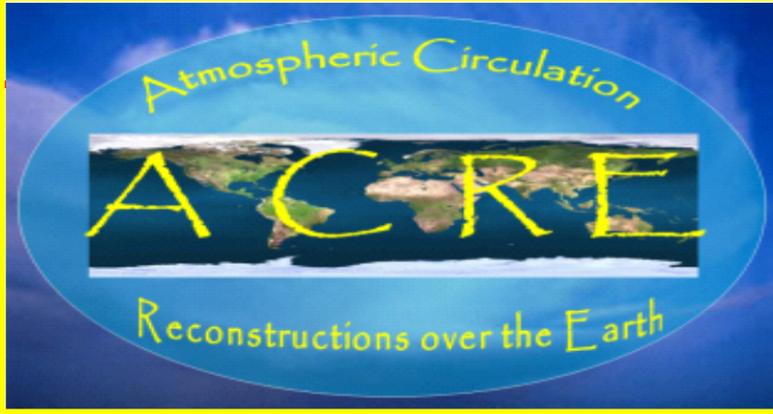


The international Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative

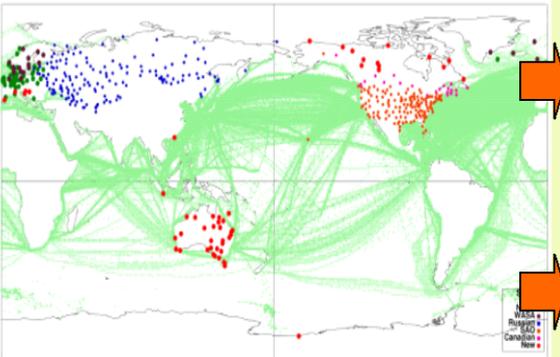


1: Undertake & facilitate international & regional recovery, imaging & digitisation of global surface terrestrial & marine weather observations over the last 200+ years

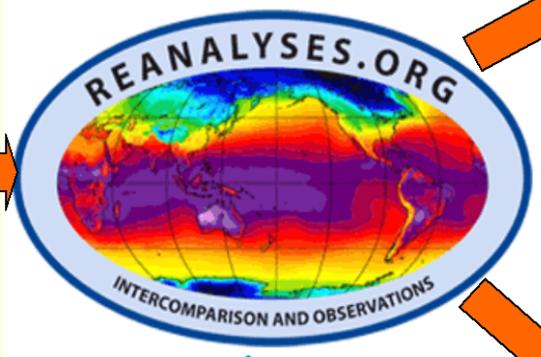


3: Global User Community Needs

2: Provide surface data requirements for all reanalyses (weather reconstructions)



