Development of Australian-Southeast Asian Atmospheric Observation Capability

The 5th Asia-Pacific GAW Workshop on Greenhouse Gases
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Outline of today's talk

CSIRO Australian Greenhouse Gas Observation Network (AGGON) –

- **Southeast Asian – Australian tropical regional GHG observation network**
  - ➢Gunn Pt tropical station update
  - ➢New Malaysian GAW station

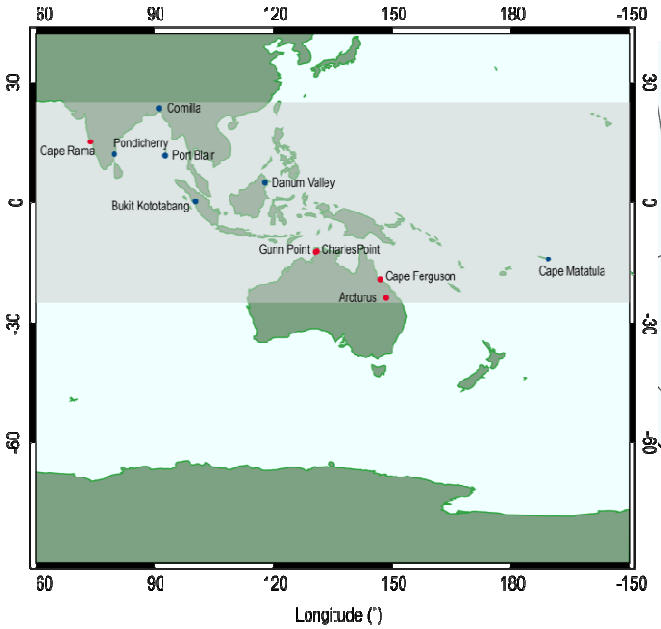
- **Australia's future research vessel (RV Investigator)**

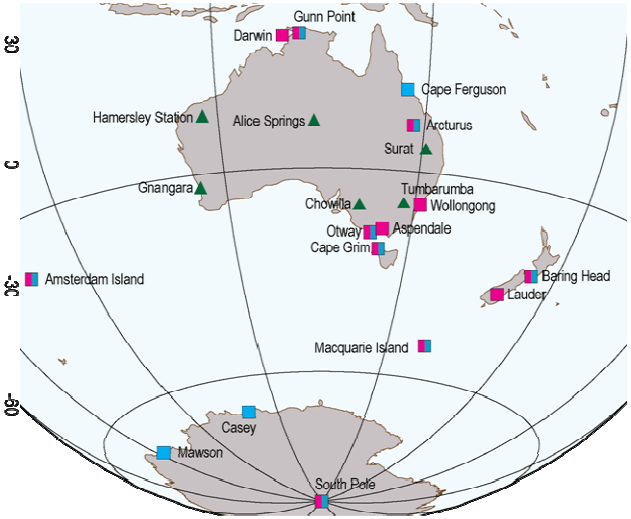
AGGON Research Applications

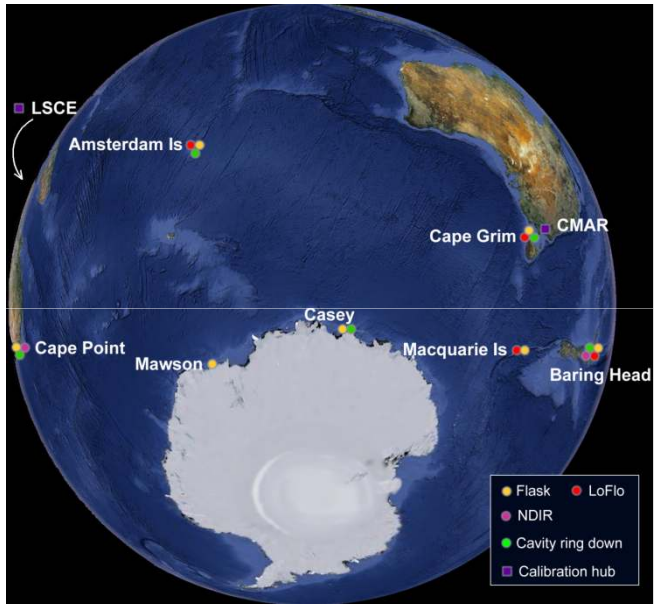
Objectives of AGGON expansion:

1. Continental Australian network to develop “top-down” emission verification tools (eg Australian Coal Seam Gas fugitive emissions applications - Arcturus GAW station, QLD)
2. Quantifying the changing Southern Ocean CO_2 sink (from an atmospheric perspective)
3. Understanding key atmospheric processes in the Southeast Asian - Australian tropical region
4. New research platforms - blue water research vessel RV Investigator (operational early 2014)

