UK University and Met Office contribution to YMC

HotHouse: The Maritime Continent – Engine Room of the Global Climate System

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Introduction

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- Proposal for 5 year £3.7 million ($5.6 million USD) project, with observations Jan-Feb 2019 to NERC
- Current status of proposal:
  - Outline proposal submitted in March 2015: successful
  - Full proposal submitted Nov 2015: outcome expected July 2016
  - Average success rate 30-50%
  - Subsequent opportunities to submit a revised project (modelling)
- This talk contains an overview of:
  - Science objectives
  - Ground and ocean instrumentation
  - Aircraft campaign
  - Modelling strategy
  - Key questions for the YMC community

Science objectives

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HotHouse aims to quantify the:

1. Complex interactions that govern the diurnal cycle of precipitation and heating
   - Development of the boundary layer and convection over the islands
   - Generation of land-sea breezes and gravity wave circulations, and the offshore convective propagation.
2. Impact of upper ocean processes and air-sea interaction on atmospheric convection
3. Two-way interaction between convection and lower-frequency variability (MJO, synoptic-scale weather)
4. Effects of heating and cooling from moist convection over the MC on the global climate

Field campaign overview

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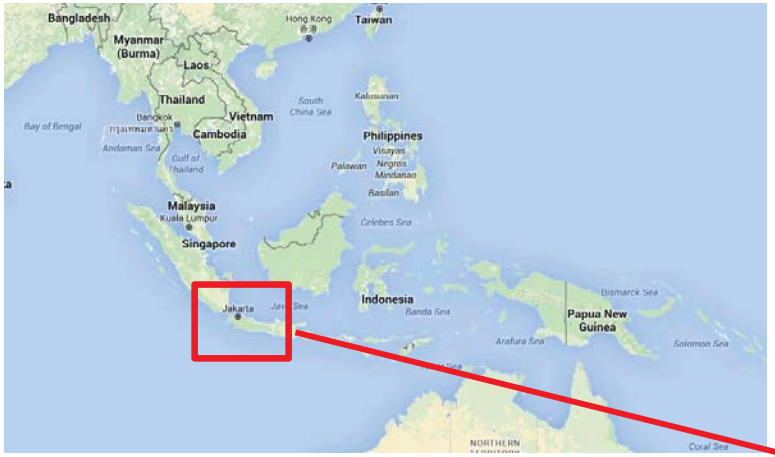
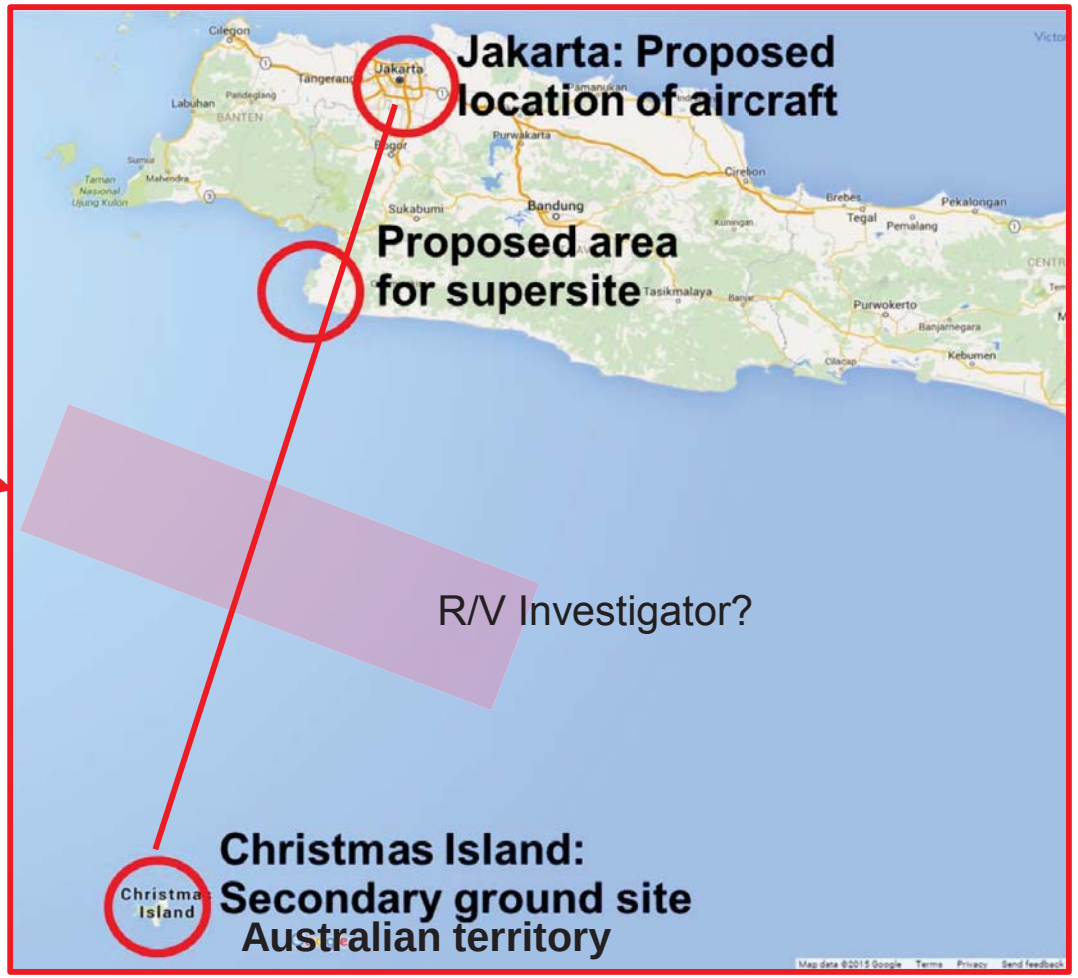


