

ACRE Overview piece for the  
**UK AHRC-funded Network Project: *Collaborative research on the meteorological  
and botanical history of the Indian Ocean, 1600-1900*** Network Meeting,  
University of Sussex, UK  
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# The international Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative

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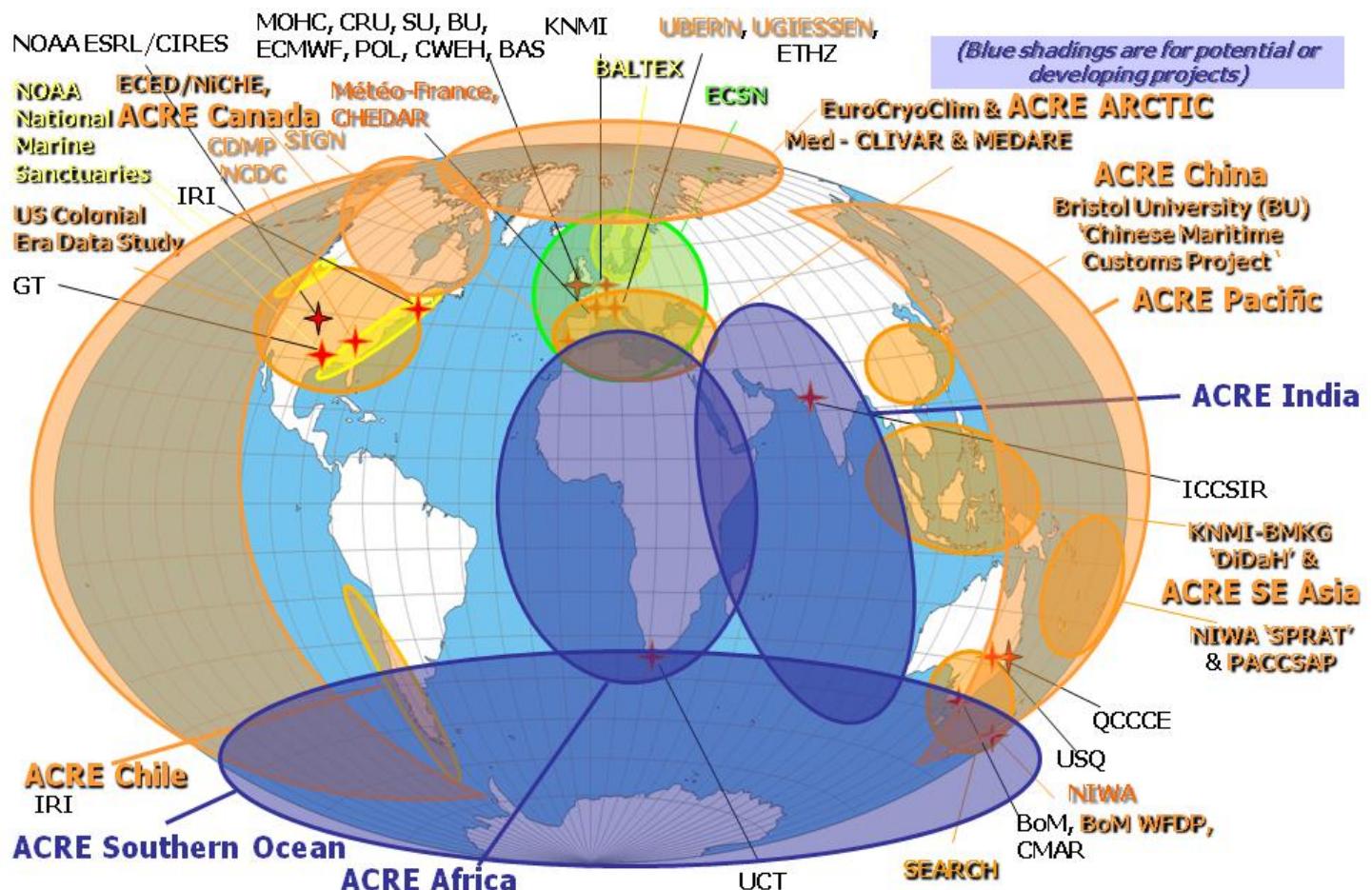
E-mail: [rob.allan@metoffice.gov.uk](mailto:rob.allan@metoffice.gov.uk)  
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The international ACRE initiative (<http://www.met-acre.org/>) is run by a consortium of nine core partners:



## Background and Research Goals?

The international ACRE initiative provides an umbrella that links together some 40+ projects, institutions, organisations, and data rescue and climate applications activities around the globe (see schematic below).



In support of its first role in providing an international umbrella to facilitate, coordinate and undertake historical surface terrestrial and marine instrumental data recovery, imaging, digitization, quality control, archiving, access and preservation in a sustainable manner, ACRE is also developing a range of regional data foci that are detailed below.

