METEOROLOGICAL SERVICE SINGAPORE
Centre for Climate Research Singapore

Maritime Continent LFRic modelling at CCRS

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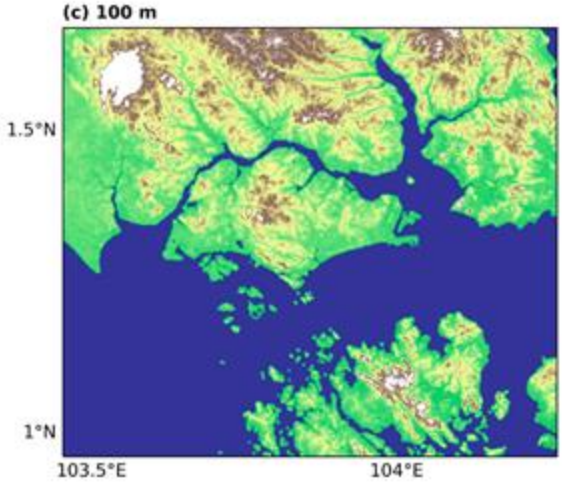
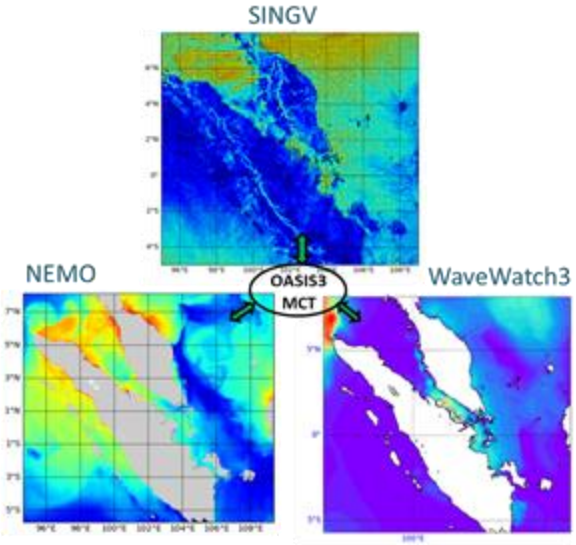
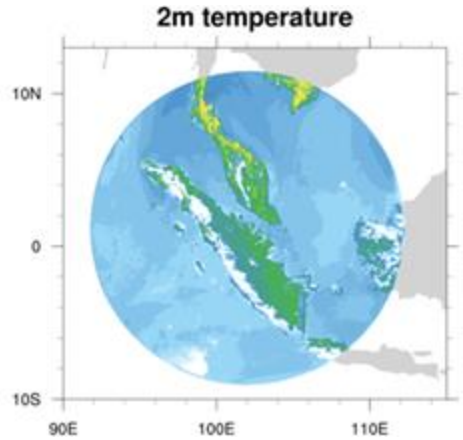
CCRS core modelling systems

Urban scale (uSINGV)	Coupled (cSINGV)	Next-gen (SINGV_NG)
• Sub-km urban-scale modelling	• Coupled & marine modelling	• Transiting to a next-generation model