Field campaign to take place
15 Jan to 1 March 2019



Field campaign overview

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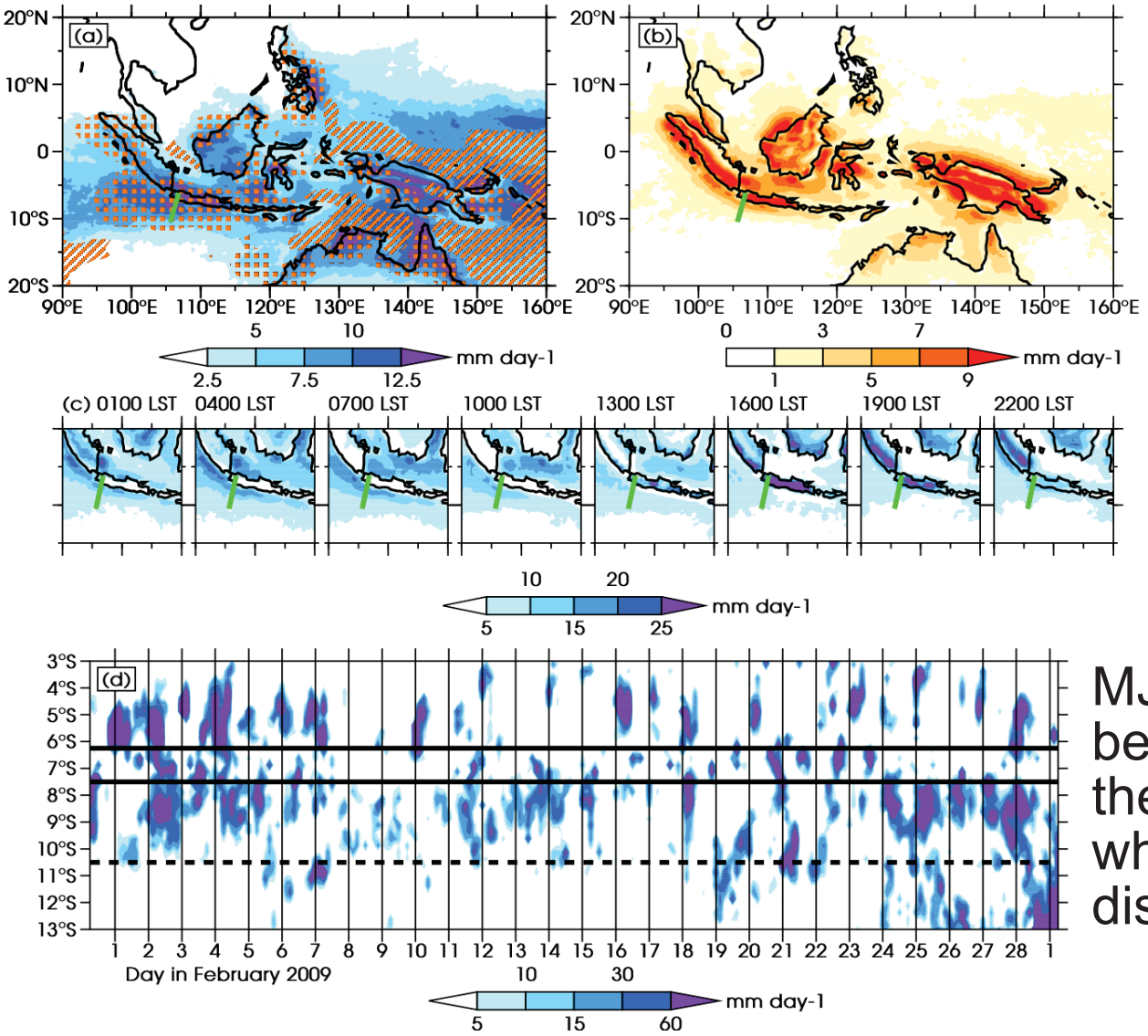
Mean November-April climatology

