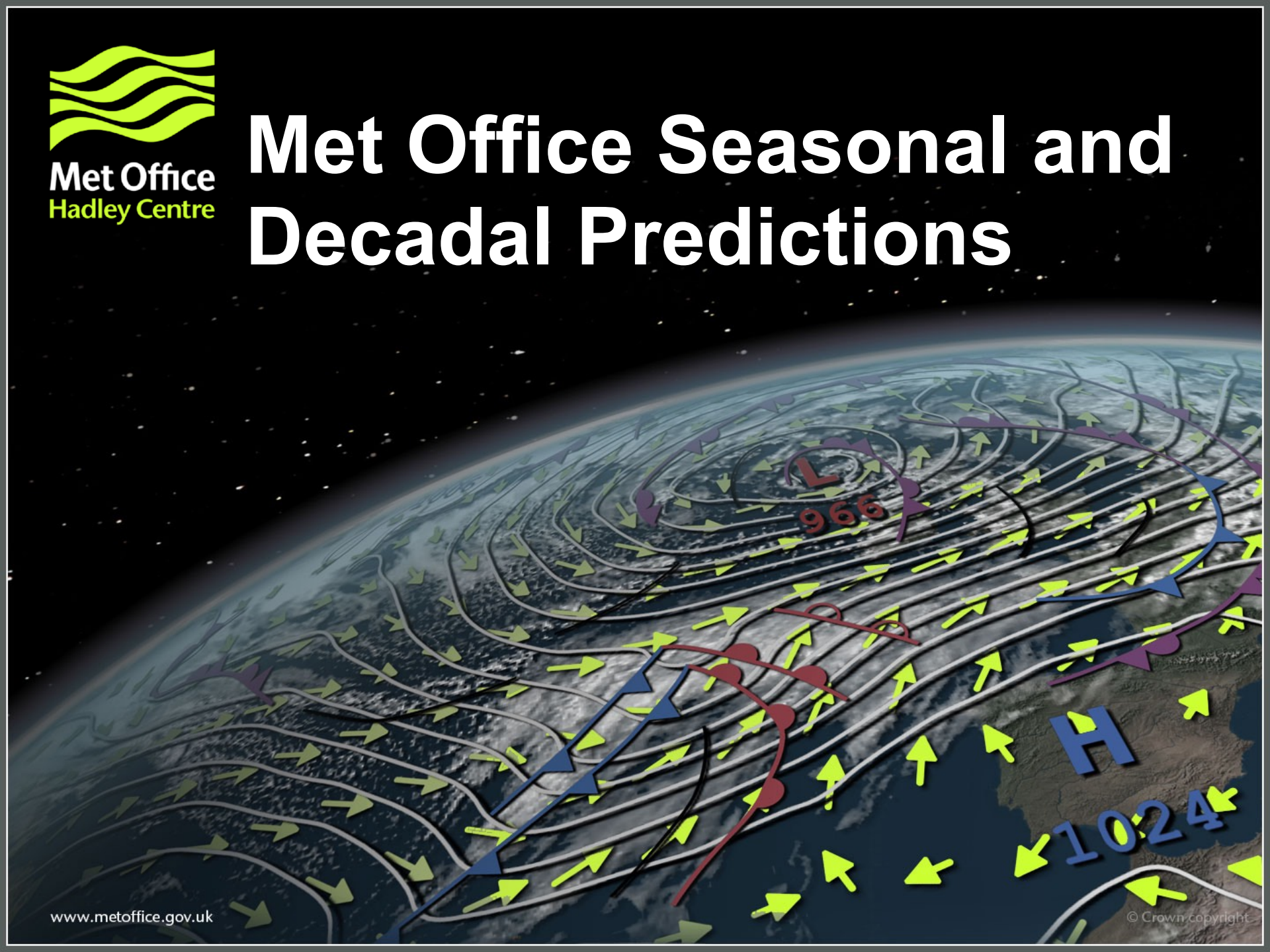
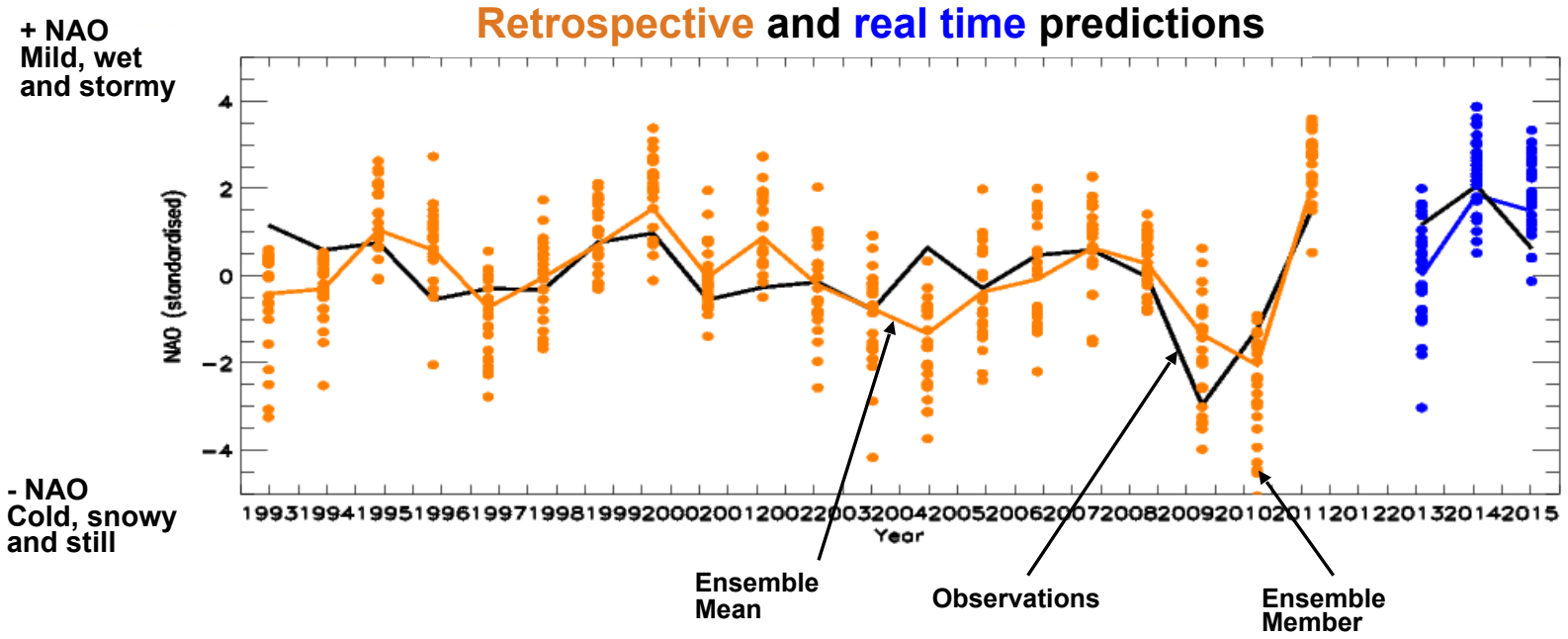
Met Office
Hadley Centre