ICODS
ISPD



- IRI
- NCAR
- NOAA ESRL
- NERSC
- KNMI
- BADC

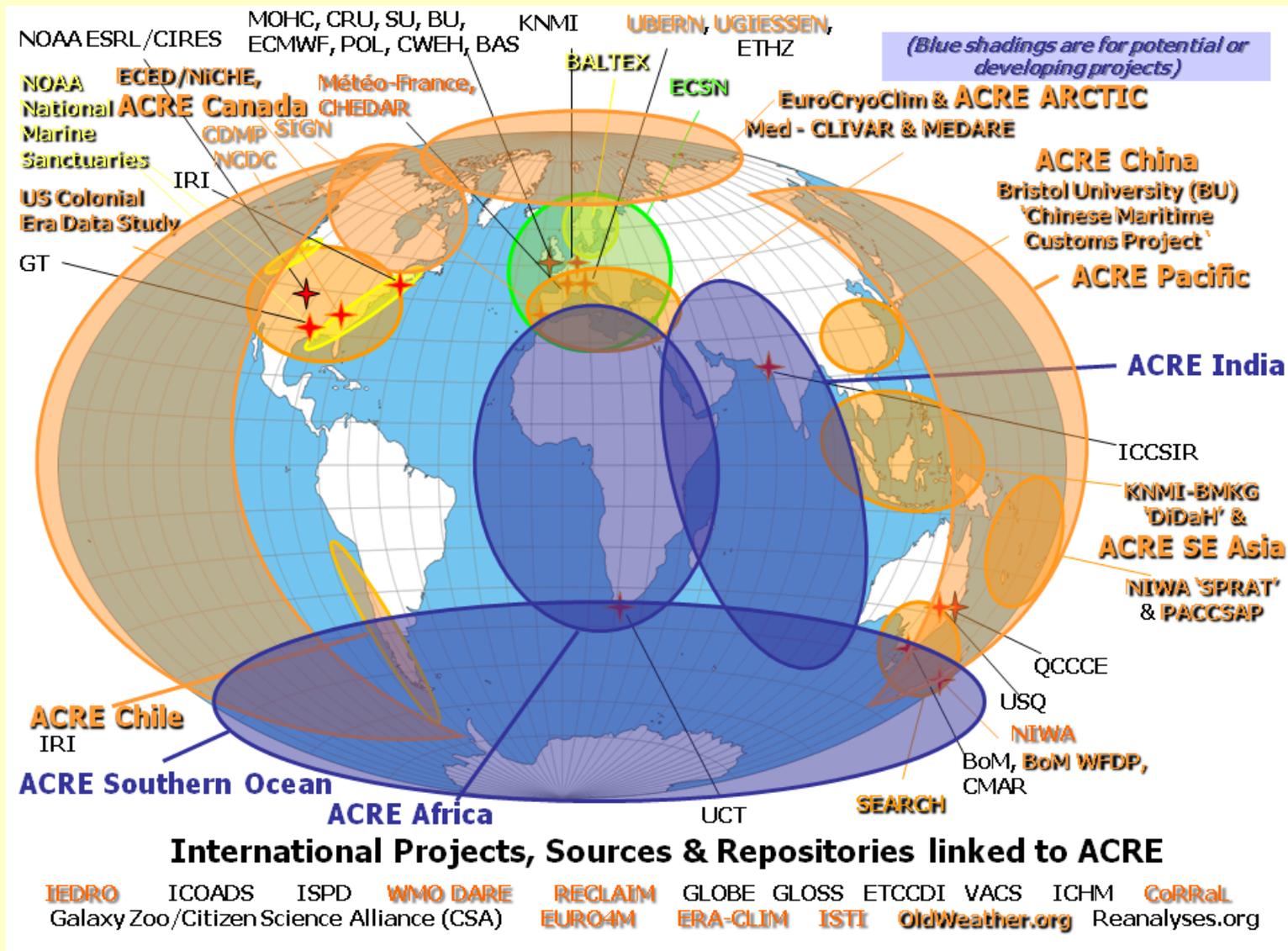
Citizen Science 'Crowd Sourcing'
(eg. Oldweather.org
Data rescue@home)

20th Century Reanalysis Project (20CR)
global historical reanalysis
assimilates only surface variables
56 realisations every 6 hours,
2° x 2° spatial resolution

MO PRECIS
Downscaling
Higher Resolution

- Environmental Assessments
- Extremes, Impacts & Risks
- Water resources
- Agricultural
- Forestry
- Energy
- Marine operations
- Fisheries
- Cultural landscapes and built heritage
- Education
- Ecological
- Phenological
- Health & Disease
- Reinsurance
- Climate Monitoring
- Model Validation

With WMO, GEO, GCOS endorsement, wide international support & the aid of various working groups of GCOS & WCRP, ACRE provides an umbrella that links together some 100+ projects, data rescue, climate science, climate applications, education, & outreach activities around the globe



Status of Regional Weather Data Recovery, Imaging & Digitisation Foci under ACRE

ACRE Chile - initially part of *EC FP7 ERA-CLIM* project; MO-USQ-Chile engagement

ACRE Pacific - led by NIWA, NZ; *French Pacific Fund* project

ACRE India - AHRC *Collaborative Research on the Meteorological and Botanical History of the Indian Ocean, 1600-1900*; MoU with Indian Meteorological Department?; *International Workshop on Rescuing Climate Heritage of Indian Ocean Countries: A necessary step for Improved Data foundations for Climate: Maputo, Mozambique, 21st-24th April 2014* (<https://sites.google.com/a/met-acre.org/acre/meetings-and-workshops-1/IODRW4.pdf?revision=1>)

