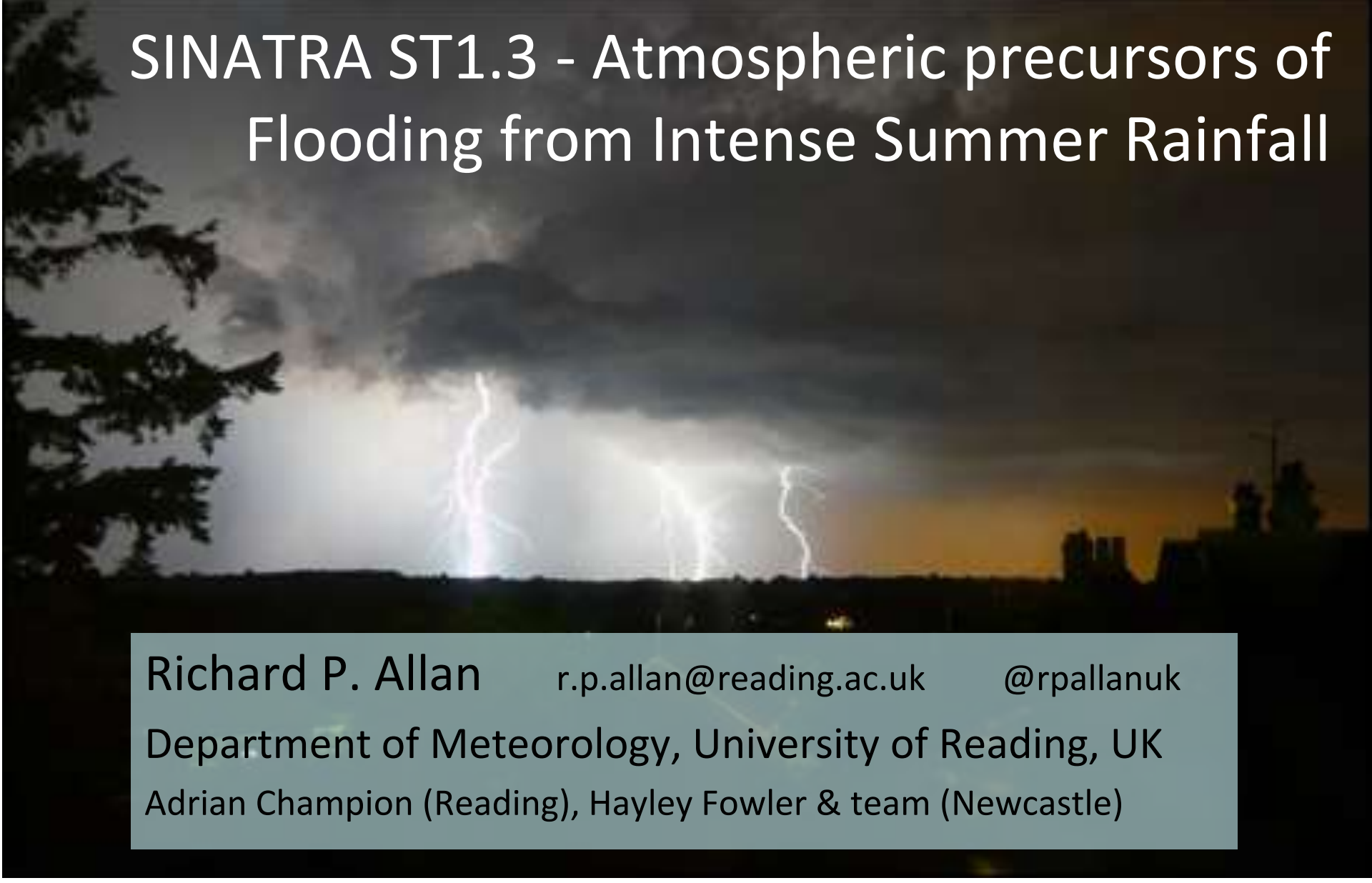
SINATRA ST1.3 - Atmospheric precursors of Flooding from Intense Summer Rainfall