Met Office Seasonal and Decadal Predictions



www.metoffice.gov.uk

North Atlantic predictions updated



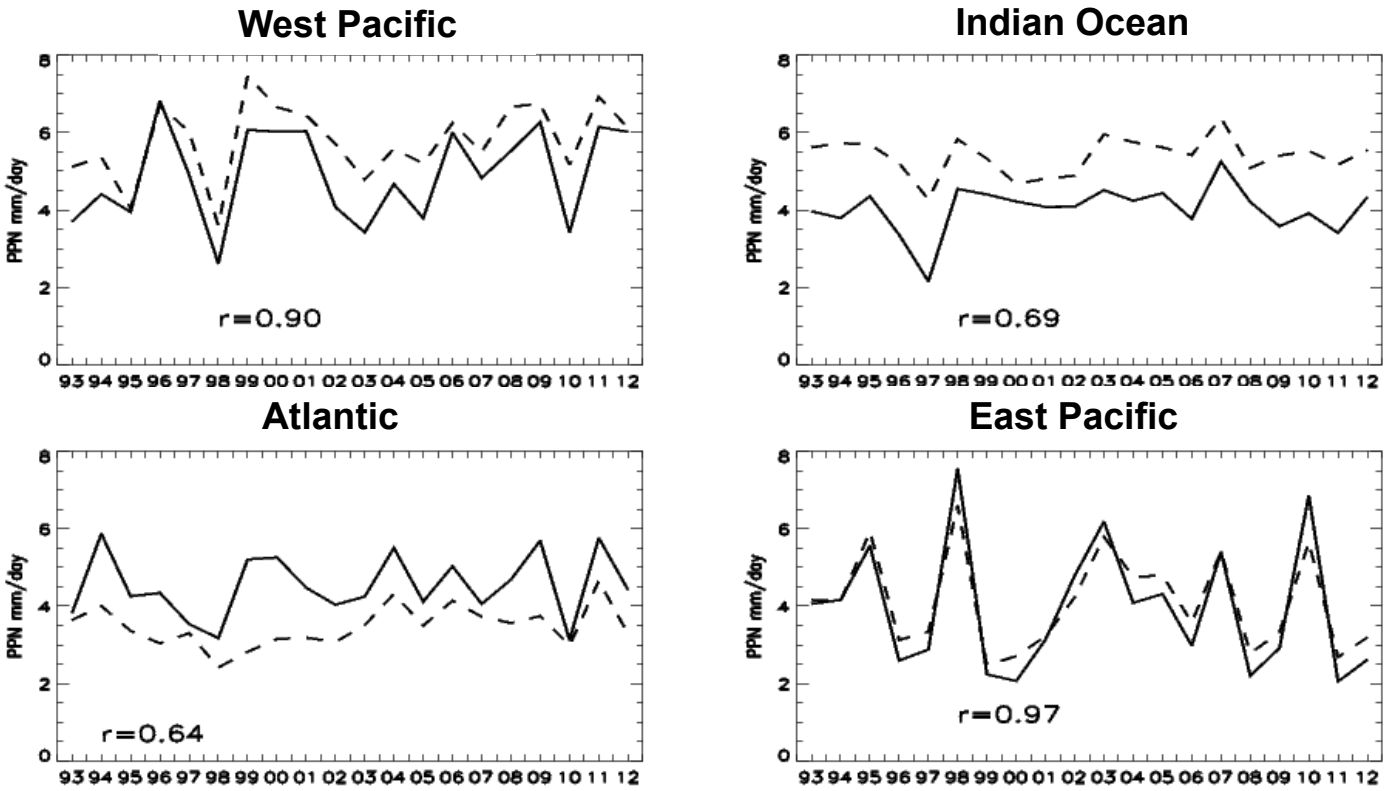
Our original tests are shown in orange and indicate a correlation skill of 62%

More ensemble members => more skill and ~0.8 may be possible

So far so good with real time forecasts...

Scaife et al, GRL, 2014

Tropical rainfall – some good news



Tropical rainfall variations are well predicted months in advance!