ACRE Arctic - being developed by the Atmosphere/Climate Working Group (WG) of the International Arctic Science Committee (IASC)

ACRE Africa - link to new Met Office Hadley Centre-UK DfiD Climate Science Research Partnership (CSRP) contract; DfiD/FCO Data Rescue with Tanzanian NMS

ACRE China - part of the new MO MoU with China Meteorological Administration (CMA) & Beijing Climate Centre (BCC) plus an AHRC proposal via Bristol University, UK

ACRE SE Asia - *APN-funded Workshop: Towards new weather and climate baselines for assessing weather and climate extremes, impacts and risks over SE Asia, Kuala Lumpur, Malaysia, 27th-28th May 2014* (<http://www.met-acre.org/data-projects-and-regional-chapters/acre-se-asia>)

ACRE Southern Ocean - links to Southern Ocean Observing System (SOOS) International Project Office (IPO), Tasmania, Australia; University of NSW, Sydney, Australia & Gateway Antarctica, NZ

ACRE & Citizen Science, Social Sciences, Humanities & Arts projects



RMS Award 2012: The IBM Award for Meteorological Innovation that Matters

Old Weather: <http://old.oldweather.org/> **Old Weather2:** <http://www.oldweather.org/>

(JISC-funded)



(NOAA Arctic Research-funded)



PMEL CITIZEN SCIENCE ALLIANCE



Historic Weather: <http://historicweather.cerch.kcl.ac.uk/node/12>

(Arts & Humanities Research Council: Landscape and Environment Programme-funded)



Historic Weather 2: Snows of Yesteryear Project: <http://eira.llgc.org.uk/>

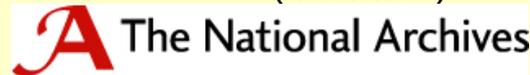
(Arts & Humanities Research Council: Landscape and Environment Programme-funded)



Shipping Archives and Integrated Logbooks of Ships: Linking WW1 Naval Records (SAILS):

<http://sailsproject.cerch.kcl.ac.uk/>

(JISC-funded)



Collaborative research on the meteorological and botanical history of the Indian Ocean, 1600-1900

<http://www.sussex.ac.uk/research/globaltransformations/projects/cwehreserach>

(Arts & Humanities Research Council: Network Project-funded)



'Spaces of Experience and Horizons of Expectation': Extreme weather in the UK, past, present and future

<http://www.nottingham.ac.uk/research/groups/weather-extremes/index.aspx>

(Arts & Humanities Research Council-funded)



ACRE Funding Sources to date

Mid-2007 to Mid-2010

Funding for the ACRE Project Manager's position came about as the result of a Statement of Intent (SOI) signed in March 2007 between the Met Office Hadley Centre and the then Queensland Climate Change Centre of Excellence (QCCCE) (representing the Queensland State Government) in Australia to explore the potential to establish joint research and development projects that would advance scientific knowledge, academic opportunity and technology transfer. Under this SOI, the first project to be established was the ACRE initiative.

Mid-2010 to end of 2011

ACRE Scientific Manager's position was maintained with funding from a European Environment Agency (EEA) European Topic Centre on Climate Change Impacts, Vulnerability and Adaptation (ETC-CCA) and from two European Commission (EC) Seventh Framework Programme Co-operation [FP7] projects, European Reanalysis of Global Climate Observations (ERA-CLIM) and European Reanalysis and Observations for Monitoring (EURO4M), and the Met Office Hadley Centre Climate Program (HCCP).

2012-March 2014

During this recent period, the ACRE Scientific Manager's funding has come from EC FP7 ERA-CLIM (30%), EC FP7 EURO4M (30%) and the HCCP (40%).

April 2014-March 2015

The ACRE Scientific Manager's funding will come from EC FP7 ERA-CLIM2 (60%) and the HCCP (40%).