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National Centre for Atmospheric Science
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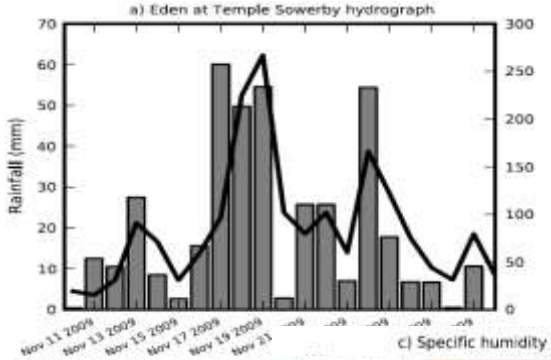
NERC SCIENCE OF THE ENVIRONMENT

Atmospheric precursors

(ST3.1) Science Overview

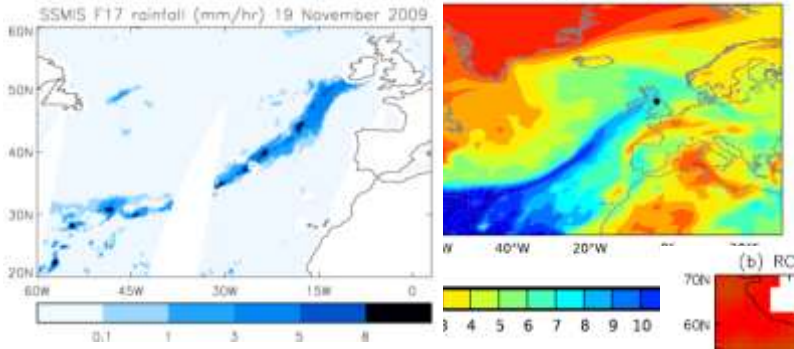
University of Reading

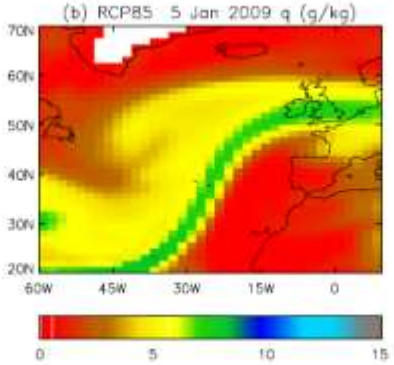


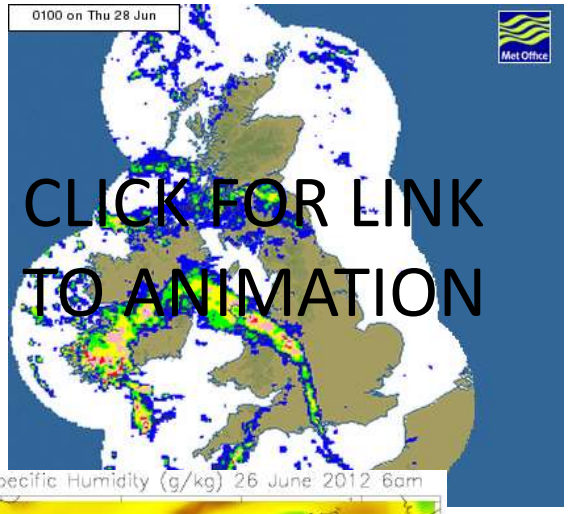
UK flooding events