High mean rainfall



High diurnal amplitude

Offshore propagation

MJO at beginning of the month, which dissipates

Field campaign overview

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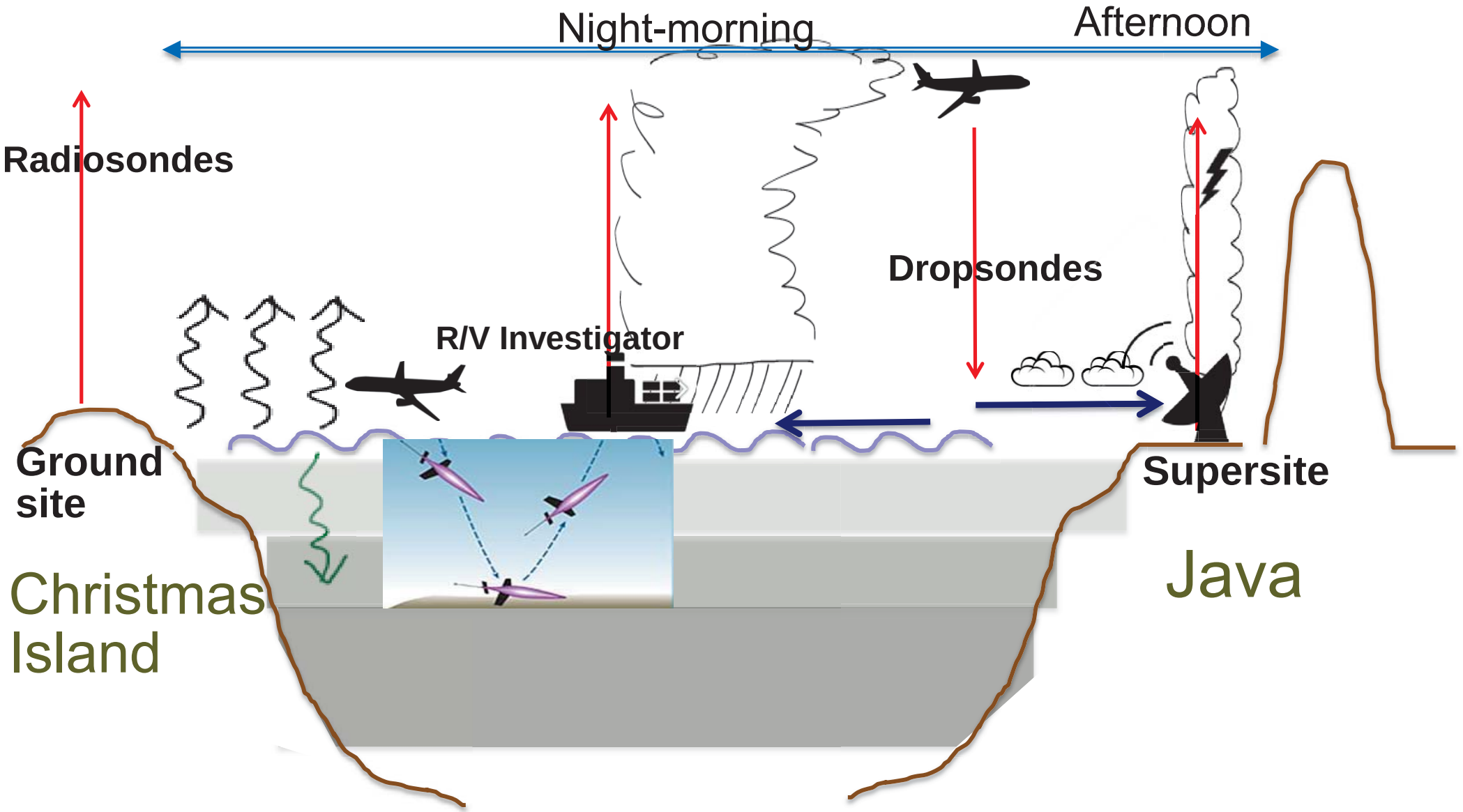

Shuyi Chen (UoMiami)