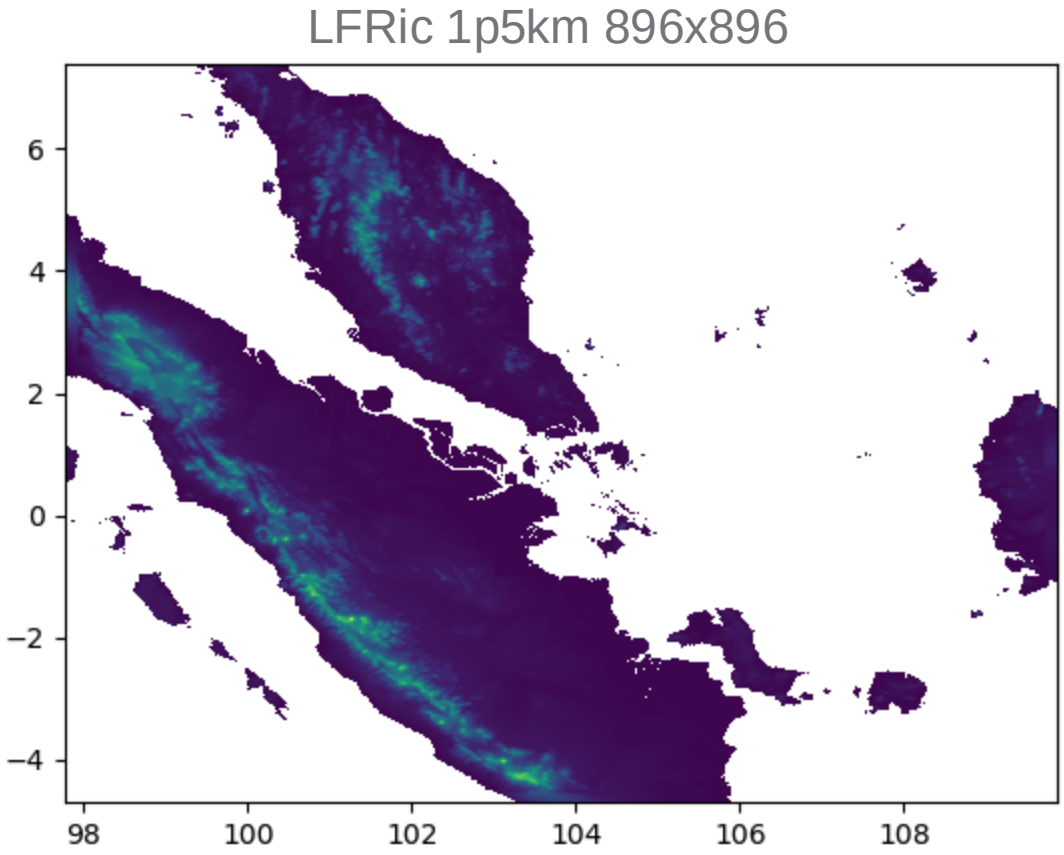




Model for Prediction Across Scales (MPAS, US)

Next Generation Modelling System (NGMS, UK)

CCRS RAL3-LFRic implementation

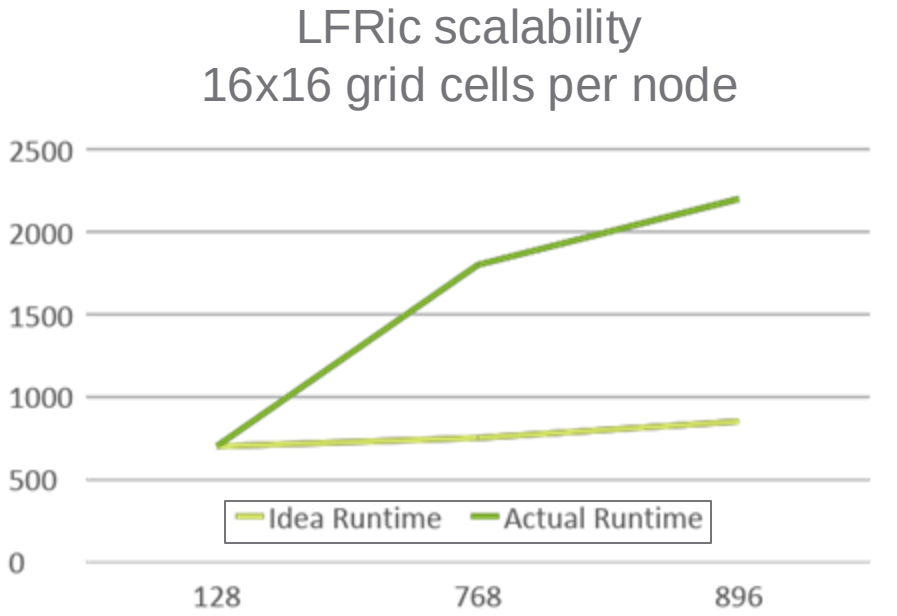


- Software versions:
- LFRic: r46556 (circa Nov 2023)
- LFRic RNS: r282084 (March 2024)
- ***news*** 1024x1024 domain also working