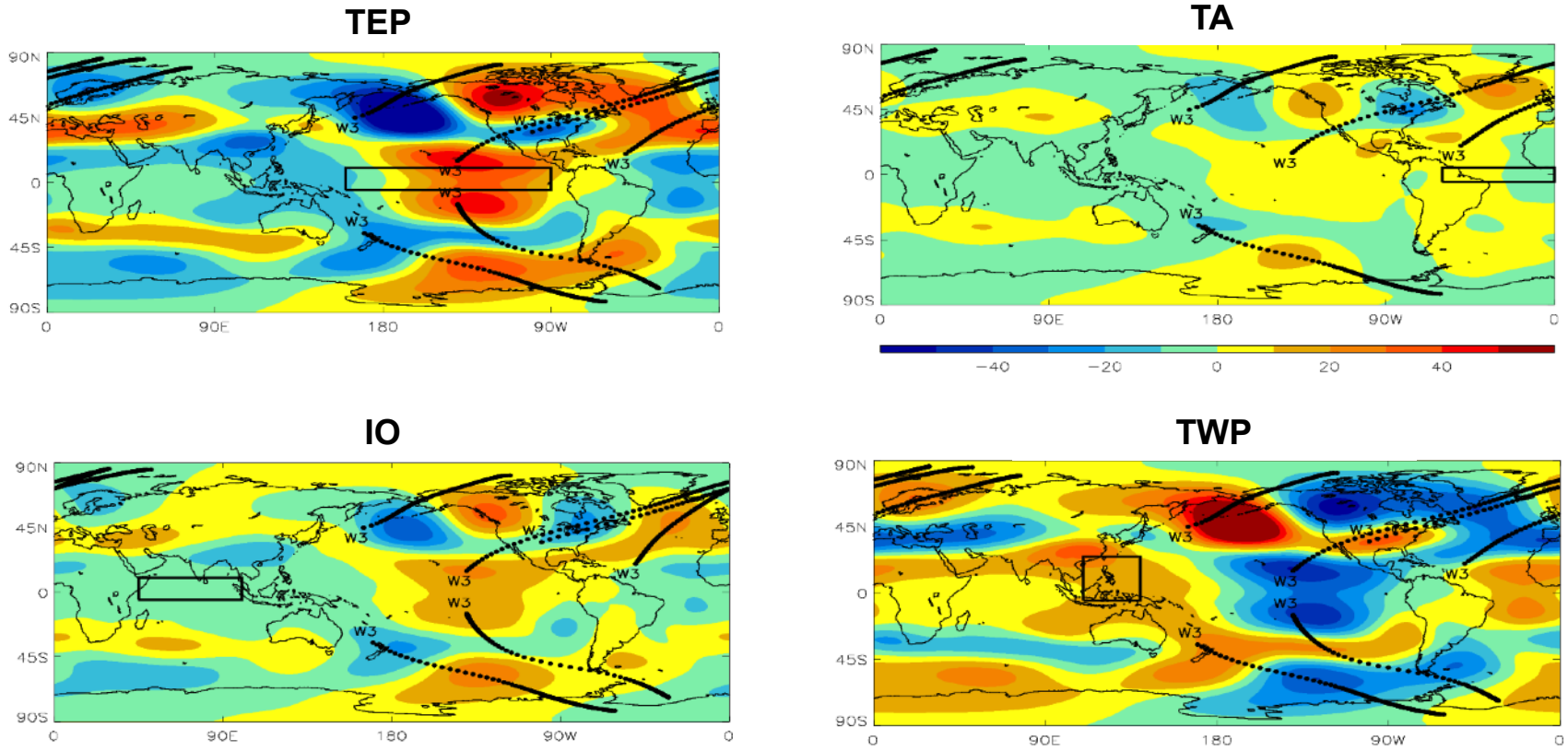
Respectable *correlations* which are all statistically significant

Ensemble mean and observations agree on *amplitude*

=> tropical precipitation is highly predictable out to months ahead

Scaife et al, QJRMS, 2016

Teleconnections as Rossby Waves



Rays intersect main centres *from a few common sources*

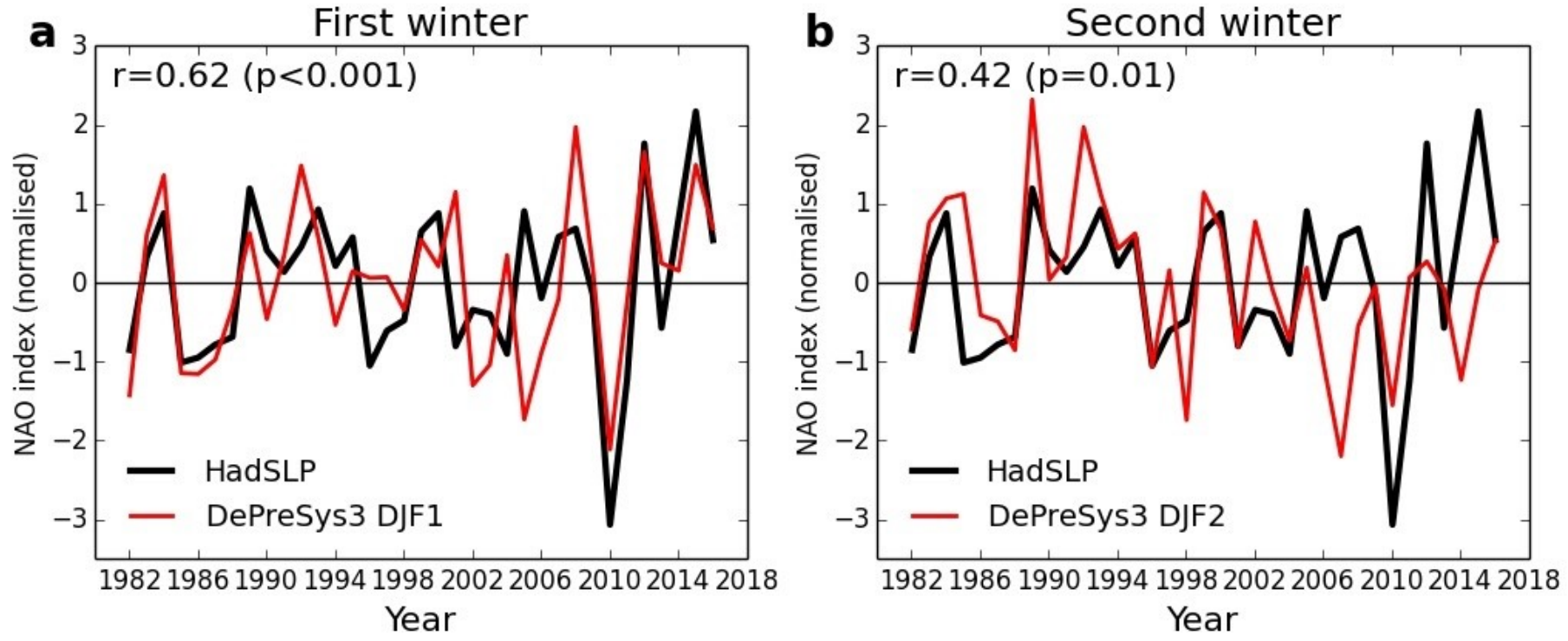
Wave 2, 3 mainly responsible as wave 4 rarely propagates