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

**ACRE Chile** - initial funding EC FP7 ERA-CLIM; APEC SPHERE proposal

**ACRE Pacific** - via NIWA, NZ; initial French Pacific Fund project

**ACRE India** - British Library-India initiative; AHRC Collaborative Research on the Meteorological and Botanical History of the Indian Ocean, 1600-1900; MoU with Indian Meteorological Department?

**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 (CSR) contract

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

**ACRE SE Asia** - APN CAPaBLE proposal; FCO Singapore proposal

**ACRE Southern Ocean** - links to Southern Ocean Observing System (SOOS) International Project Office (IPO), Tasmania, Australia & Gateway Antarctica, NZ

As with all of ACRE's international activities and regional foci (noted above), the historical instrumental weather observations will feed into international terrestrial and marine weather data repositories, and will be freely available. These data will in turn be assimilated into freely available 3D global dynamical weather reconstructions (reanalyses) (see current timeline below) spanning the last 200+ years.

## ACRE-facilitated Historical Reanalyses

### 20th Century Reanalysis Project (20CR)v1: 1891-2008 [Autumn 2009]

### 20th Century Reanalysis Project (20CR)v2: 1871-2010 [December 2011]

- Global historical reanalysis

- Assimilates only surface synoptic pressure, monthly sea surface temperature (SST) and sea-ice distributions
  - 56 realisations of 32 (20CRv1) - 41 (20CRv2) variables at 24 pressure levels every 3 and 6-hours
  - Ensemble mean and spread forecast (first guess) fields (T62 ~ 200km x 200km spatial resolution)

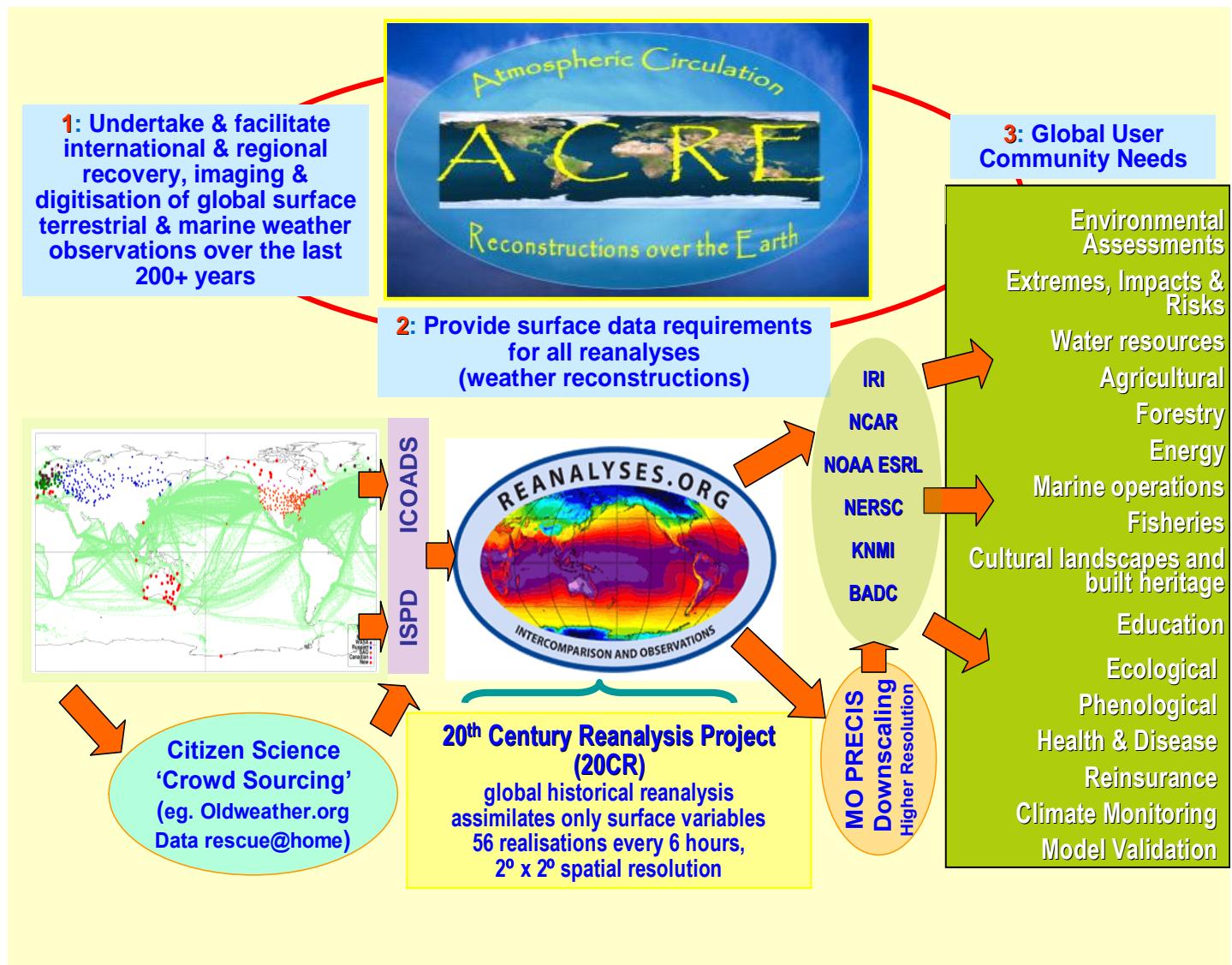
### Sparse Input Reanalysis for Climate Applications (SIRCA): 1850-2014 [Autumn 2014]