	UTAMA
CPU	2x AMD Milan 7713 64-core 2.0Ghz
Memory	512G DDR4@3200MT/s

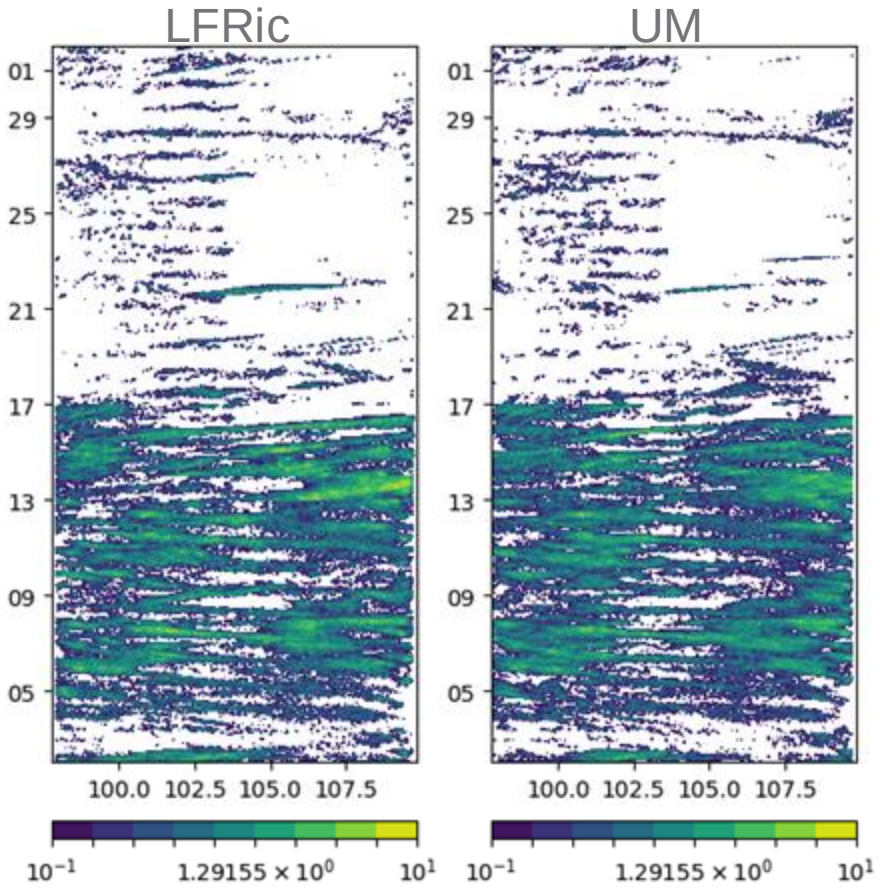
Scalability

- Increase core count proportional to domain size: x36, x49
- Ideally, walltime relatively constant as size and cores increase
- Actual scaling less efficient, in this range

