produce floods.

Future work

- Screen for ARs in future climate projections to determine change in AR frequency/intensity.
- Finalise index for UCL downscaling.
- Summer floods.

Any Questions?

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