Ground supersite

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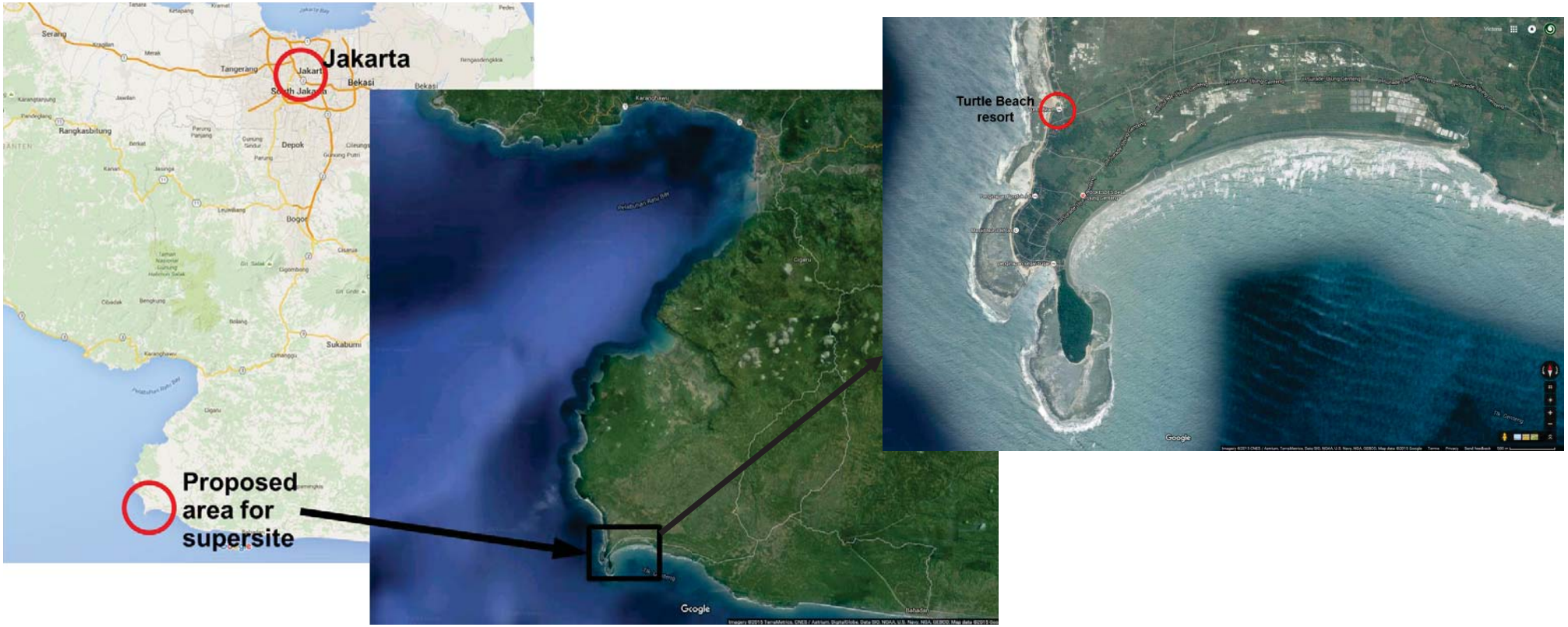


- Multi-platform suite of instruments (in-situ and remote sensing)

Ground supersite

X-Band Doppler Radar

- Areal precipitation
- Radial winds
- Polarisation parameters
- Maximum range 200km (100-150 km is typical)

- Sits on two 20ft shipping containers
- Office container with A/C plus empty one for storage
- Crane/forklift required
- Power by diesel generator
- Site availability – any local government land or similar? Security?
- Internet/network options. Satellite? Mobile data?
- Local assistance with logistics – hire a local manager?