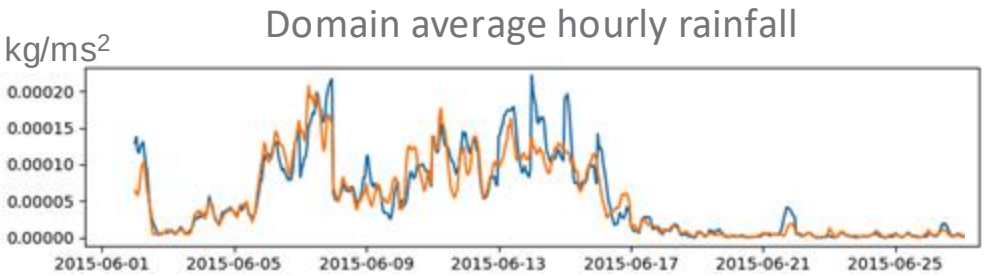


Domain size	Cores	Actual
128x128	64	700
768x768	2304	1800
896x896	3136	2200

Initial assessments of rainfall

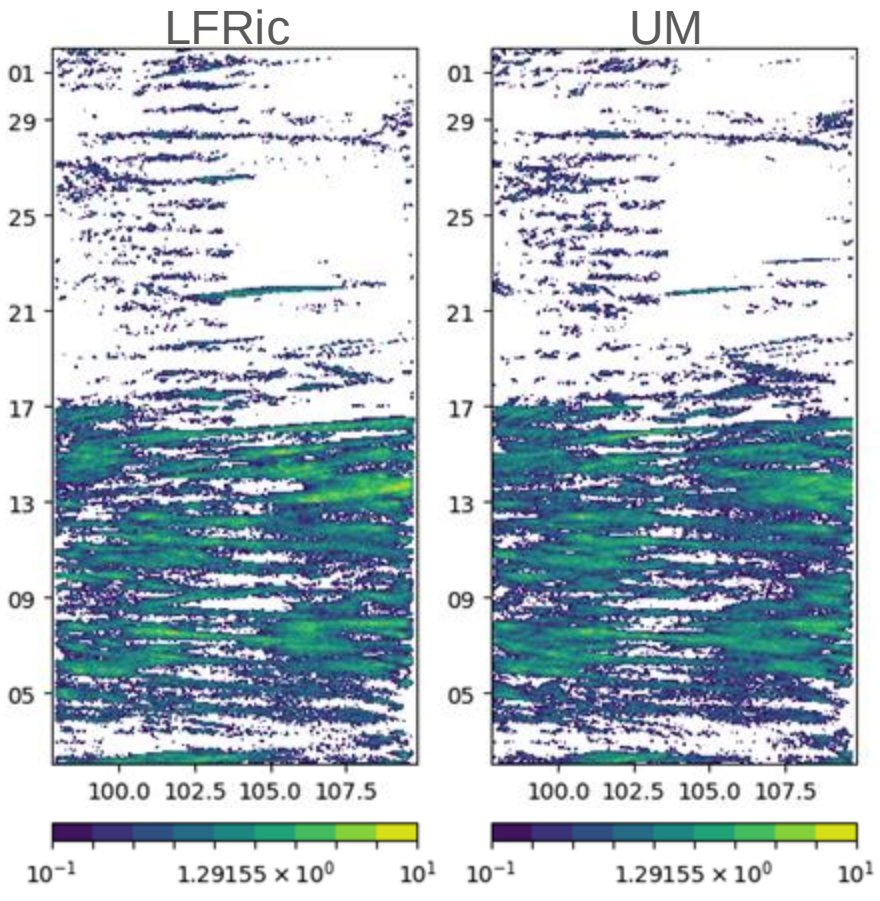


- 1-month (June 2015) test period
- 1 cycle per day (00Z)
- 48h forecasts
- Global UM driving