A theory for the teleconnections from tropical rainfall

Scaife et al, QJRMS, 2016

But can this also explain the NAO forecast skill?

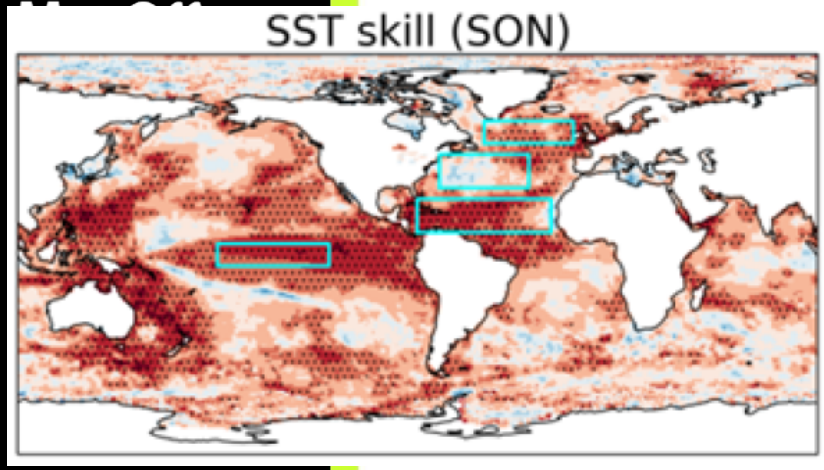
Skilful predictions of European winter

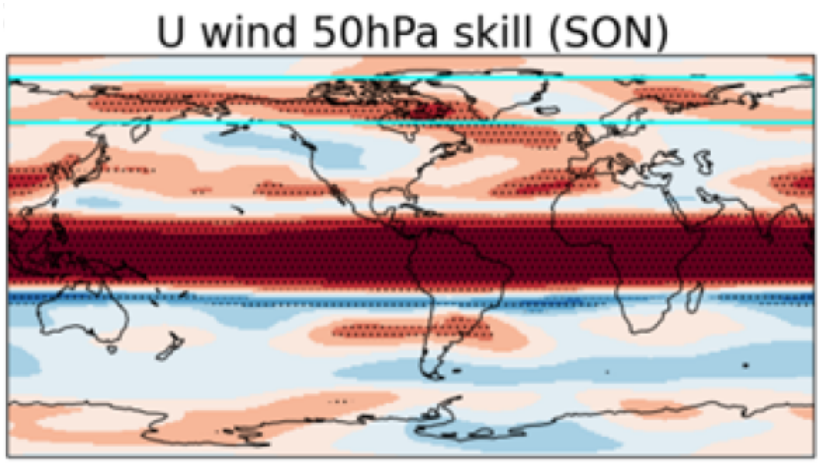


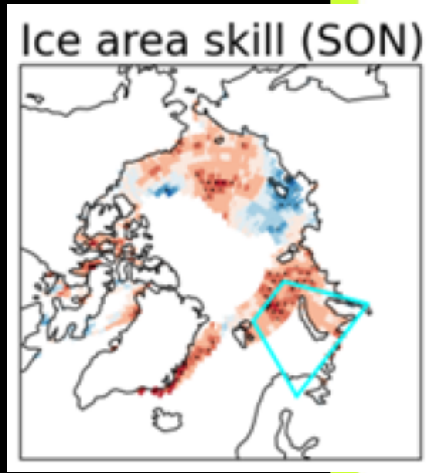
- **Skill extends over the whole satellite era since 1980**
- **Recent large signals are captured**
- **Significant skill from more than a year ahead**