Ground supersite

NCAS atmospheric measurement facility amf excellence in measurement

Doppler aerosol LiDAR

- Profiles of aerosol backscatter and radial velocity
- Max. range 9.6km

Scanning radiometer

- Vertical profiles of T, RH
- Liquid water path
- Stability indices

Boundary layer wind profiler

- Wind speed and direction
- Max. range 8km

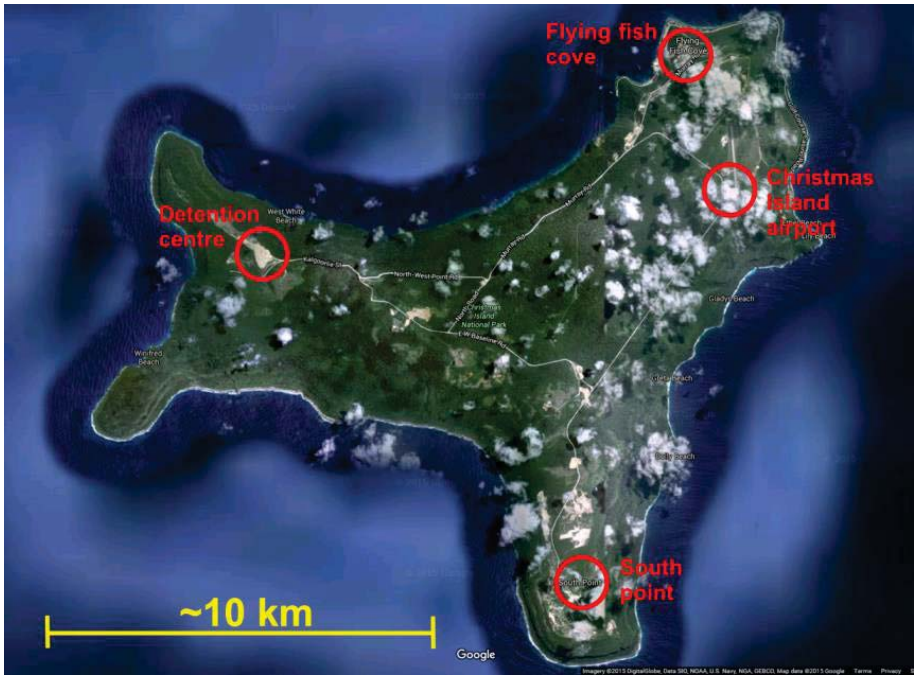
Vaisala RS41 radiosonde system

- 300+ sondes to launch (~8 per day for 6 weeks)

Flux towers

- p, T, q
- 10Hz 3D winds
- 10Hz H20 and CO2
- LW, SW radiation
- Soil temperature and moisture

Christmas Island



- Cloud Radar 94 Ghz
- Doppler LIDAR
- Microwave Radiometer

Vaisala RS41 radiosonde system

- 300+ sondes to launch (~8 per day for 6 weeks)
- Possibility of a 3rd radiosonde station for e.g. R/V Investigator
- Could share the 600 radiosondes between 3 locations

Flux towers

- p, T, q
- 10Hz 3D winds
- 10Hz H20 and CO2
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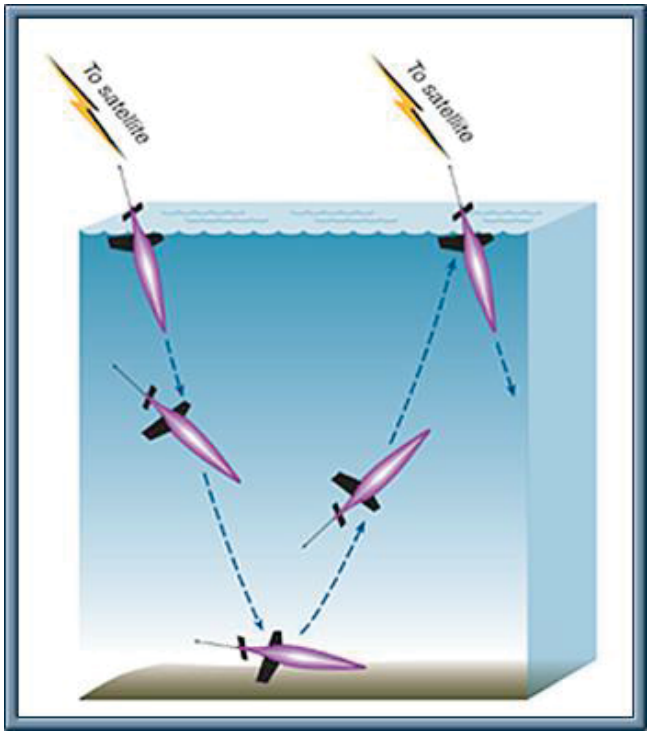
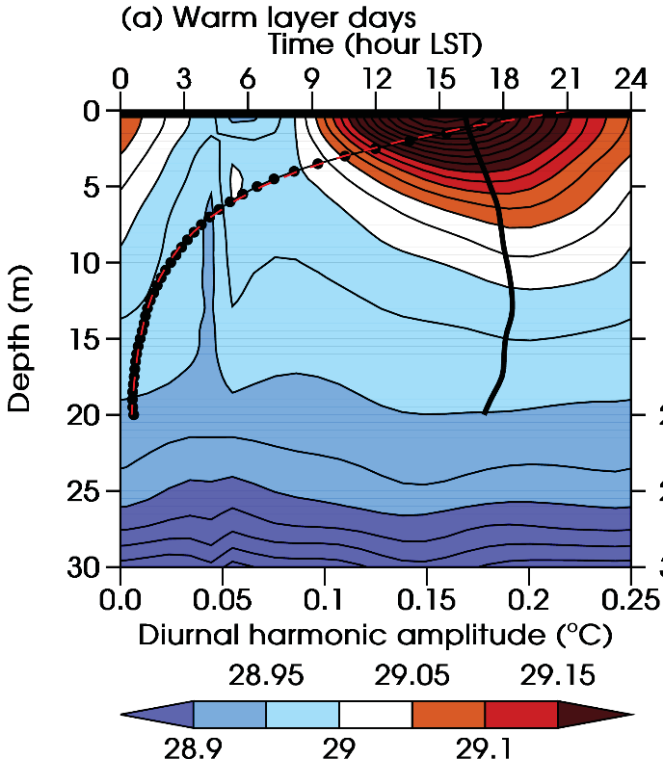
Christmas Island