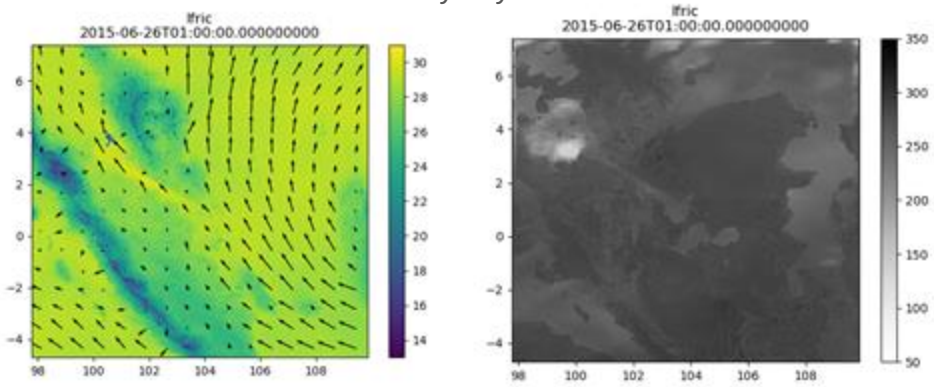


LFRic blue
UM orange

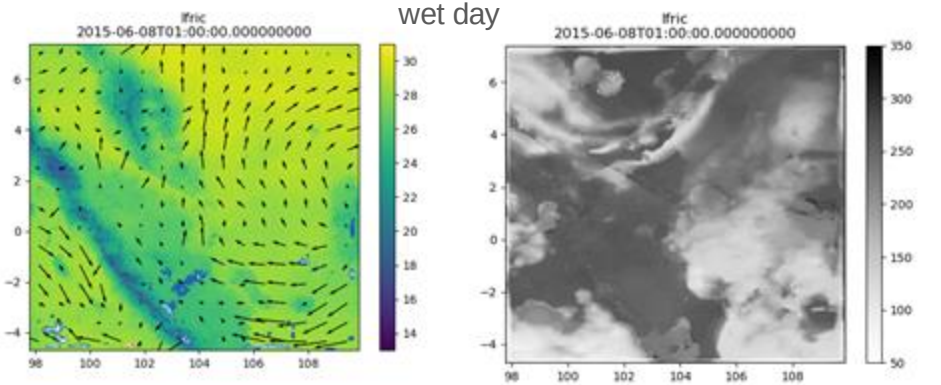
Initial assessments of rainfall



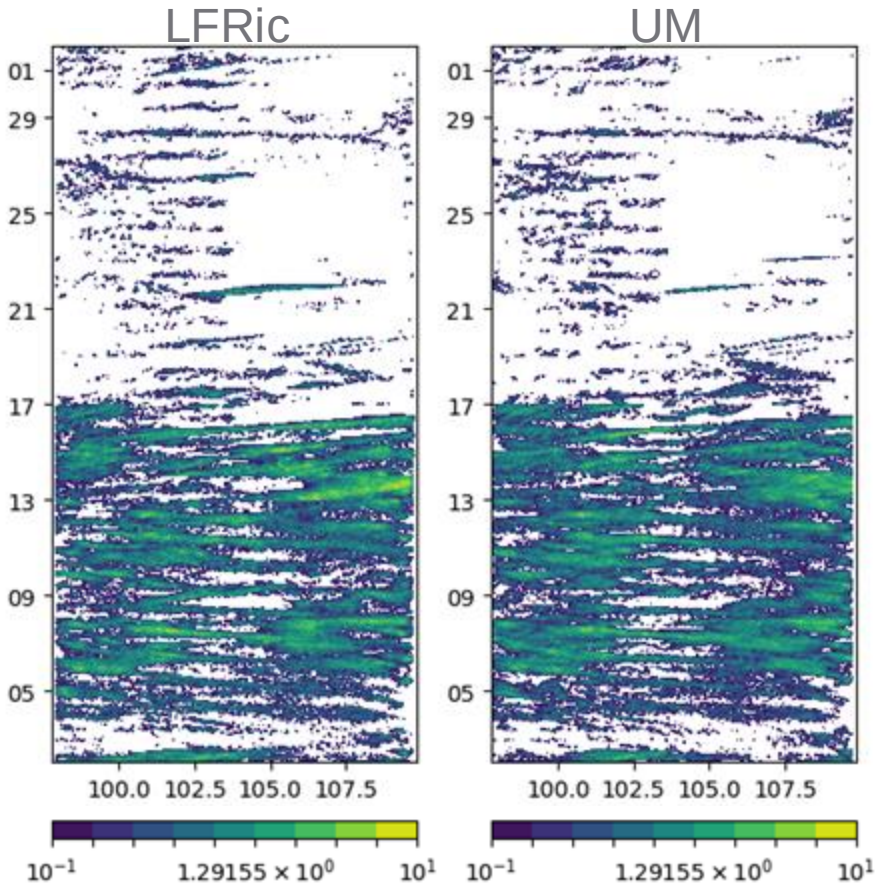
dry day

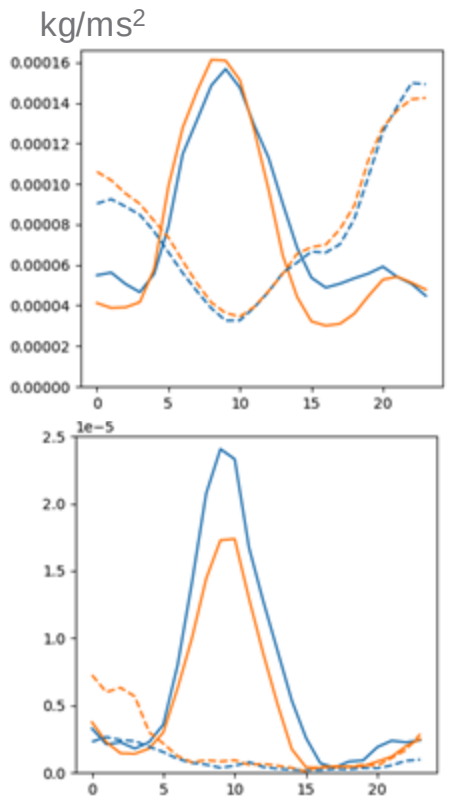


wet day



Diurnal cycle





dry period