Dunstone et al 2016

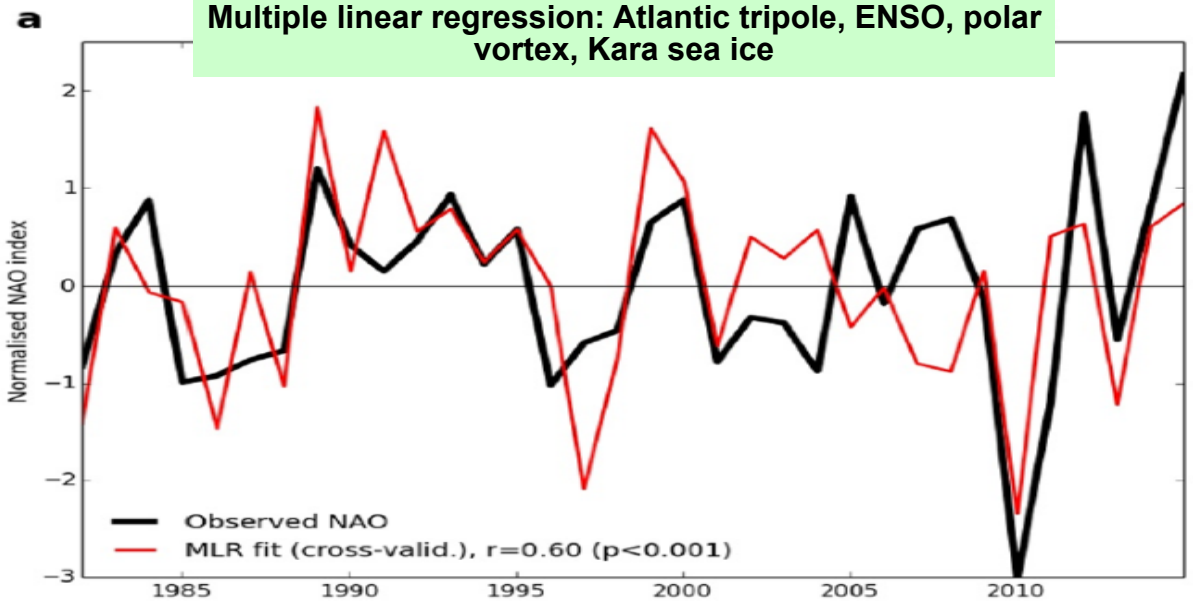
Sources of NAO skill







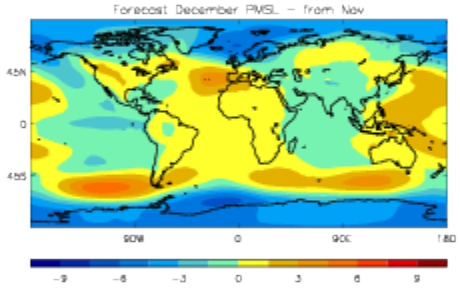
Multiple linear regression: Atlantic tripole, ENSO, polar vortex, Kara sea ice

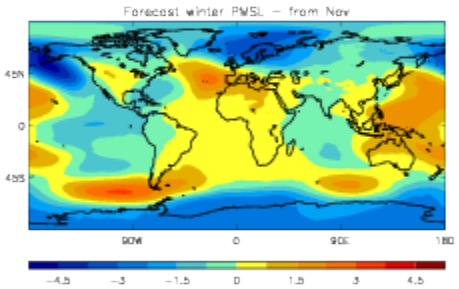


Dunstone et al 2016

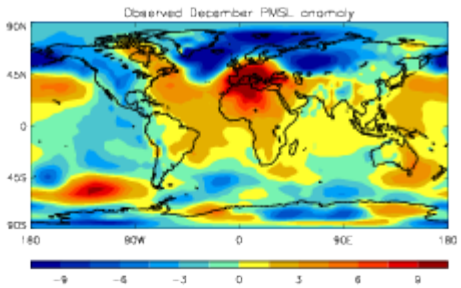
Winter 2015/16

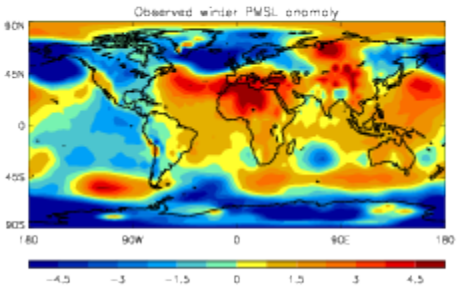
From November





Observations





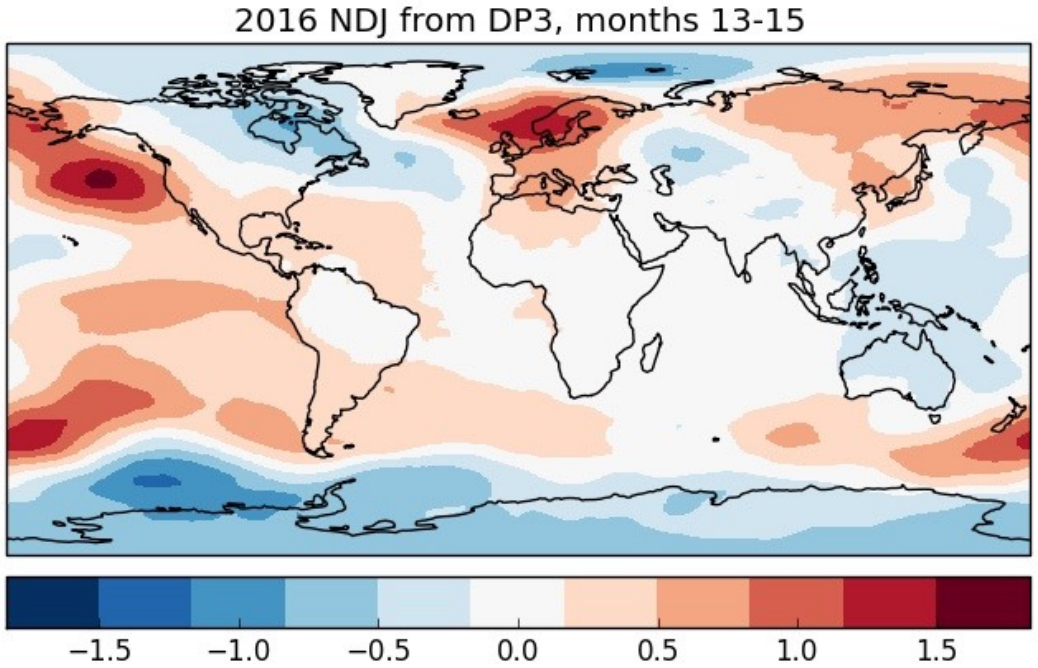
Very clear signals for a westerly winter