- Higher resolution (T126 ~100km x 100km spatial resolution or higher)
- improved methods (e.g., quality control, bias correction)
  - More input data (e.g., ACRE)
  - Latest model from NCEP
- Include uncertainty in forcings (e.g., ensemble of SSTs and sea-ice, CO2, solar)

### Ocean-Atmosphere Reanalysis for Climate Applications (OARCA): 1800-2017 [Autumn 2017/8]

- Higher resolution (T382 ~ 35km x 35km spatial resolution or higher)
- Improved methods (e.g. coupled Cryosphere-Ocean-Land-Atmosphere-Chemistry system, link with SODA advances, possibly NOAA CarbonTracker advances)
- More input data (e.g., ACRE-facilitated: maybe winds and T, storm position, trace gases)
- Latest model from NCEP, multi-model with other models (e.g., NASA, NCAR, GFDL, ESRL)

Dynamical downscaling by the Met Office PRECIS (<http://www.metoffice.gov.uk/precis>) team dynamical models will then take the reanalyses output down to finer resolution (25 km to 100 m), for use by the climate science community, wide ranging climate applications and services, policy makers, planners, environmental managers, educational and public sectors - the following schematic provides an overview of the full ACRE initiative.



The link at the end of this sentence, is to a set of visualisations of the results of both ACRE historical weather data activities plus ACRE-facilitated 20th Century Reanalysis Project (20CR) outputs that are dynamically generated from the historical weather observations that ACRE and its partners recover, image and digitise: <https://vimeo.com/channels/345571>

## How would interdisciplinary collaboration benefit your work or change your approach?

As shown below, ACRE also links closely with Citizen Science, Social Sciences, Humanities and Arts projects, which extend its activities far beyond climate science into inter/cross/multidisciplinary engagements, and provide the basis for access to expertise for training in data rescue, scanning and digitisation tools and techniques for analyses and interpretation of historical documentary weather observations. This is an ongoing ACRE activity evolving as the initiative itself grows and expands its interactions and collaborations.

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



CITIZEN SCIENCE ALLIANCE

Old Weather: <http://old.oldweather.org/>

(JISC-funded)

NAVAL-HISTORY.NET  
1998-2010  
Knowledge not shared is lost



nmm.ac.uk



Pacific Marine Environmental Laboratory

Arctic Rediscovery Project: <http://www.oldweather.org/>

(NOAA Arctic Research-funded)

CITIZEN SCIENCE ALLIANCE



University of London



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

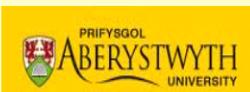
(Arts & Humanities Research Council: Landscape and Environment Programme-funded)



Llyfrgell Genedlaethol Cymru  
The National Library of Wales  
Aberystwyth



University of Wales  
Prifysgol Cymru



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

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



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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)



Currently, the initiative is part of two proposals to the AHRC '*Environmental Change and Sustainability* area of the *Care for the Future*' theme:

**Climate Histories of the West African Monsoon**      Led by Professor David Nash, University of Brighton, UK

**Representing and communicating uncertainty: climate change and risk**      Led by Professor Georgina Endfield, University of Nottingham, UK

## In what collaborative work are you already involved?

As shown above, the international ACRE initiative, by its very nature, already embraces inter/cross/multidisciplinary engagements and collaborations under the following specific data rescue and related activities.

ACRE's regional data rescue foci, ACRE India, ACRE Africa and ACRE SE Asia, already effectively cover the Indian Ocean domain and embrace a strong inter/cross/multidisciplinary network.