ACRE WORKSHOPS AND MEETINGS

(<http://www.met-acre.org/meetings-and-workshops-1>)

1st ACRE Workshop: Reanalyses Data, Historical Reanalyses & Climate Applications

(MeteoSwiss, Zurich, *Switzerland* 23- 25 June 2008)

2nd ACRE Workshop: Shaping an ongoing road map for ACRE

(O'Reilly's Rainforest Retreat, Lamington National Park, Queensland, *Australia*, 1-3 April, 2009)

ACRE Working Group 1: Data and Data Visualisation planning meeting

(Bologna, *Italy*, 27-29 May 2009)

ACRE Data and Data Visualisation meeting

(Met Office, Exeter, *UK*, 15-17 September 2009)

3rd ACRE Workshop: Reanalysis and Applications

(Linked to the US Workshop on the evaluation of recent reanalyses and steps towards an integrated Earth System Analysis)

(Baltimore Sheraton Inner Harbour, Baltimore, *USA*, 3-5 November 2010)

4th ACRE Workshop

(In conjunction with EC FP7 EURO4M and ERA-CLIM plus AHRC *Historic Weather*)

(KNMI, De Bilt, *The Netherlands*, 21-23 September 2011)

5th ACRE Workshop

(In conjunction with EC FP7 ERA-CLIM plus AHRC *Historic Weather2*)

(Météo-France, Toulouse, *France*, 28-30 November 2012)

6th ACRE Workshop: Applications of Reanalysis Products

(In conjunction with EC FP7 ERA-CLIM, EURO4M and AHRC *Historic Weather2*, with additional sponsorship from Verisk Climate)

(FFCUL/IDL, Campo Grande, Lisbon, *Portugal*, 18-20 November 2013)

7th ACRE Workshop: Expanding Applications of Reanalysis Products

(Environment Canada, Toronto, Ontario, *Canada*, 25-27 August 2014)

Existing Met Office/ACRE: Memoranda of Understanding; Co-Operation & Collaboration Agreements

1. Collaboration Agreement: University of Southern Queensland (USQ) & Met Office
Provision of monthly-to-seasonal forecast outputs for sugar production (1st June 2012-31st May 2017)

2. Memorandum of Understanding: International Environmental Data Rescue Organisation (IEDRO) Met Office/ACRE

To assist each organization to accomplish mutually beneficial goals:

- Promote planned Data Rescue and Digitization (DR&D) projects.
- Identify future DR&D opportunities.
- Enable both organizations to benefit from donor and grant funds to support the climate services community's requests for digitization of and access to historical climate data.
- Identify training and technical assistance needs of the climate services community.
- Support free and open exchange of climate data under the Global Framework for Climate Services (GFCS).

3. Co-operation Agreement: Met Office/ACRE, British Library & University of Sussex

The following general areas have been identified as potential areas for collaboration (2012-2015):

- Sharing historical weather and/or climate data for the purposes of scientific research relating to the AHRC-funded project "*Collaborative Research on the Meteorological History of the Indian Ocean, 1600-1900*", led by the Centre for World Environmental History at the University under the ACRE project
- Sharing historical weather and/or climate data for the purposes of other scientific research relating to ACRE
 - Any other historical weather or climate data as may be identified from time to time

ACRE and 20CR Publications in the International Literature

There are some 182 publications using and/or citing ACRE and/or 20CR in the international literature:

http://www.esrl.noaa.gov/psd/data/20thC_Rean/pubs/

20CR and ACRE in the media

Various media items can be found at:

http://www.esrl.noaa.gov/psd/data/20thC_Rean/news/

CURRENT RESULT

A state-of-the-art, spatially and temporally-complete, global gridded 3D historical (potentially 200+ years) reconstruction of 6-hourly weather variables with **some** inter/cross/multidisciplinary links to social sciences, humanities and arts projects

BUT

Major Questions:

Funding?

Staffing?

Sustainability?

How to go further?