Good agreement with subsequent observations

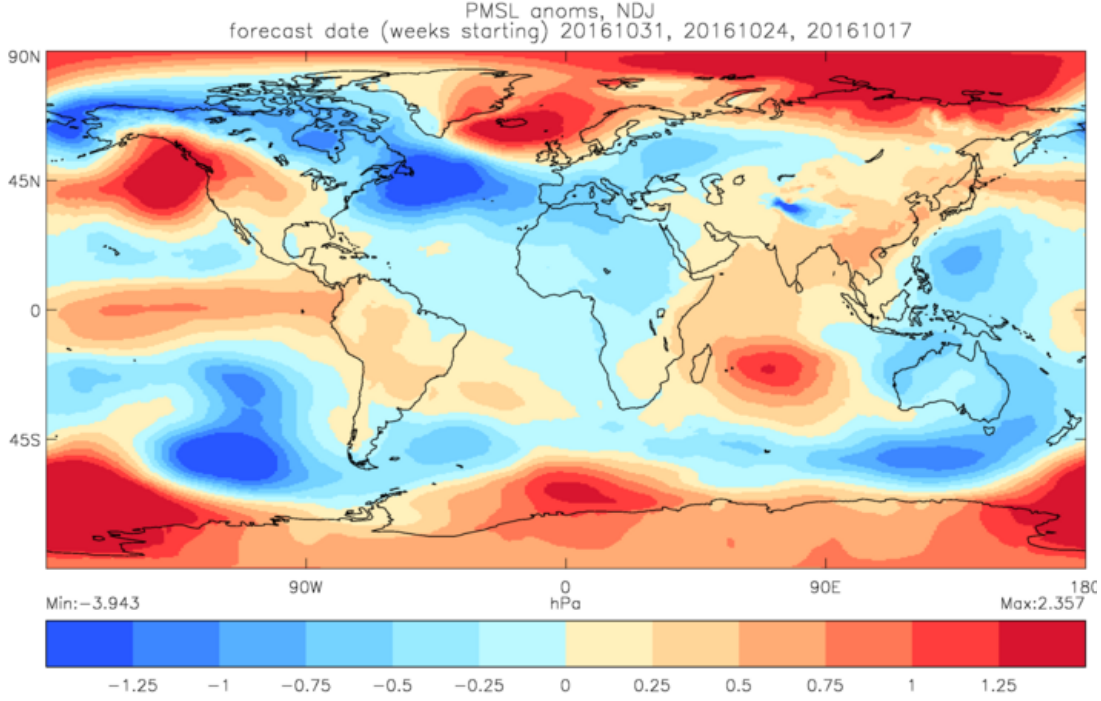
Early warning of December flooding

Scaife et al, ASL, accepted

Winter 2016/17
NDJ forecasts



DePreSys3 forecast from 1st November **2015**

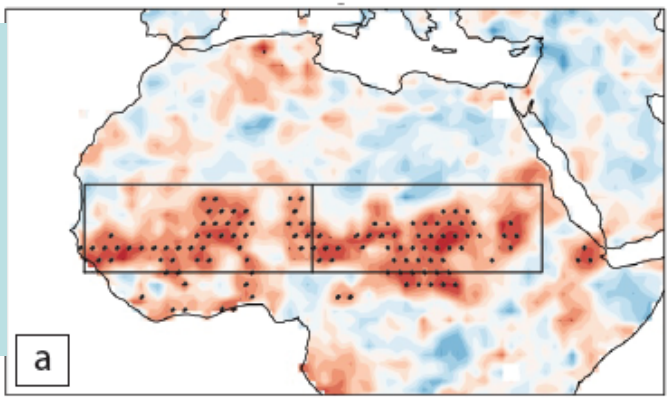


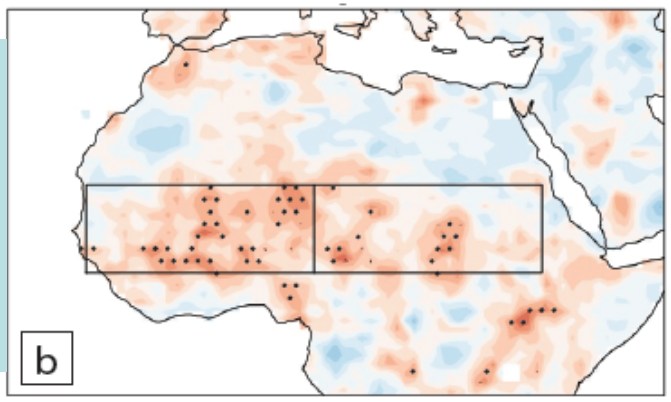
GloSea5 forecast from 1st November **2016**