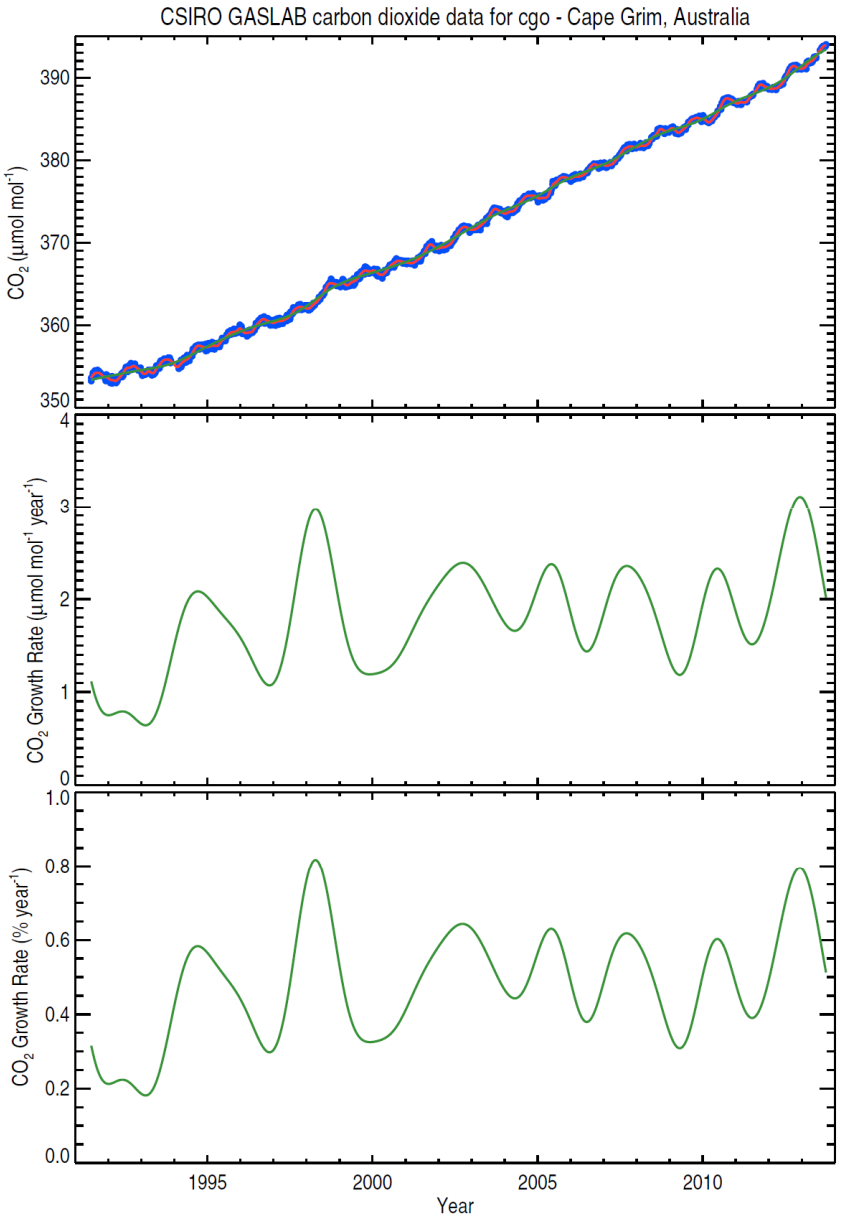
AGGON Research Applications







SH CO_2 2013 update - Cape Grim *(flask CO_2)*



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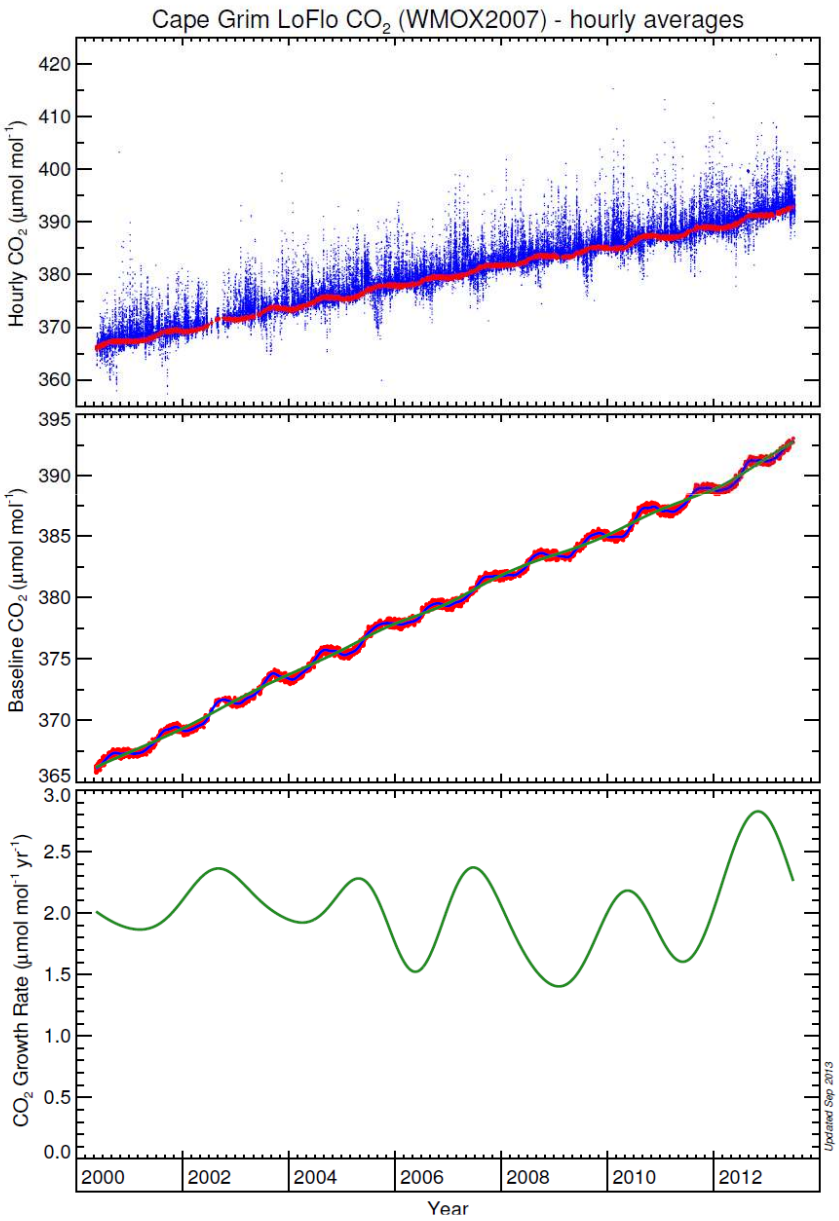
SH CO_2 2013 update - Cape Grim *(LoFlo in-situ CO_2)*