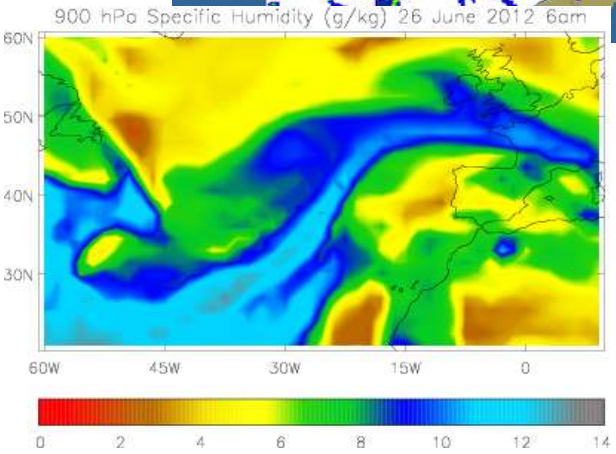
atmospheric precursors

climate simulations









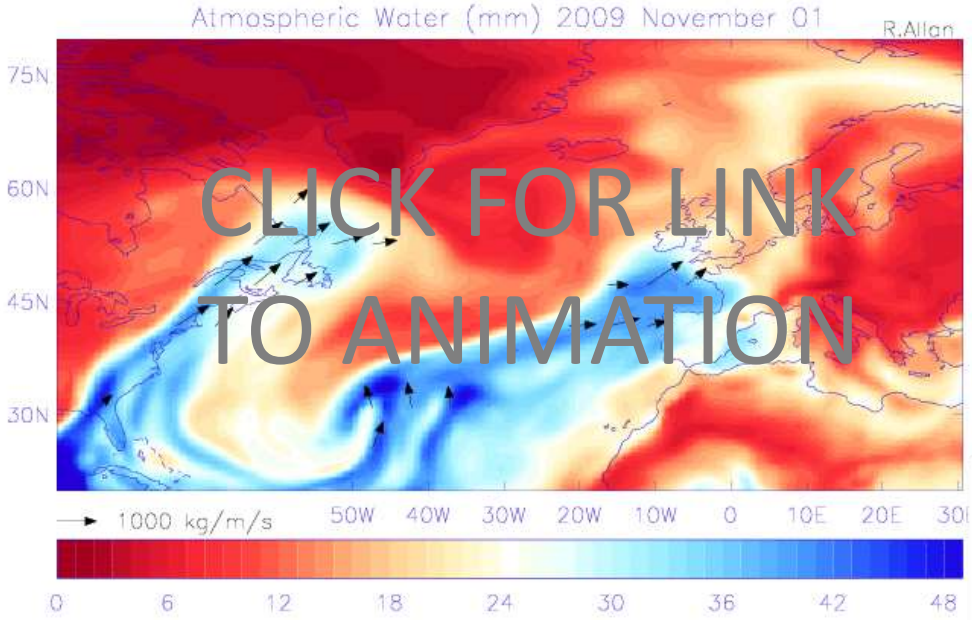
Winter flooding has been linked to Atmospheric Rivers: intense moisture transport events
Lavers et al. (2011) GRL,
Lavers et al. (2012) JGR

HydEF project

Changing water cycle

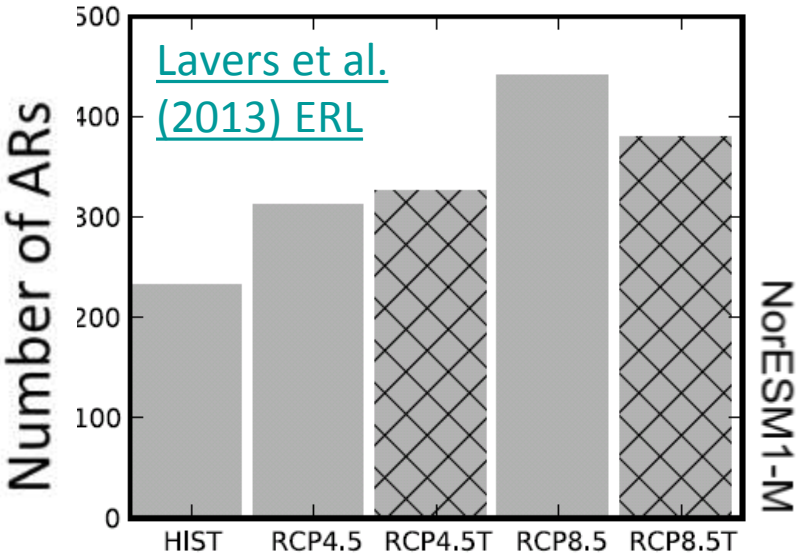
In **SINATRA** ST1.3 we will link summer flooding events (ST1.1) to atmospheric precursors, including Atmospheric Rivers