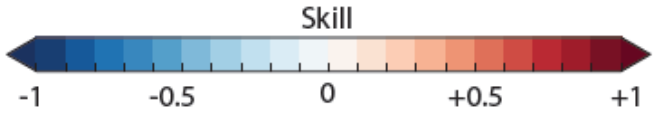
Sahel rainfall

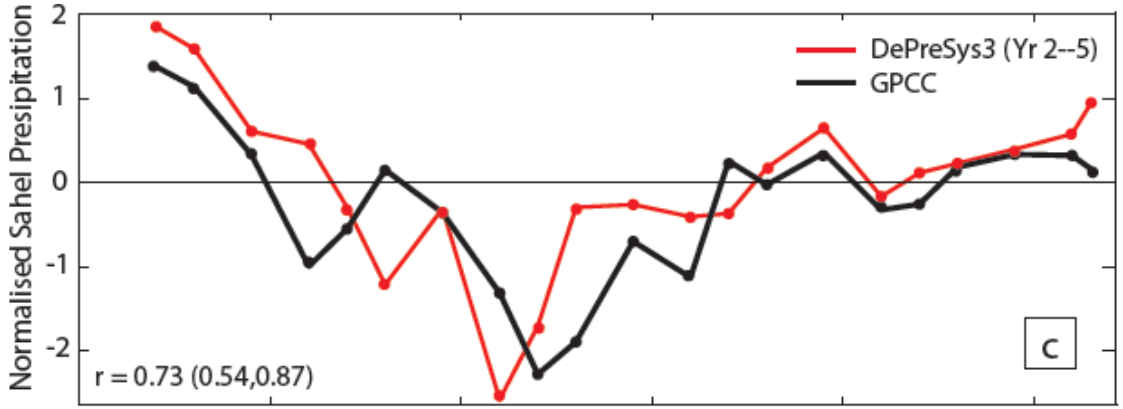
Multiyear

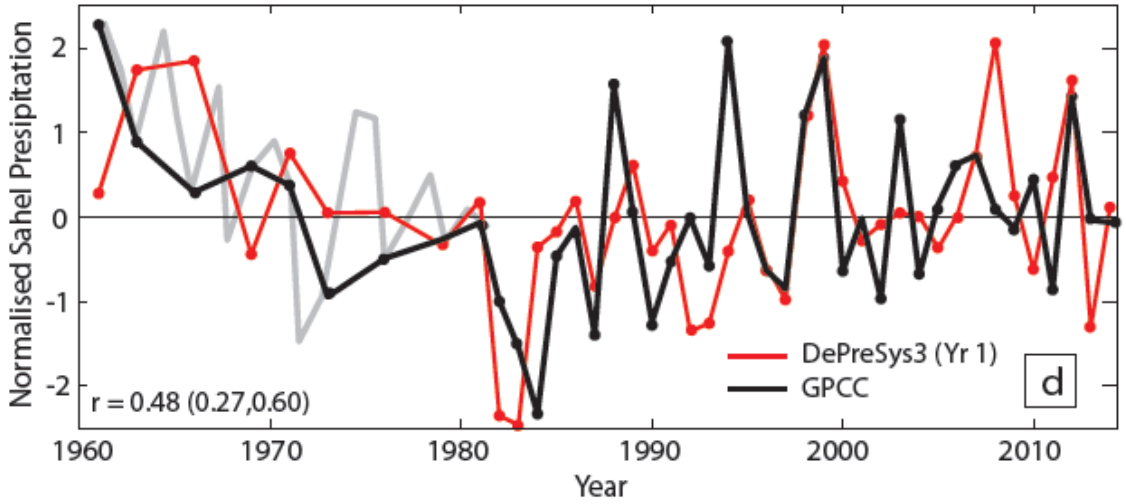
Inter-annual











- **Significant skill for both multiyear (years 2 to 5, top row) …**
- **… and inter-annual at 8 month lead (bottom row)**

(Sheen et al. submitted)

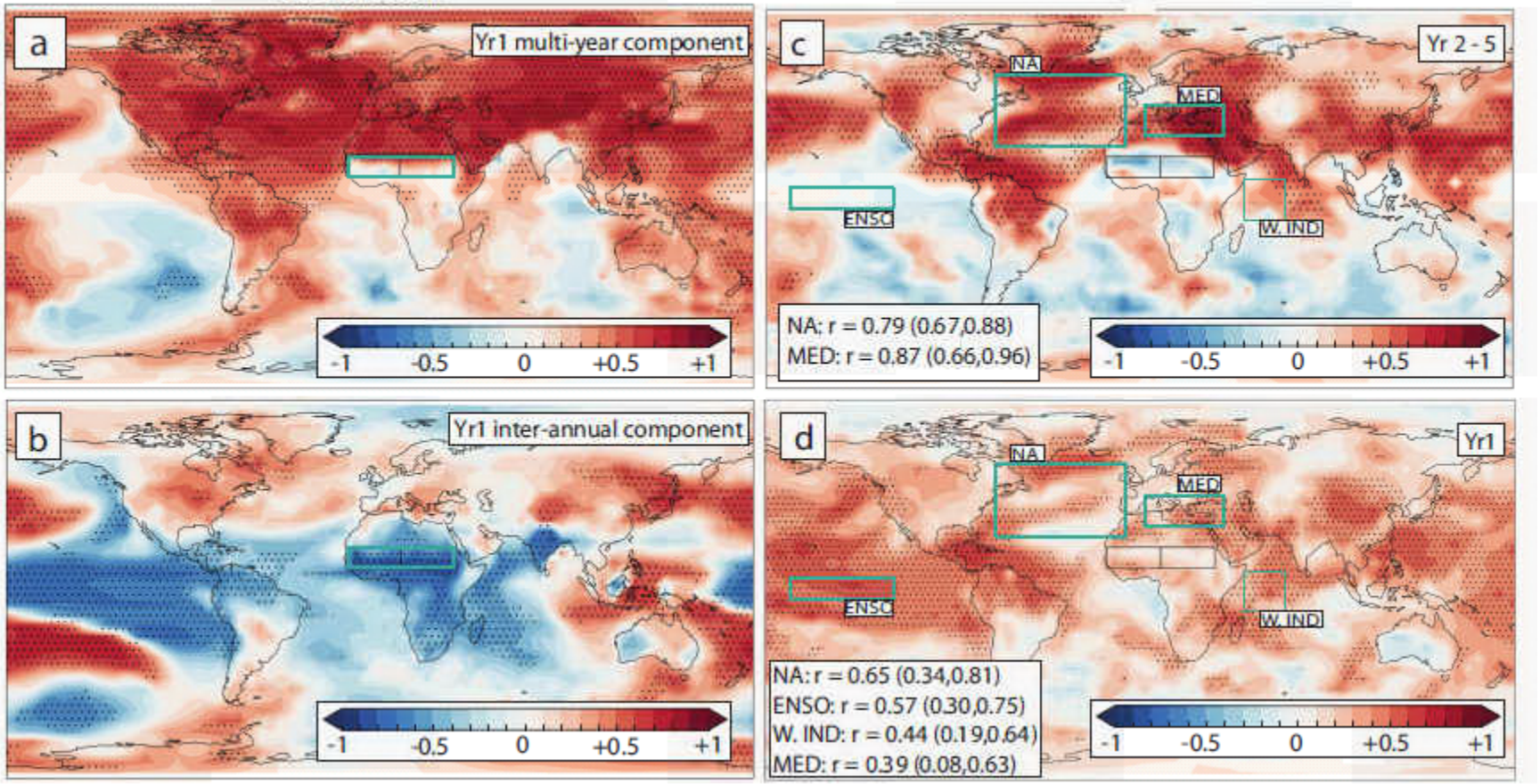
Sources of Sahel rainfall skill

Teleconnections

Skill (detrended)