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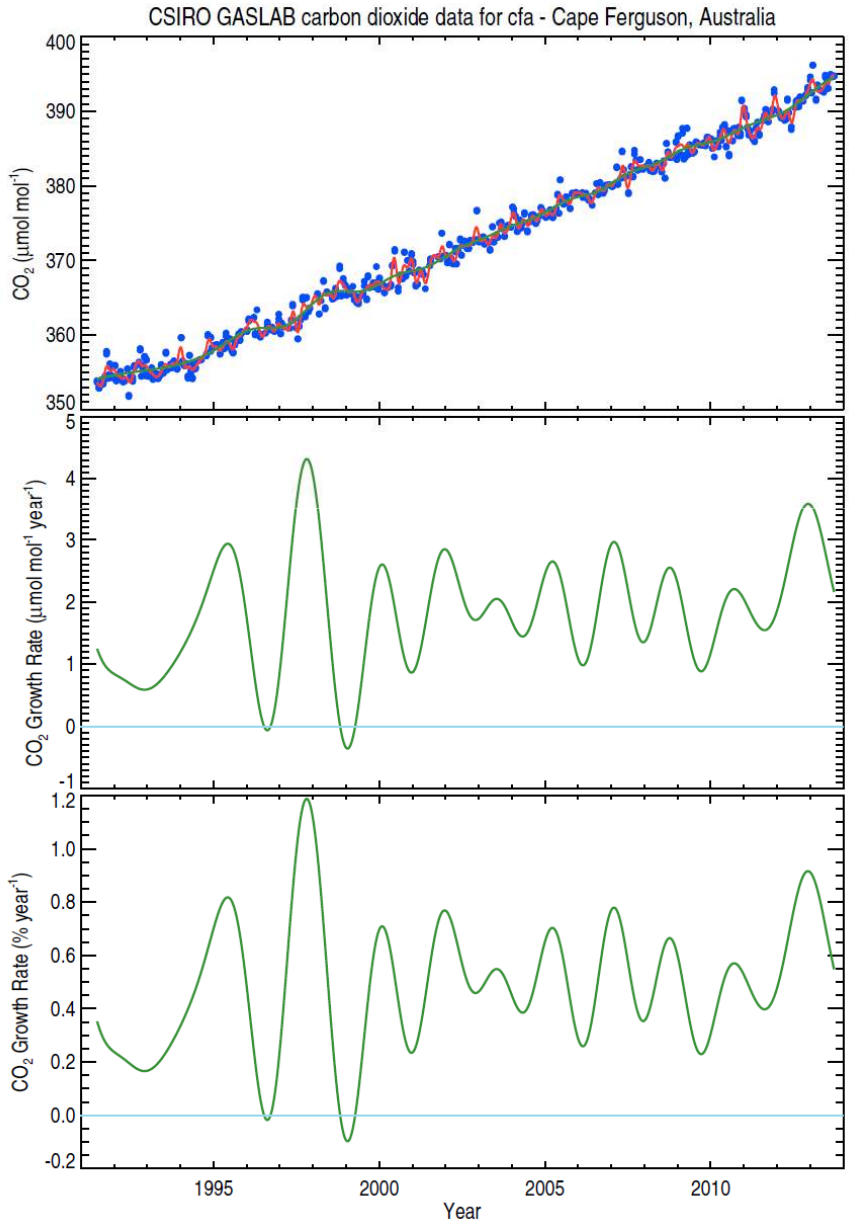
SH CO_2 2013 update - Cape Ferguson (19°16‘ S 147°3’E)