University of East Anglia





- Unmanned seagliders will be launched for Christmas Island in Dec 2018
- Seagliders dive every 2 hours to depths of ~1km – diurnal cycle
- Measure upper ocean structure (T, salinity, chlorophyll, dissolved oxygen)
- Operate automatically for up to 4-5 months, data communicated via satellite

Aircraft campaign

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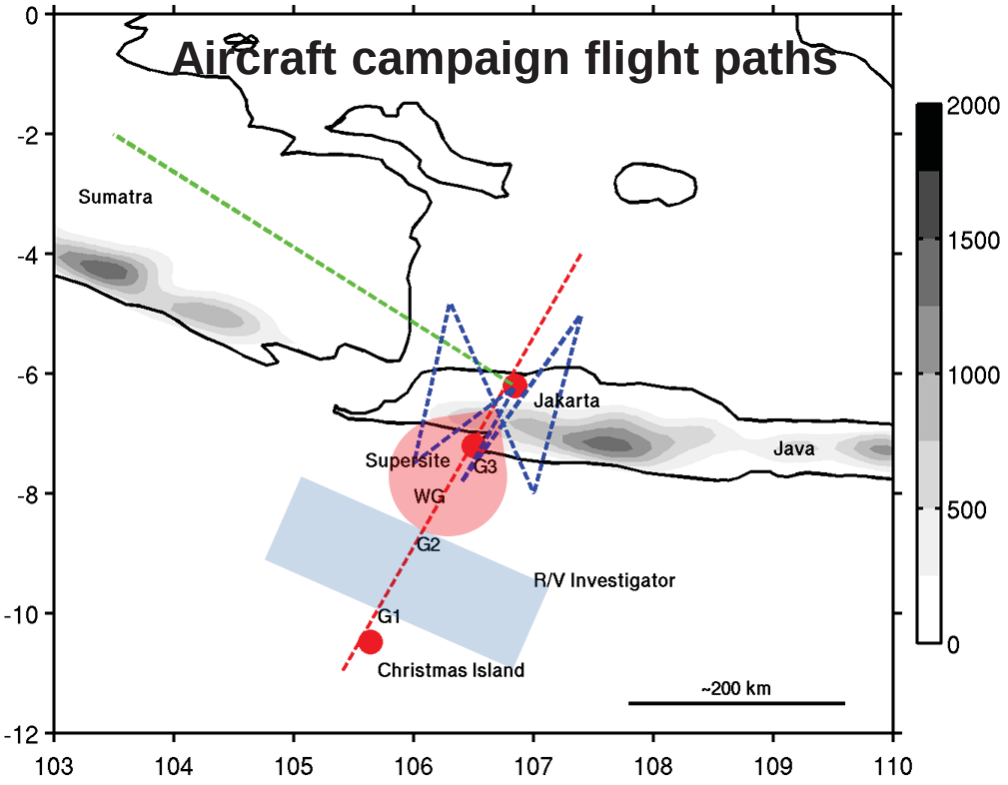
FAAM BAe146-301

- 5.5 week deployment in Jan-Feb 2019
- Based at Halim (Jakarta) airport
- 24 flights of 4.5 hours
- 147 dropsondes (6 per flight)