Land: solid
Sea: dashed

LFRic blue

UM orange

wet period

Diurnal cycle

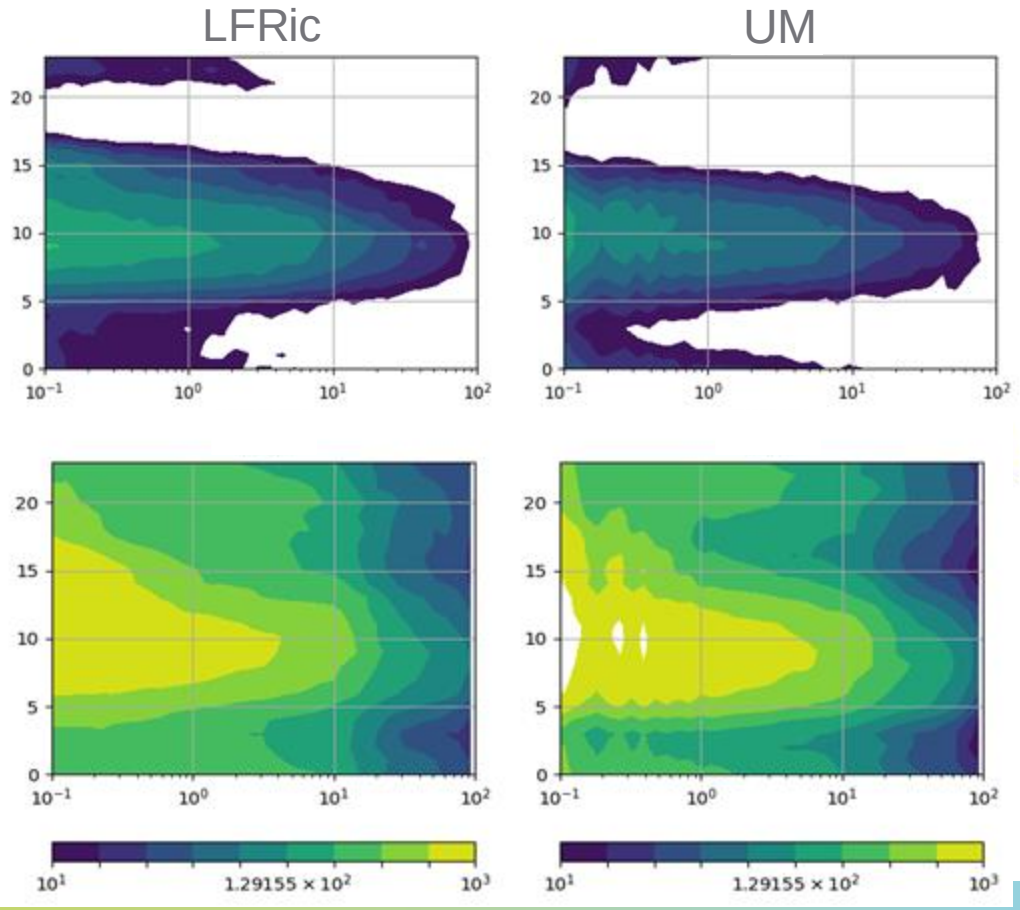
dry period

Over land

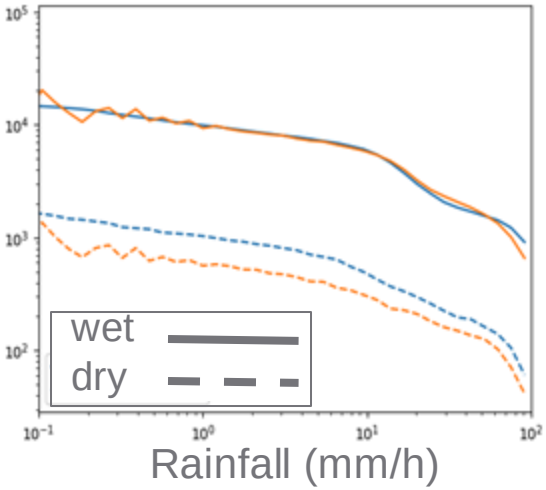
longitudes:
101 - 104E

wet period

Over land



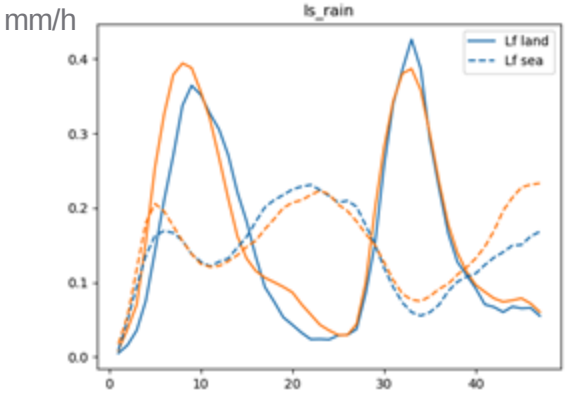