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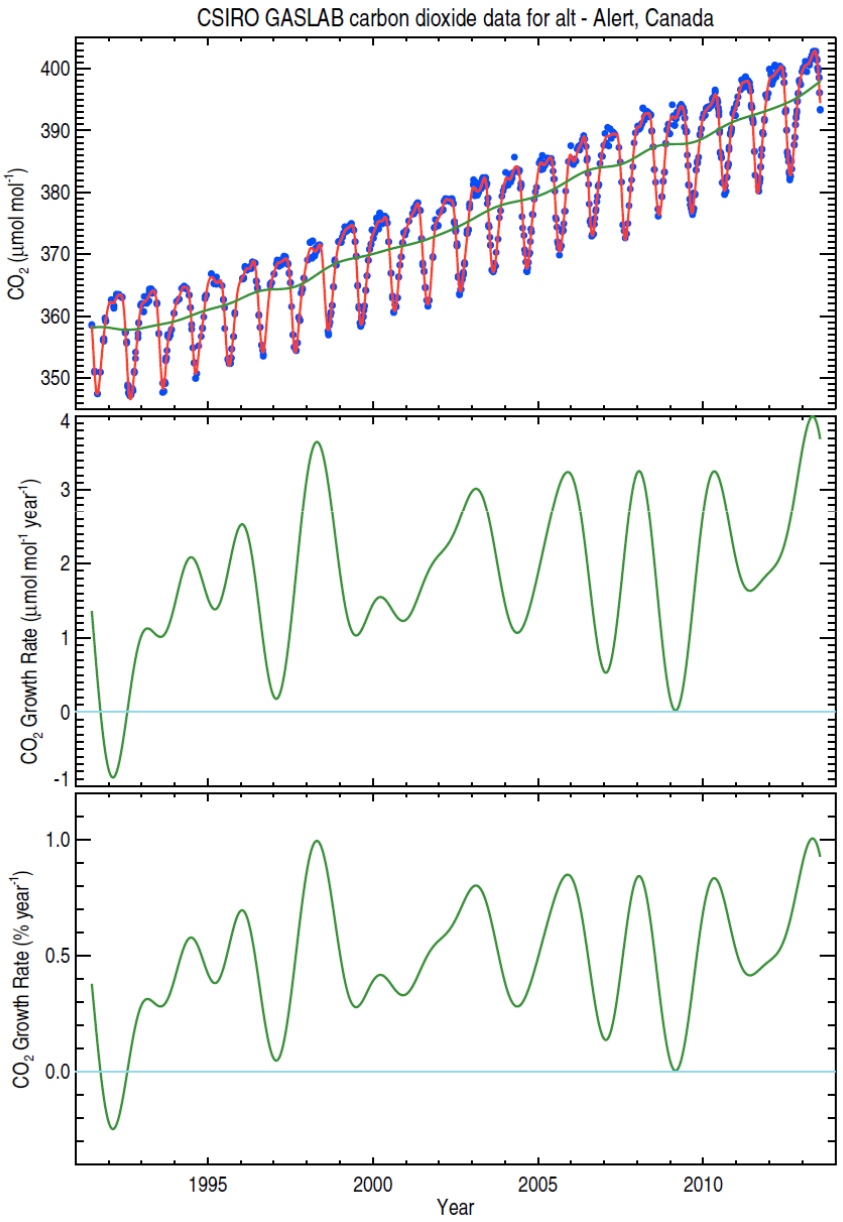