Aircraft campaign

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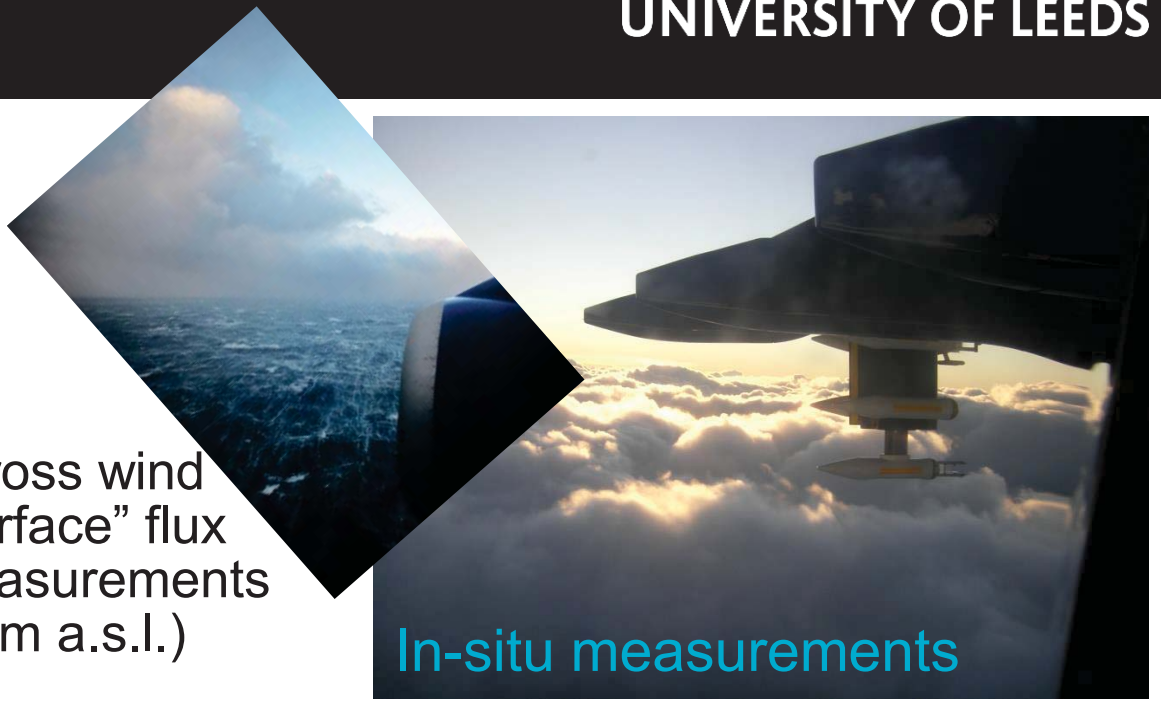
Basic Meteorology

- T, P, q
- Wind components, turbulence and fluxes
- LWC, IWC
- Position, attitude
- Sea Surface Temperature
- Dropsondes: T,q,winds



Across wind "surface" flux measurements (30m a.s.l.)

Cloud and Aerosols

- Full size range 0.1 μm to 6 mm: PCASP, CDP, CIP15, CIP100
- Cloud Condensation Nuclei Counter
- Basic chemistry O_3, CO

If flight permissions and research permits for Indonesia have not been obtained by April 2018 we will relocate to Malaysia or Australia

Modelling strategy

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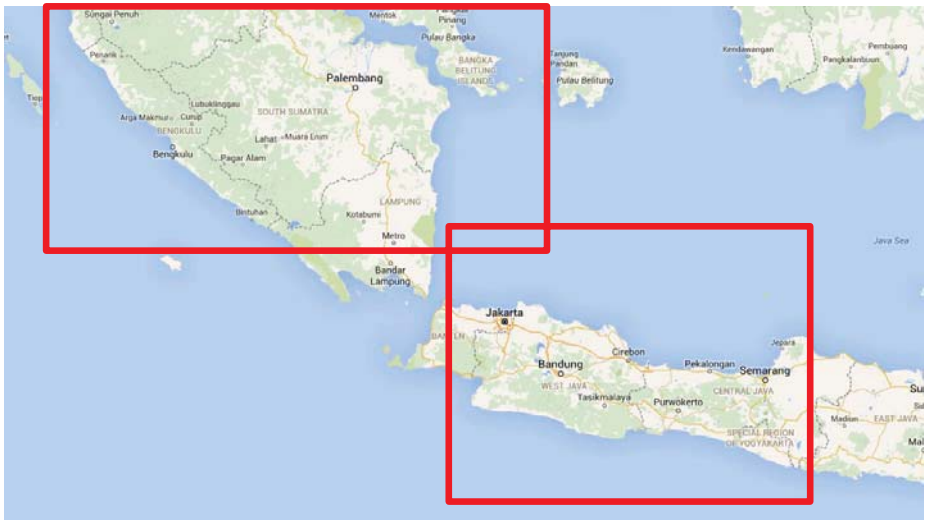
Met Office Unified Model simulations