Rainfall rate histograms



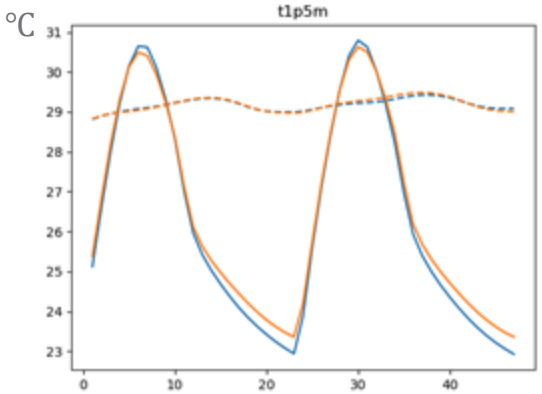
LFRic blue
UM orange

Forecast-range dependence

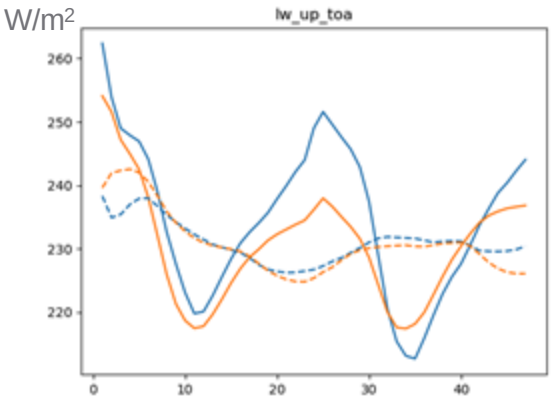
Average rainfall



1.5m air temperature



Outgoing TOA longwave



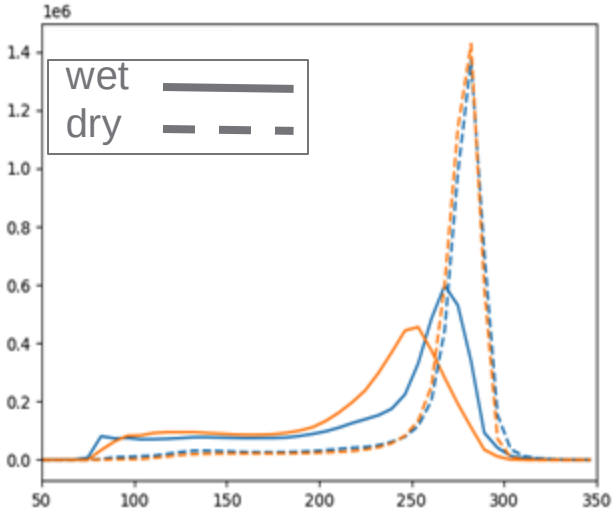