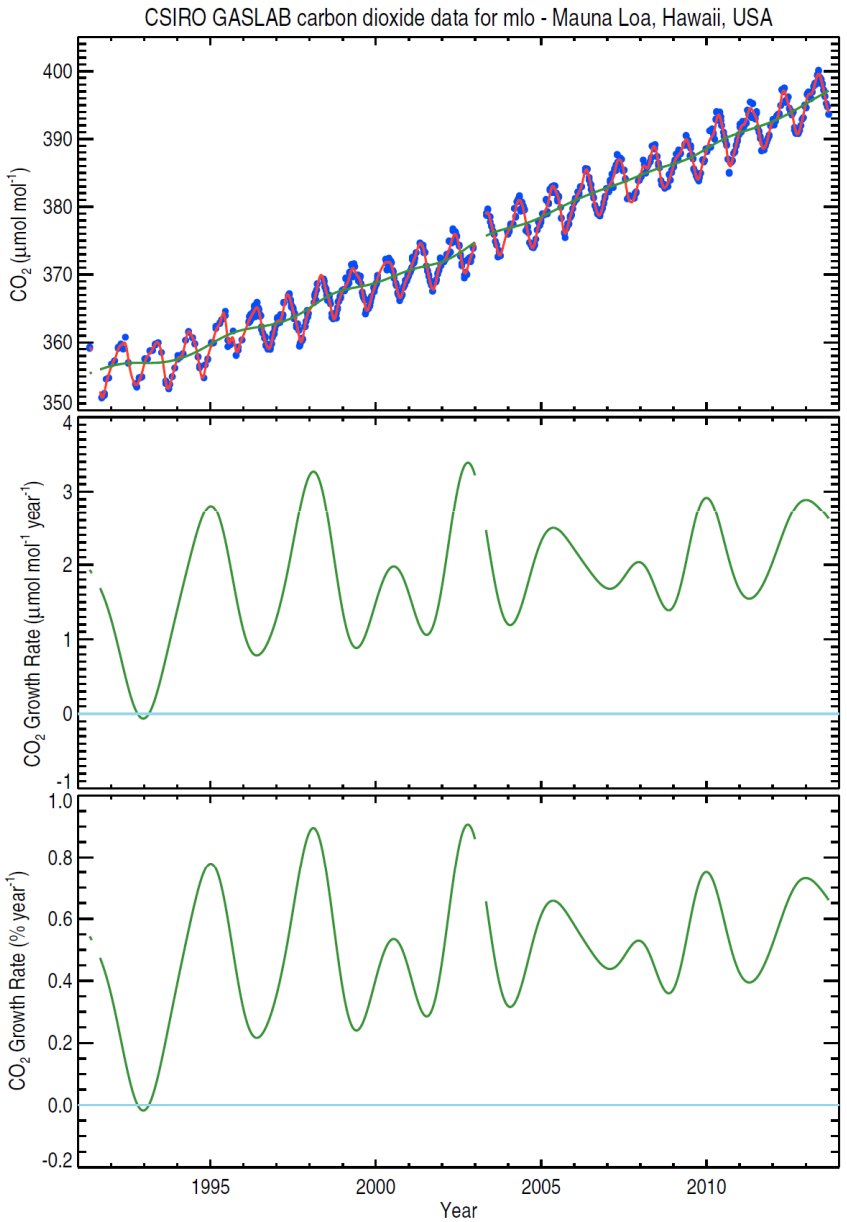
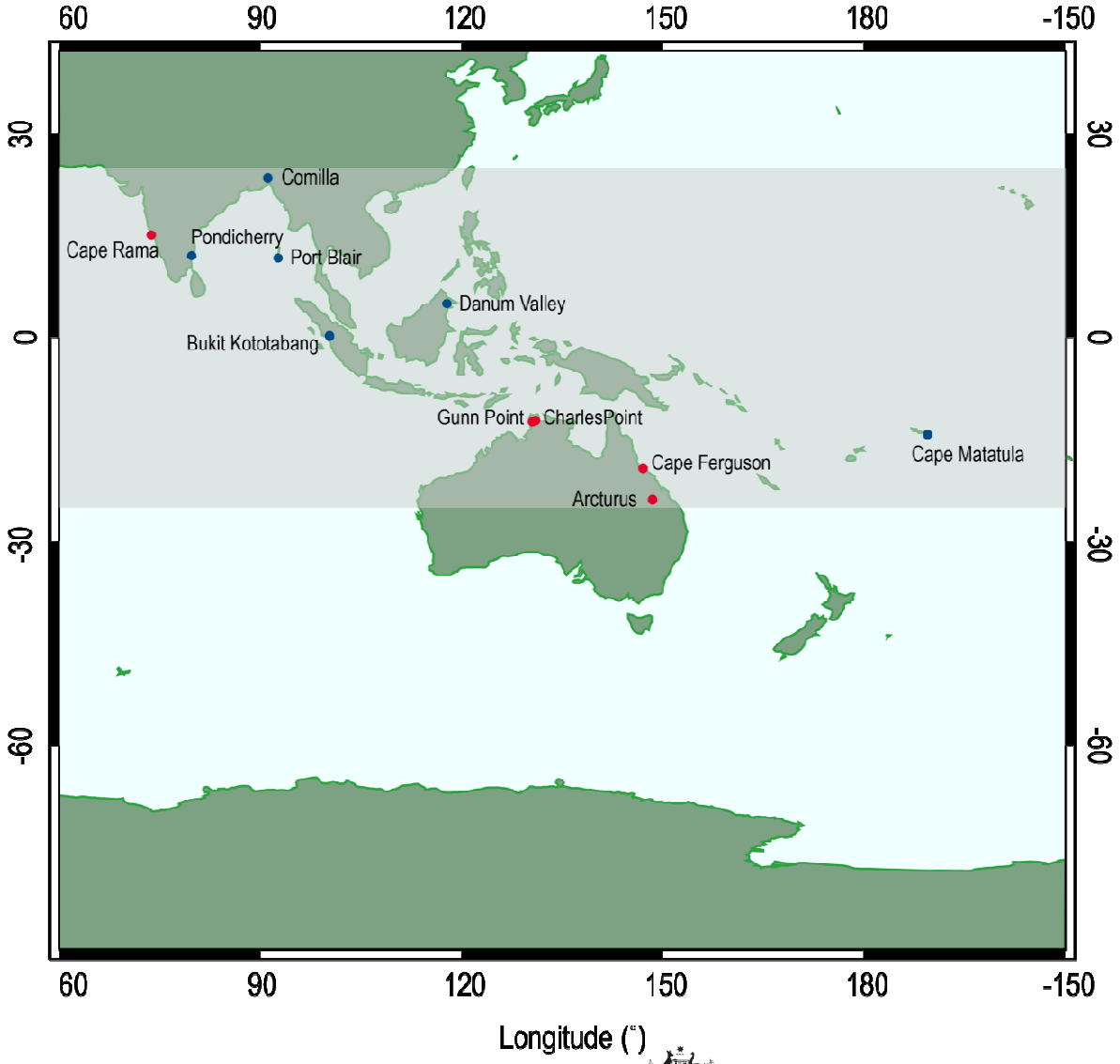
NH CO_2 2013 update - Alert and Mauna Loa