SOLUTION

Meld together the global gridded ACRE-facilitated 3D historical reconstruction of 6-hourly weather with relevant historical environmental, social sciences, humanities and arts material in one online entity

=>

An easily accessible vehicle that underpins and enhances the capability and capacity to undertake more coherent and integrated research, leading to a deeper understanding and propensity for visualisations of environmental extremes, impacts and risks in their full historical context



5 FP7-SPACE projects prepare for a **Copernicus Climate Change Service** (*Copernicus, previously known as GMES [Global Monitoring for Environment and Security], is the European Programme for the establishment of a European capacity for Earth Observation*):

ERA-CLIM2 (global reanalysis, Dick Dee, ECMWF)

UERRA (regional reanalysis, Per Uden, SMHI)

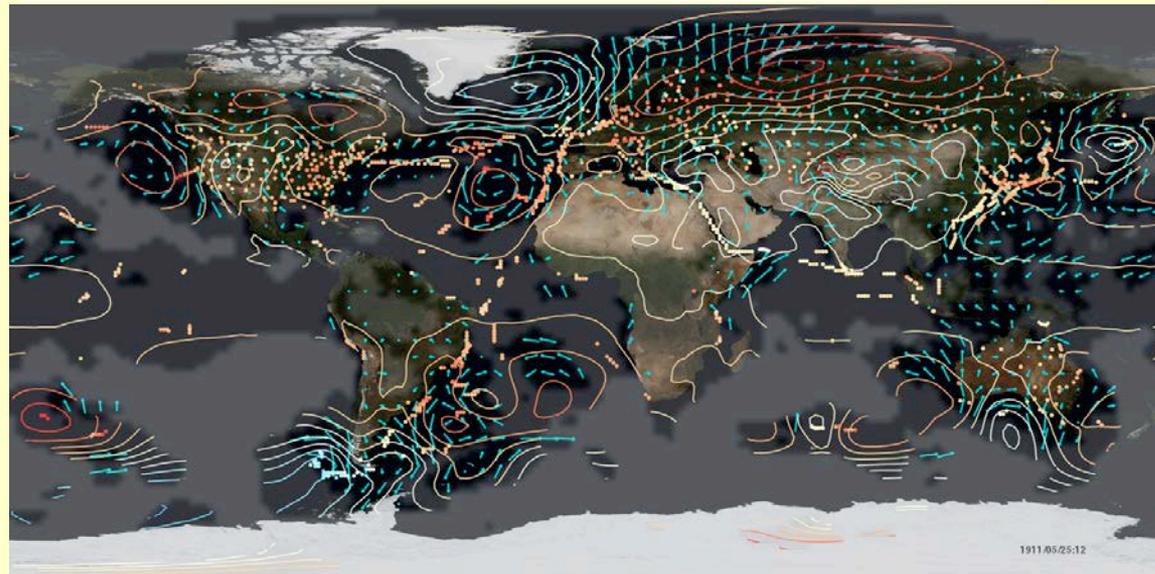
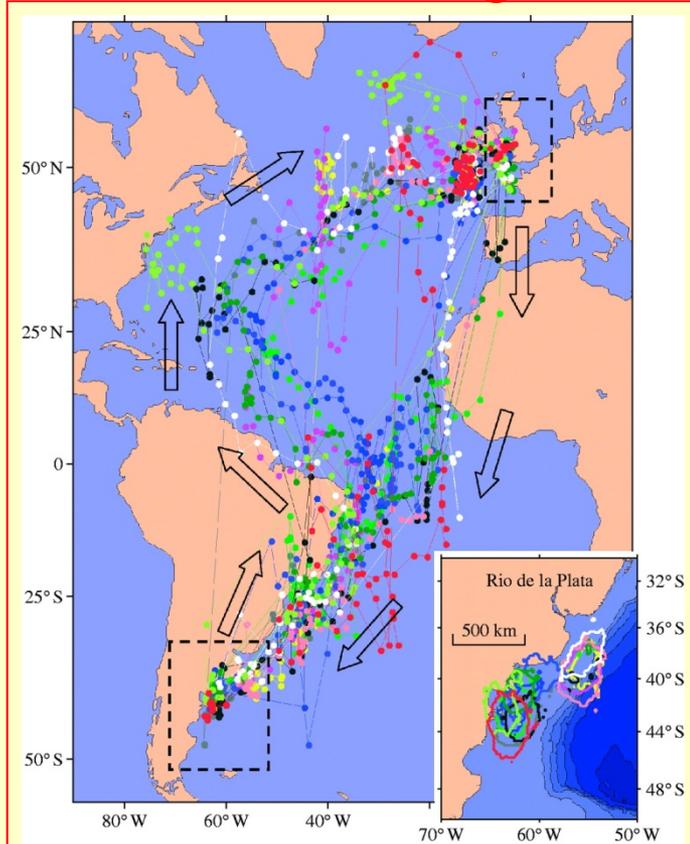
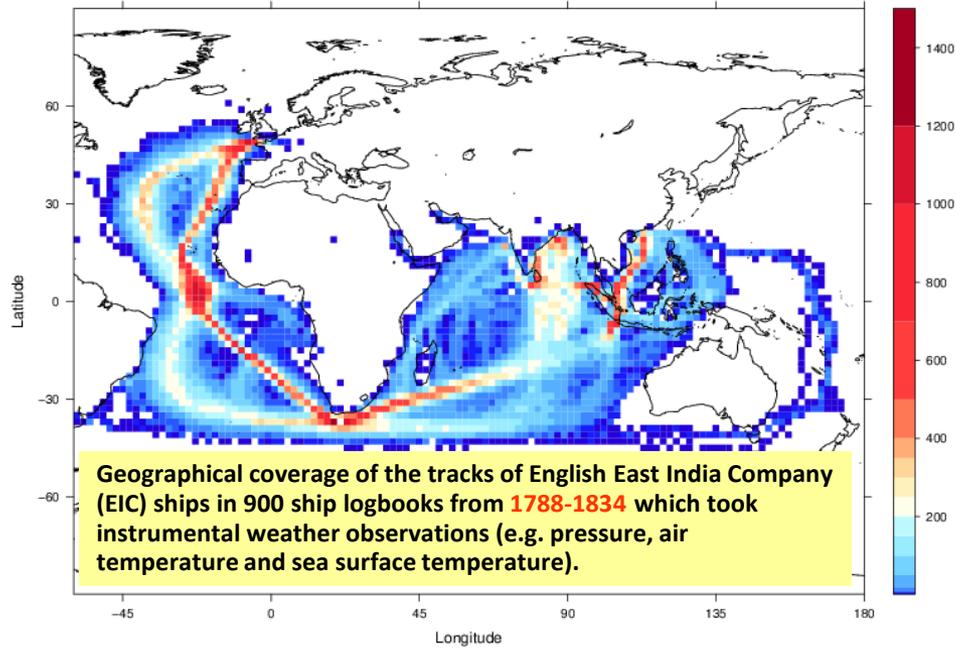
QA4ECV (air quality ECVs, Folkert Boersma, KNMI)