Linking flooding impacts to atmospheric precursors

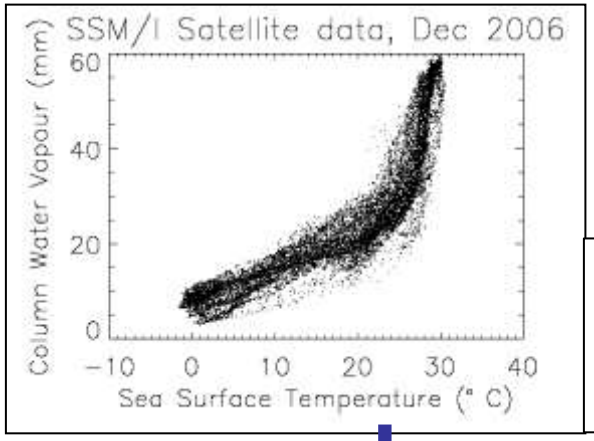


- Future increase in moisture explains most (but not all) of intensification of AR events
  - Confident in the mechanisms and physics involved

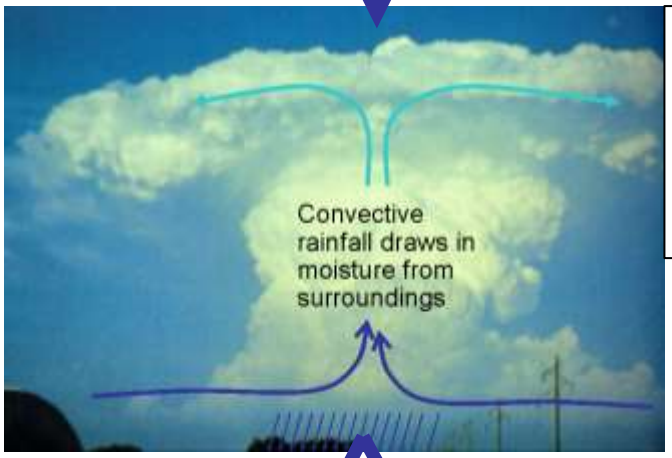
- UK winter flooding linked moisture transport events
  - Cumbria November 2009 (Lavers et al. 2011 GRL)
  - "Atmospheric Rivers" (ARs) in warm conveyor
  - "seeder feeder" mechanism



Mechanisms

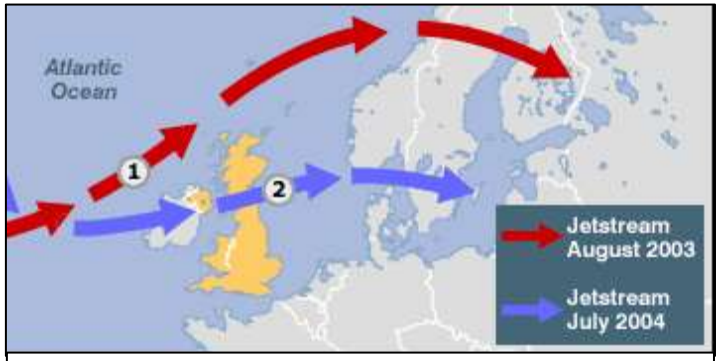


Low-level water vapour increases at around 6-10%/K



Increased moisture convergence in storms → increased precipitation

References: e.g.,
Berg et al. (2013) Nature Geosciences
O'Gorman & Schneider (2009) Nature Geosci
Trapp et al. (2009) GRL
Harvey et al. (2012) GRL