Multiyear

Inter-annual



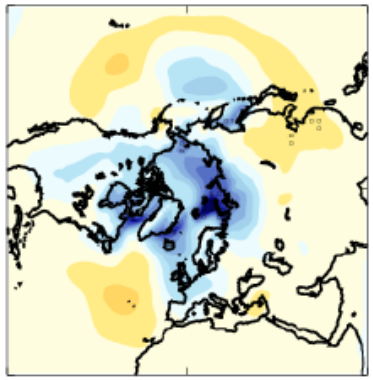
- **Multiyear driven by hemispheric temperature gradient which shifts the ITCZ**
  - ➢ **anomalous Hadley (meridional) circulation**
- **Interannual driven mainly by ENSO**
  - ➢ **anomalous Walker (zonal) circulation**

(Sheen et al. submitted)

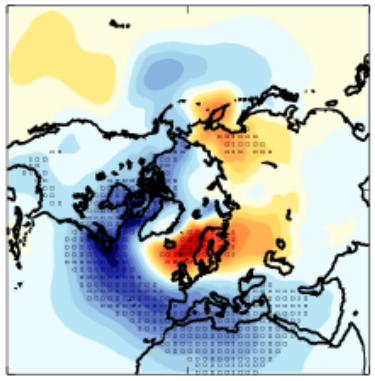
Will the melting Arctic sea ice promote cold European winters?

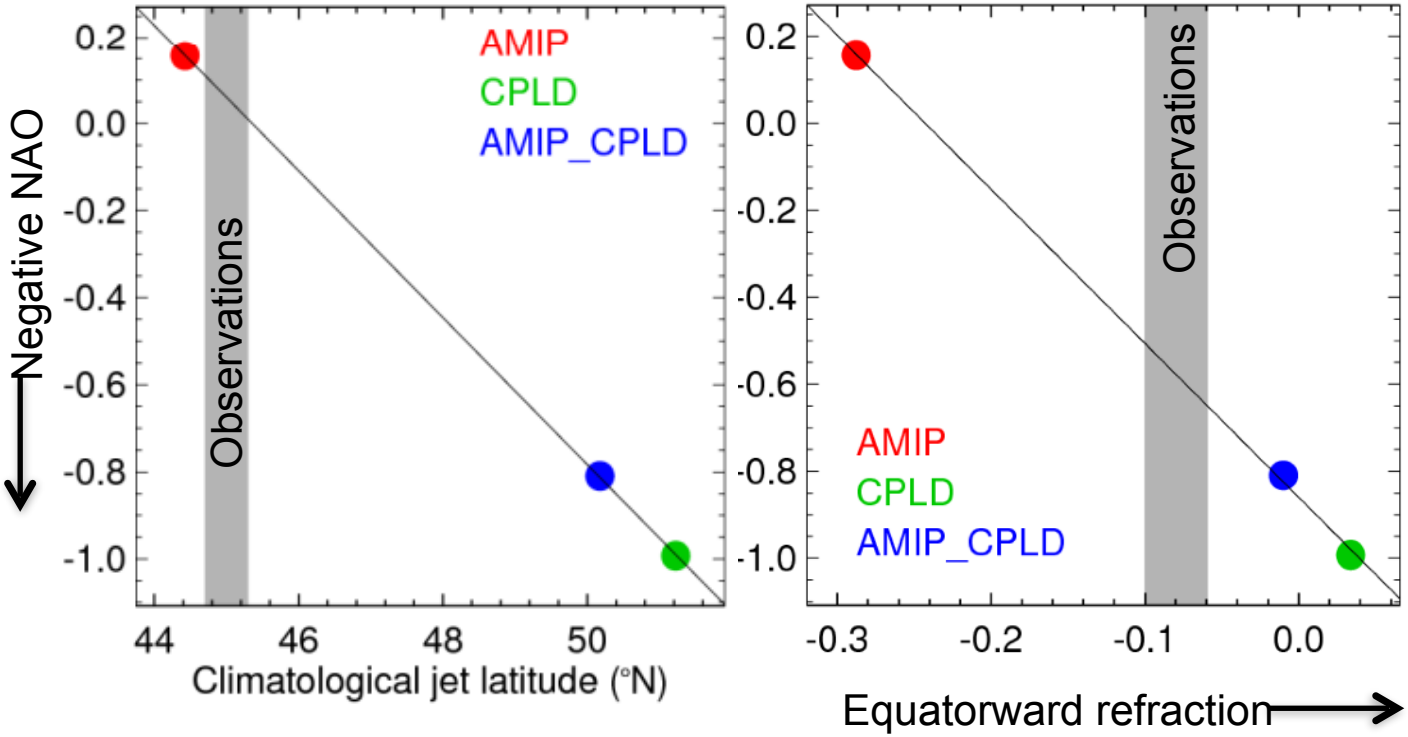
Met Office

Atmosphere model



Coupled model





- **Reduced ice → reduced Equator to pole temperature gradient → less wave activity**
- **Response depends on wave propagation, and hence background refractive index**
- **Possibility of "emergent constraint"?**
- **Need more models → coordinated multi-model experiments (EU APPLICATE project)**

(Smith et al. submitted)