Tropical Southeast Asia-Australian regional network



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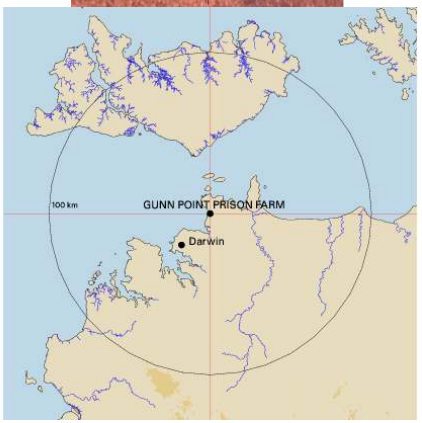
Gunn Point Pilot Tropical Atmospheric Research Station (GAW)



- **Latitude :** 12º 15'S
- **Longitude :** 131º 3'E
- **Elevation:** 25 m
- **Road Access**
  - 1-2 hours from Darwin (70 km road)
  - 4WD
  - 35 km unsealed road subject to wet season flooding
- Site History
  - Ex-prison farm (closed 1990)
  - Radar Site - Bureau of Meteorology lease since 2004
  - Atmospheric Radiation Measurement Site (ARM funded US Department of Energy)
- Power
  - Town power (generally reliable but does fail in storms)
  - Backup generator for essential applications (~3 days)
- Communications
  - Land line and mobile next G reception

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Gunn Point GAW station update (NT) (12º 15’ S 131º 3’ E)

Gunn Point – atmospheric measurement program

- Current (June 2013)
  - *In-situ* CO_2 & CH_4 (CRDS)
  - *In-situ* $^{13}CO_2/^{12}CO_2$ *(CRDS)**
  - Flask CO_2, CH_4, $^{13}CO_2/^{12}CO_2$, N_2O, CO, H_2
  - Radon (ANSTO)
  - Short-lived halocarbons ($CHBr_3/CH_2Br_2/CHCl_3/C_2Cl_4/CH_2CCl_3/CCl_4$..): GC-ECD (N. Harris, U. Cambridge, UK) (2013)
  - AWS (Jul 2013) and tower meteorology (WS, WD)
  - O_3 (UV spectrometry) / CO (NDIR) /NO/NO_X *(chemiluminescence)*
  - *Aetholometer and nephelometer*

- Proposed measurement program
  - *In-situ* CO/N_2O (Off-axis ICOS-Los Gatos) (2013/14)
  - $PM_{2.5}/PM_{10}$
  - Aerosols+VOCs (dry season campaign completed June 2010)
  - Campaign early dry season April/May 2014

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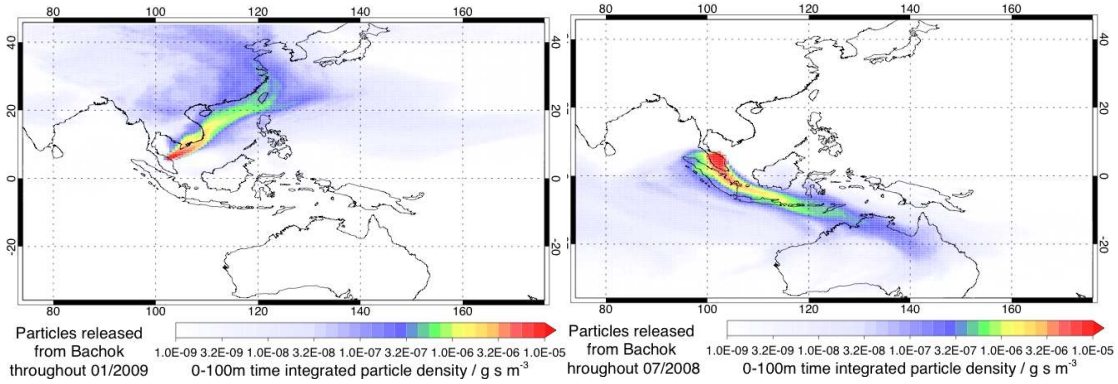
Future GAW station in Malaysia (Bachok) (*courtesy Dr. Iq Mead)*

- University of Malaysia / University of Cambridge (UK) collaboration *"International Opportunity Fund" (IOF) (NERC funding)*
- At University of Malaya Bachok research station (east coast peninsula Malaysia)
- Objectives:
  - Improve UK/NCAS capability to observe atmospheric changes in SE Asia
  - Install instruments and programmes
  - Demonstrate potential of site
  - Maintain observational program
  - Establish / develop scientific networks

IOF at Bachok. A Brief Overview (*courtesy Dr. Iq Mead*)



NAME back-trajectories in lowest 100m from Bachok during January 2009 (left) and July 2008 (right). Warmer colours show the chance of air being in that place in the previous 12 days.

Meteorology

Winter: Northern Monsoon with flow from Siberian High over SE Asia.

Summer: Southwest Monsoon with Flow from Australia and sometimes the Bay of Bengal.

Involved Stations:

B: Bachok Station (University of Malaya).

BA: Bukit Atur (Danum) GAW site (Malaysian Meteorological Department).

D: Darwin Site (CSIRO).