Changing position/orientation/ clustering of storm systems

Latent heat release stabilises atmosphere on larger space/time-scales

Latent heat release invigorates storms on smaller space/time-scales

← THERMODYNAMICS

Character of rainfall events

DYNAMICS →

Initial Plans

- Adrian Champion starts 30 month ST1.3 post 3 January 2014
- Literature review
  - precursors for thunderstorms, summer flooding, etc
- Gather datasets:
  - 20CR, ERA Interim water vapour and winds. ERA CLIM.
  - Satellite data (e.g. SSMIS, GPCP)
  - Gridded rainfall data; rain guage data (MIDAS, EA, CHESS, …)
  - Monitoring of events evolving during project (Case Studies, WT2)

Milestones and Deliverables

- **M1.3.1** Identification of precursors and time/space scales of FFIR events (M12)
- **M1.3.2** Identification of clusters of events and links to catchment types (M24)
- **D1.3.1** Development of a case study set for WT2 intercomparison experiments (M33)
- **D1.3.2** peer reviewed articles for *Journal of Climate*, *JGR* (M36)

Plans for next 6 months

Milestones and Deliverables

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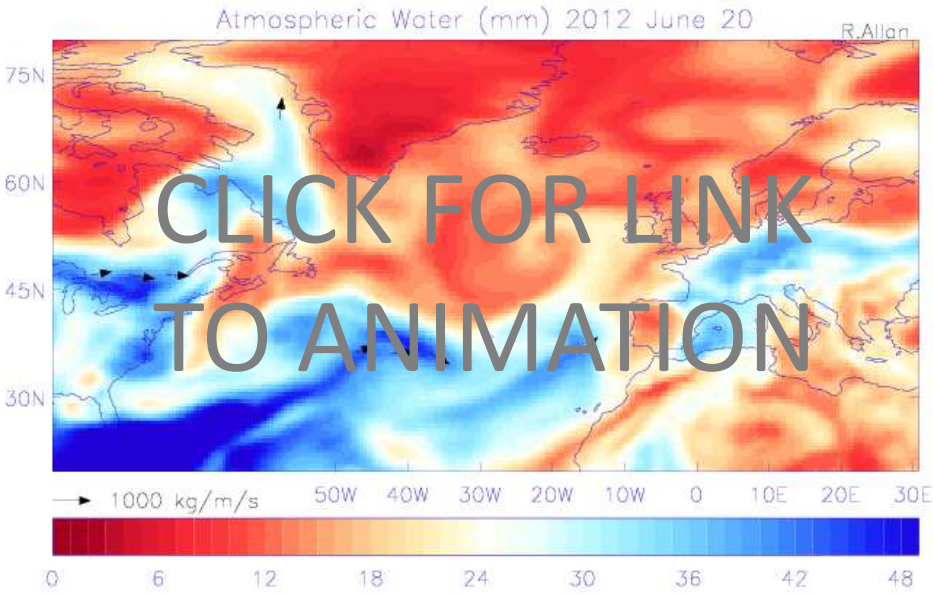
- AR detection software and apply to reanalyses for summer months
  (with David Lavers U. Iowa)

$$IVT = \sqrt{\left(\frac{1}{g}\int_{1000}^{300} qu\, dp\right)^2 + \left(\frac{1}{g}\int_{1000}^{300} qv\, dp\right)^2}$$



Plans for next 6 months

- Work with ST1.1 linking historical floods to atmospheric state
- Work with Newcastle on statistical analysis (clustering, extreme value theory, etc)
- Composite by catchment characteristics → WT2/3
- Climate change responses of flooding precursors

Indicator Catchments?

HydEF project: contrasting responses of small, permeable catchments (e.g. Eden) and slower, larger chalk catchemnts (e.g. Thames)

Pluvial vs Fluvial flooding: contrasting time/space scales

Dissemination

- Provide up to date ST3.1 information on web: http://www.met.reading.ac.uk/~sgs02rpa/research/SINATRA/SINATRA.html
- Media opportunities
- Outreach (schools, interest groups)
- Twitter (@rpallanuk)