CLIPC (climate impact platform, Martin Juckes, STFC)

EUCLEIA (event attribution, Peter Stott, Met Office)

An overarching WP (led by Albert Klein-Tank) will co-ordinate information exchange between these projects and the outside world, including relevant Commission DGs and joint stakeholders Albert Klein-Tank (WP11 lead)

Ships, Shearwaters and Weather => Circulation & Bird Migration



Global surface pressure and wind field vectors (light blue arrows) for 12Z 25/5/1911 generated by the ACRE-facilitated 20th Century Reanalysis Project (20CR). Red (blue) isobars are high (low) pressure regions. Coloured dots are the terrestrial and marine weather observations used to create this dynamical reanalysis (reconstruction). Light grey shaded areas are where current lack of data is making the reanalysis uncertain.

(<http://onlinelibrary.wiley.com/doi/10.1002/qj.776/abstract>)

The Thames Floods of November 1894



=> need to be readily able to integrate of all of this data, output & documentary material

Source: Brugge (1994), The floods of October and November 1894 in southern Britain. *Weather*, 49, 383-390

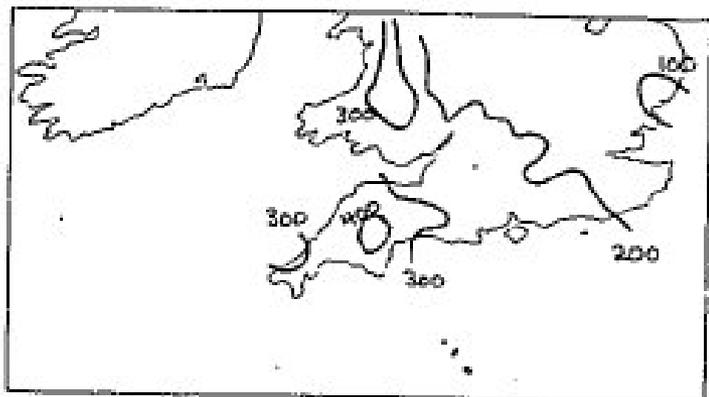
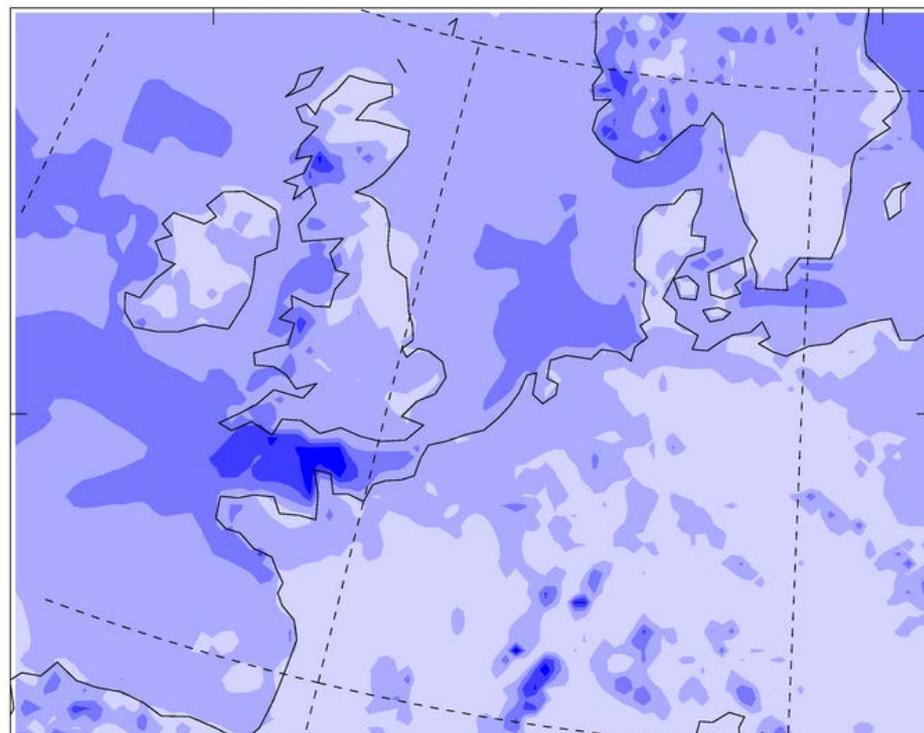


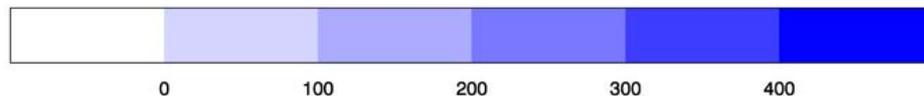
Fig. 4 Rainfall totals from 9 a.m. on 20 October to 9 a.m. on 15 November 1894. Contours are drawn every 100 mm. Drawn from data in Symons (1894).