Under ACRE India, apart from activities linked to the UK AHRC-funded Network Project: *Collaborative research on the meteorological and botanical history of the Indian Ocean, 1600-1900*, the initiative's other efforts have been in trying to develop an MoU, or similar, with the Indian Meteorological Department (IMD)/Indian Ministry of Earth Sciences (aided by the UK FCO in New Delhi), respond to interest by the Sri Lankan Meteorological Service in a data rescue project, and develop a specific data rescue task with the 'The Mauritius Project' (outlined below). The latter is now likely to be part of a wider project looking at renewable off-shore wind energy potentials for the Government of Mauritius through an enhancement of the historical regional marine weather data feeding into dynamically downscaled (using the PRECIS system) ACRE-facilitated 20CR and SIRCA/OARCA reanalyses across the region.

National Archives of Mauritius      Mauritius Meteorological Services

## THE MAURITIUS PROJECT

Recovering, imaging, digitising, archiving and preserving of old weather observations extracted from ship logbooks in 188 volumes of Charles Meldrum's 'anemological' journals from 1853 to 1914 and terrestrial weather observations for Mauritius (including data from Colonel Lloyd's Colonial Observatory at Port Louis) from the late 18th to the early years of the 20th century held by the Mauritius Meteorological Services (MMS).

University of Brighton

Atmospheric Circulation  
ACRE  
Reconstructions over the Earth

IEDRO  
INTERNATIONAL ENVIRONMENTAL DATA RESCUE ORGANIZATION

Met Office  
Hadley Centre

With ACRE Africa, apart from more integration with the new Met Office Hadley Centre-UK DfID Climate Science Research Partnership (CSRP) contract, the initiative is part of a Met Office funding proposal to DfID for a major data rescue project for the Tanzanian Meteorological Agency, is looking to link with Germany's National Meteorological Service, the Deutscher Wetterdienst (DWD), with their Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) - a Regional Science Service Centre (RSSC) in Southern Africa project (<http://www.sasscal.org/>) involving Angola, Botswana, Namibia, South Africa and Zambia in southern Africa, is working with the South African Weather Service on data rescue in their country, and looking to link with the International Research Institute for Climate and Society (IRI) and the expansion of the concept of their IRI-Google.org project ([http://portal.iri.columbia.edu/portal/server.pt?open=18&objID=7959&qid=44812383&rank=1&parentname=SearchResult&parentid=21&mode=2&in\\_hi\\_userid=2&cached=true](http://portal.iri.columbia.edu/portal/server.pt?open=18&objID=7959&qid=44812383&rank=1&parentname=SearchResult&parentid=21&mode=2&in_hi_userid=2&cached=true)), *Building Capacity to Produce and Use Climate and Environmental Information for Improving Health in East Africa*, to other areas of the African continent

Finally, the initiative is working to develop an ACRE SE Asian data rescue and regional foci. Funding proposals for network meetings to start ACRE SE Asia have been made to the Asia-Pacific Network for Global Change Research's CAPABLE call (*ACRE SE Asia – towards new weather and climate baselines for assessing weather and climate extremes, impacts and risks over SE Asia*), and to the UK FCO in Singapore in response to a request from them for an environmental network meeting in the region (*Environmental History and Bio-diversity in Southeast Asia: A Collaborative Workshop*). The following panel below shows the aims of ACRE SE Asia, and the potential for using the ACRE-facilitated 20CR output to assess weather extremes and climate drivers across the region (further refinement through PRECIS system-downscaling of ACRE-facilitated 20CR output is also being developed).

## ACRE SE ASIA

**The primary goals of the Atmospheric Circulation Reconstructions over the Earth (ACRE) SE Asian are:**

- To build both capabilities & capacities within SE Asian institutions, agencies & National Meteorological Services (NMS) to improve & extend historical instrumental, documentary & palaeo databases of SE Asian weather/climate.
- New historical SE Asian instrumental weather observations will contribute to the mass of global weather data being used by new generations of high-resolution historical global weather reanalyses (especially EC FP7-funded ERA-CLIM [<http://www.era-clim.eu/>] & the ACRE-facilitated 20<sup>th</sup> Century Reanalysis Project [20CR] [[http://www.esrl.noaa.gov/psd/data/20thC\\_Rean/](http://www.esrl.noaa.gov/psd/data/20thC_Rean/)]).
- These new global reanalyses will be downscaled to provide scientists & policy makers across the region with high resolution baselines that are able to address weather /climate extremes, impacts & risks in ways & over time spans not previously possible.

**Cold Surges**

MSLP 6<sup>th</sup> February 1908 20CR Daily Composite of a Cold Surge

**Typhoons (1887-present)**

On the 8th of October 1881, a massive typhoon struck Haiphong.

- Up to 300,000 people were thought to have been killed.
- It is considered to be one of the deadliest cyclonic storms in history.
- Winds were estimated at 185 km/hour over the Gulf of Tonkin, it generated a 7 metre storm surge.
- It is currently not in the International Best Track Archive for Climate Stewardship (IBTrACS) data base nor in 20CR.

• An improved 20CR could resolve the 1881 and similar events