- 15km standard configuration
- 2km convection-permitting
- 10xDJF seasons including 2019
- Coupled to an ocean mixed-layer model (MetUM-GOML)
- Driven by ERA-I or MetUM analyses



- 200m convection-permitting
- 20 case studies of two days at various locations to coincide with observations
- Outer nests driven by ERA-I or MetUM analyses

Forecast products for YMC campaign

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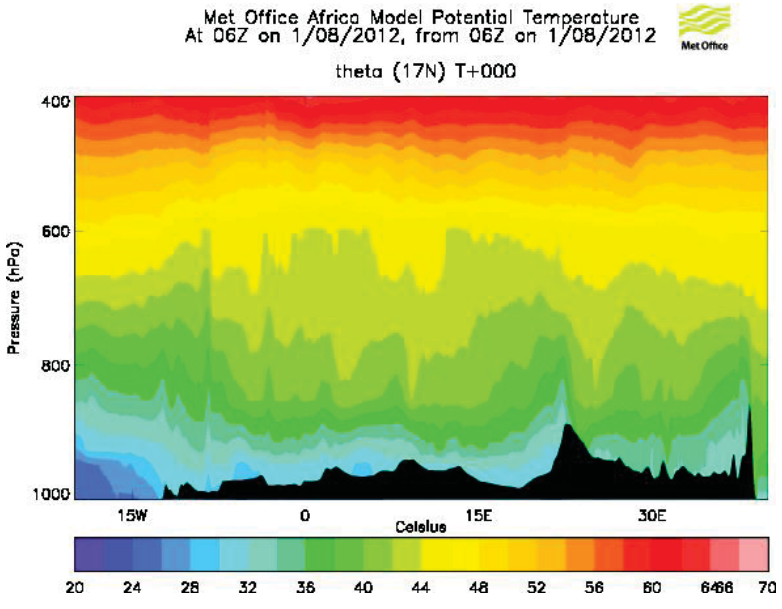

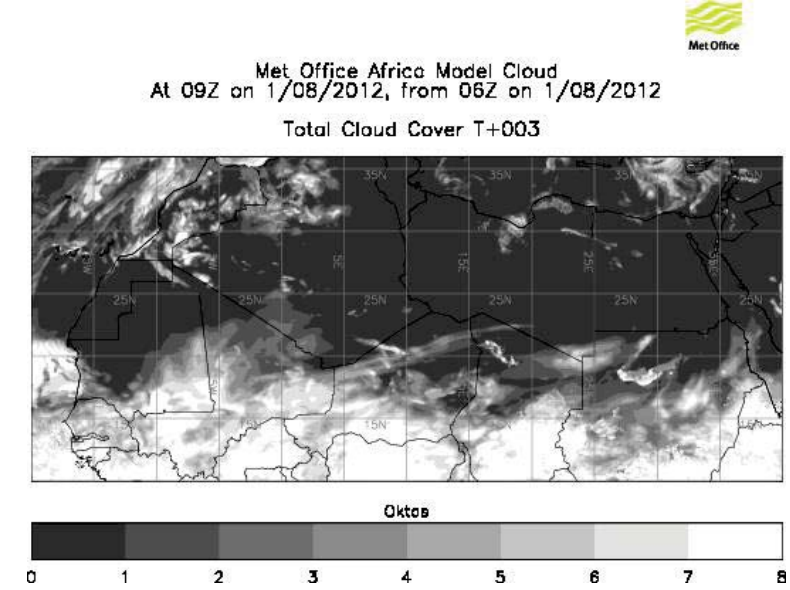

Met Office will provide forecast products for the field campaign:

- Twice daily global NWP forecasts (~17km)
- Daily 3-day convective scale model forecasts (2 or 4 km)
- Any model diagnostic could be plotted
- Made available via ftp
- Coordination with MSS?

Key questions

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- We are keen to collaborate and co-locate our instrumentation with other groups. Plan is currently flexible.
- Are any other groups planning to locate on Java or Christmas Island?
- We will require assistance with:
  - Locating ground sites on Java and Xmas Island – visit Jan/Feb 2017?
  - Obtaining research permits, and flight permissions for aircraft. Who to contact?
  - Local help with radiosondes (8 per day) on Java and Xmas Island
  - Hire local shipping/logistics manager on Java?
  - Who to contact about radiosonde launch permissions on Java?
- Planning cut off is April 2018 – look to Malaysia or possibly Australia
- Keen to collaborate on modelling
- We have proposed a local ‘Forecasting Demonstration Workshop’

Please come and talk to us

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