LL: Lu-Lin GAW site (Taiwan National Central University).

TR: Tana Ratah Site (Malaysian Meteorological Department).

X: Taiwan Coastal Site (Taiwan National Central University).

Bachok Measurement Program (Dec 2013) (*courtesy Dr. Iq Mead*)

Bachok instrumentation (permanent):

- N_2O
- NOx
- O_3
- SO_2
- Aerosol (0.25 to 32um)
- *CO_2/CH_4/H_20 (~Mar 2014)*

Jan 2014 Campaign –

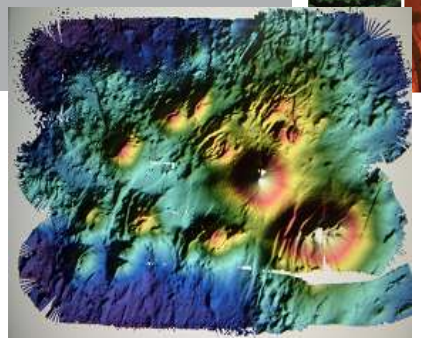
- **UEA instruments:** SO_2, Teco NOx, O_3, HCHO, TA3000 CO/H_2, PTRMS, flasks
- **UK (non UEA):** spectral radiometer (Leeds), VOC/OVOC FID (York), filter collection (York)
- **Non-UK:** Grimm aerosol (UKM), radiosondes (UM), wet deposition (MMD), MAX-DOAS (NIWA/Bodecker), flasks (CSIRO)

Future Research Vessel Project

RV *Investigator* – a new era in marine and atmospheric research for Australian scientists and international collaborators

Vessel Capability Comparison

Capability	*Southern Surveyor*	*Investigator*
Length	66 m	93.9 m
Width	12.5 m	18.5 m
Number of scientific berths	15	40
Max distance in a single voyage	6 000 nautical miles	10 000 nautical miles
General purpose	Retro-fitted	Purpose-built scientific research vessel



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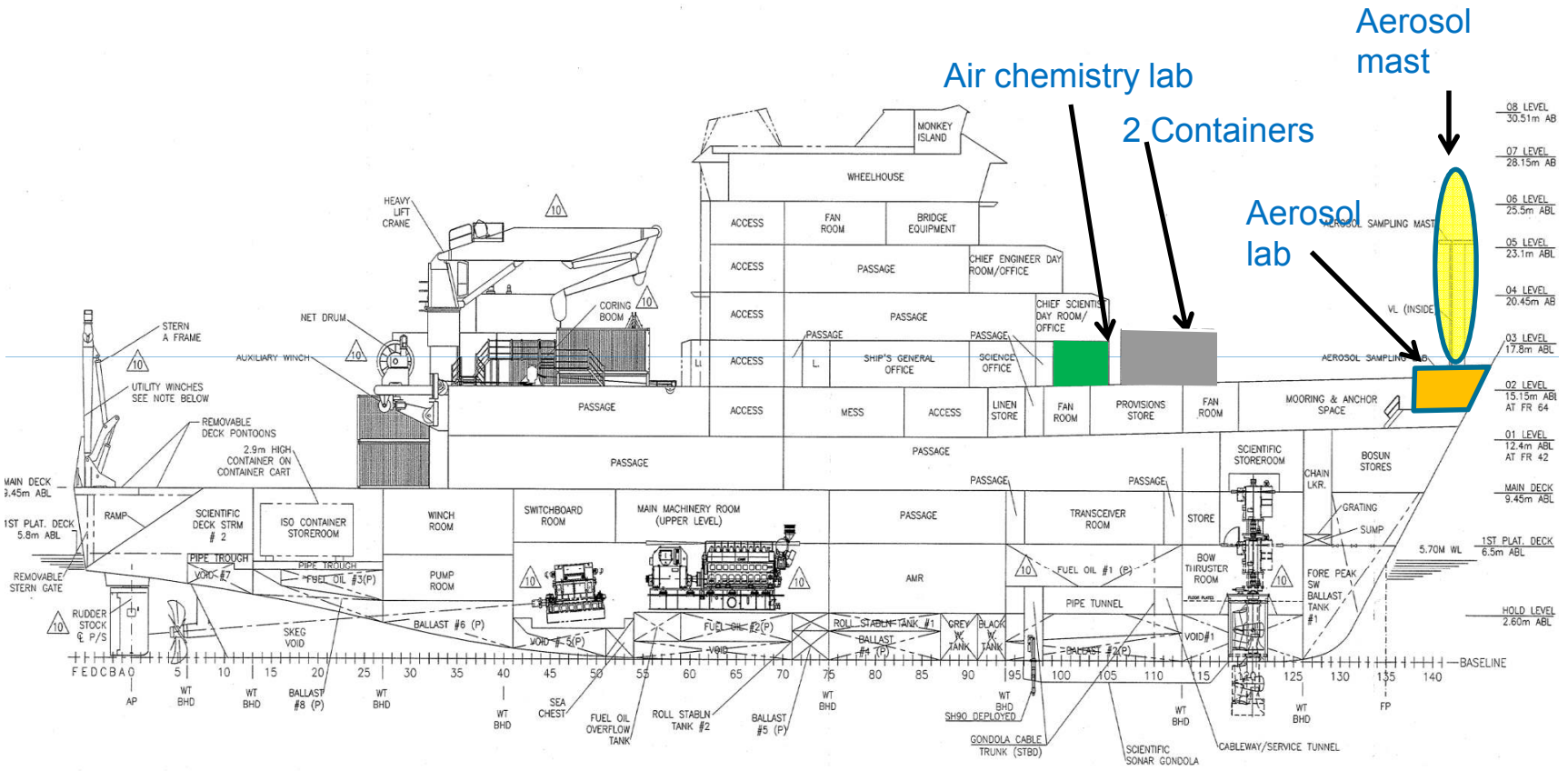
RV Investigator Research Program