Rainfall totals from 20th October to 14th November

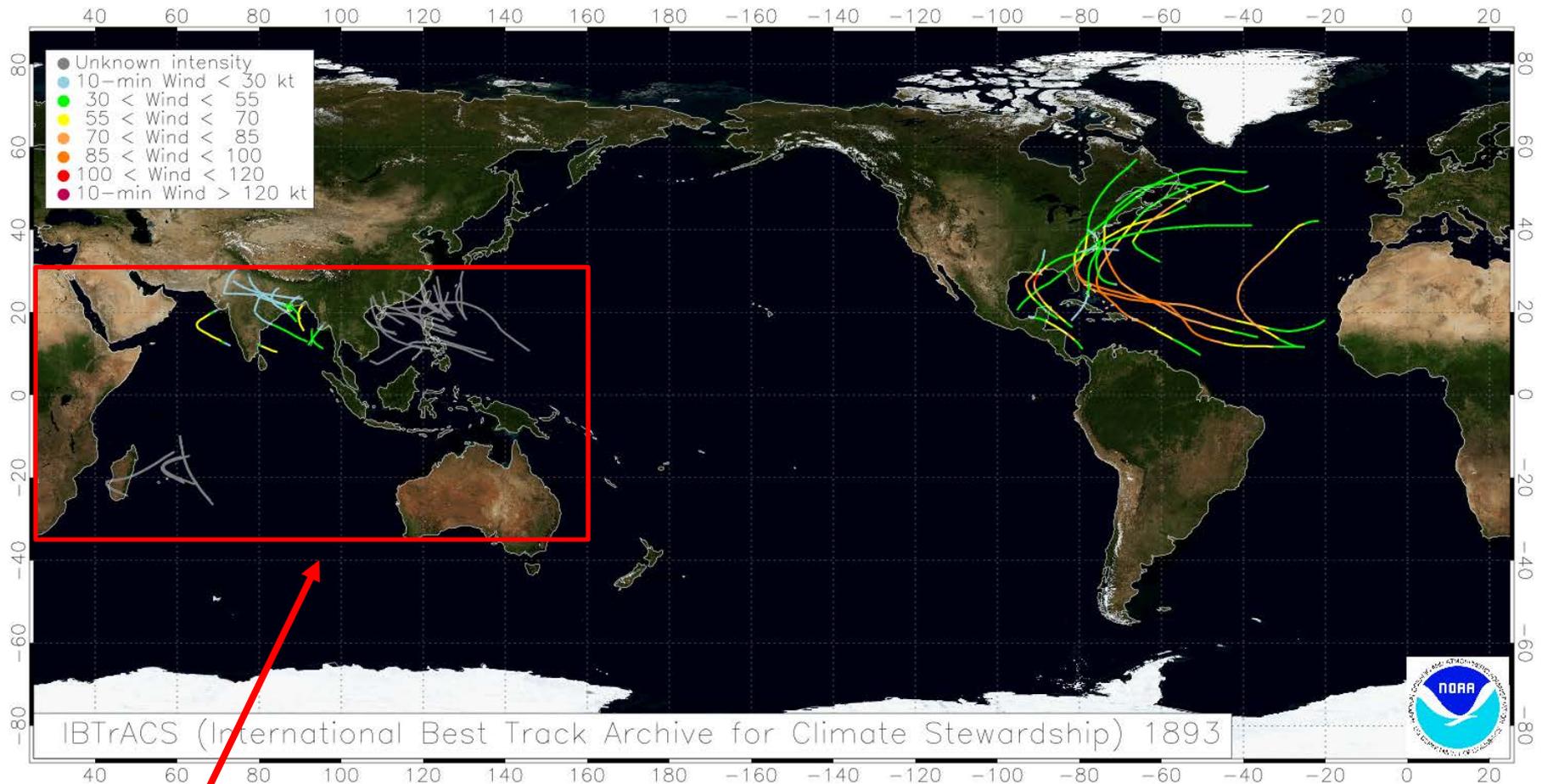


PRECIS downscaled ACRE-facilitated 20CR rainfall

Member 37 PRECIS output in mm



Tropical storm tracks - 1893



Source: <http://www.ncdc.noaa.gov/oa/ibtracs/>

Tracks in grey currently have no more information about them => data recovery for 20CR can provide central pressure, wind etc....

International ACRE Scientific Manager

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Climate Monitoring and Attribution Group,
Met Office Hadley Centre

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ACRE WWW Site: <http://www.met-acre.org/>

Old Weather WWW Site: <http://www.oldweather.org/>

Phone: +44 (0)1392 886904

Fax: +44 (0)1392 885681

Address: FitzRoy Road

Exeter EX1 3PB

U.K.

An overview piece on ACRE has been published in the November issue of the *Bulletin of the American Meteorological Society* (BAMS), and can be downloaded at:

<http://journals.ametsoc.org/doi/pdf/10.1175/2011BAMS3218.1>