- **GHG spectrometers (CO_2/CH_4, N_2O/CO)**
- **O_2/N_2**
- **Polarimetric Weather Radar**
- **Absorption photometer**
- **Atmospheric nephelometer**
- **Ozone monitor**
- **NOx monitor**

- Sea surface temperature radiometer
- Gravity meter
- Multicorer
- Towed general purpose profiling CTD
- Underway water analysis instruments
- XBT system
- CTD/O_2 Rosette System
- 24 and 36 bottle carousel & frame
- Trace-metal rosette
- Trace-metal in-situ pumps

Location of atmospheric chemistry labs and position of specialist containers.



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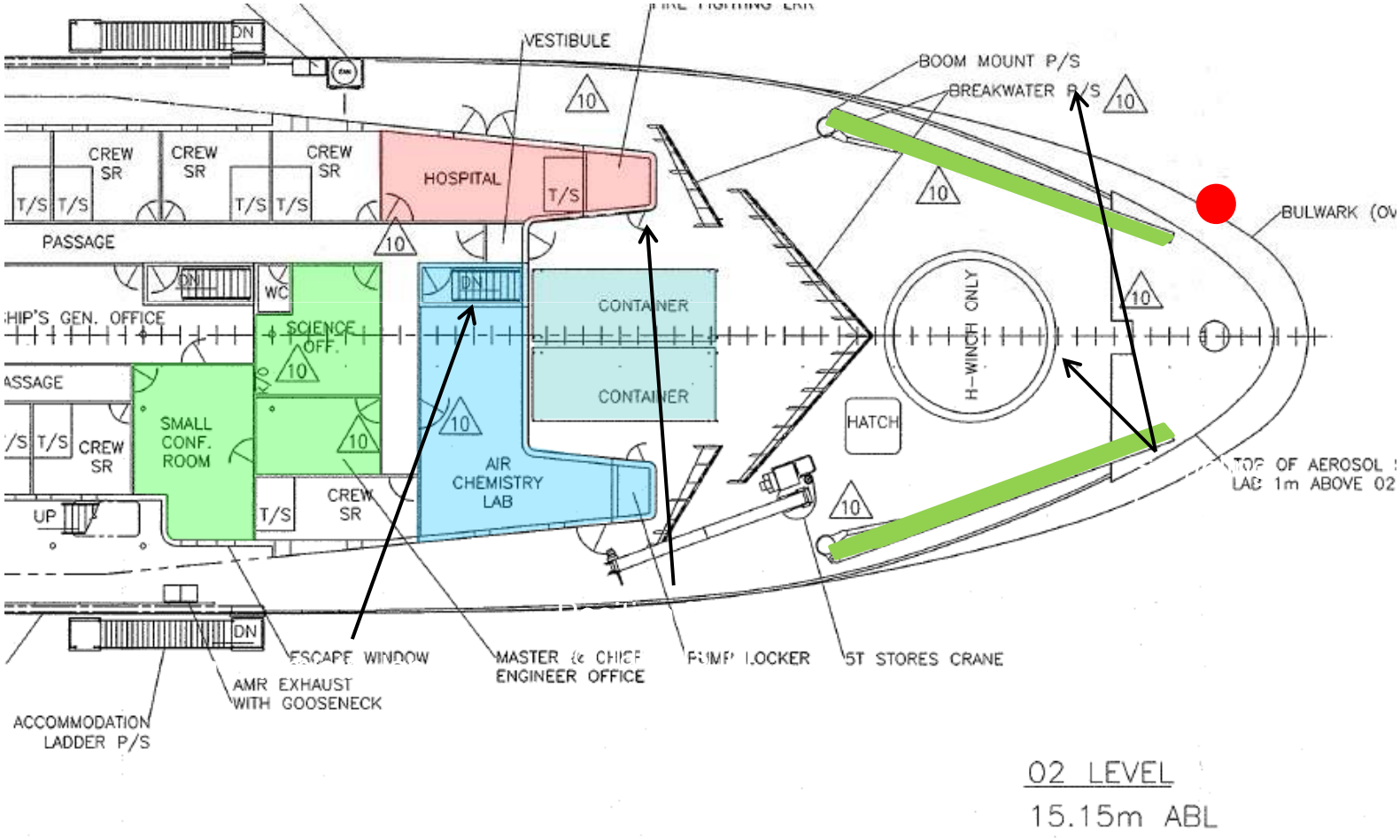
Air chemistry lab, containers and booms



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