Forecast range (hours)

LFRic blue
UM orange

Land ——— Sea - - - -

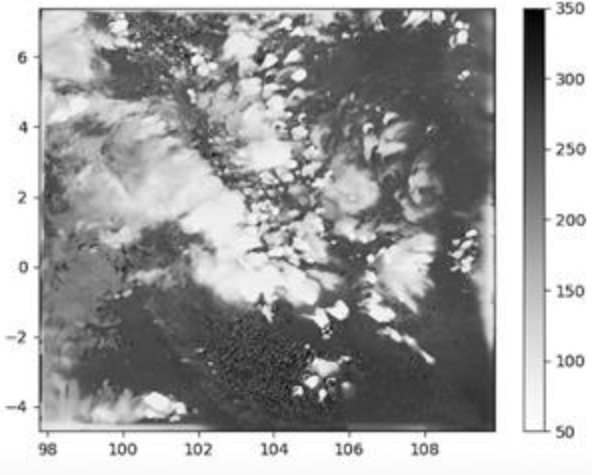
Outgoing Longwave

OLR histograms

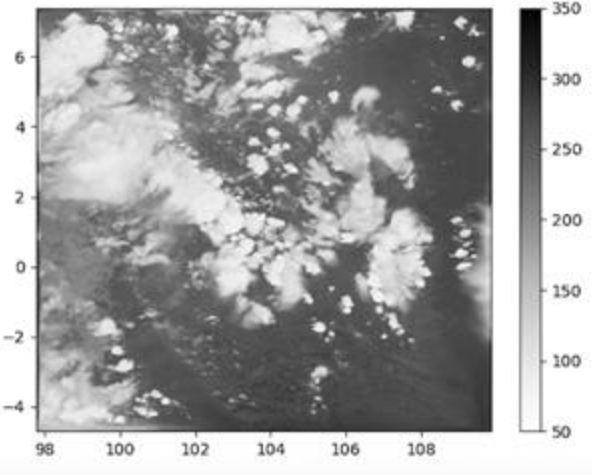


Outgoing TOA longwave
(W/m^2)

LFRic
12 June 05 UTC



UM
12 June 05 UTC



LFRic blue
UM orange

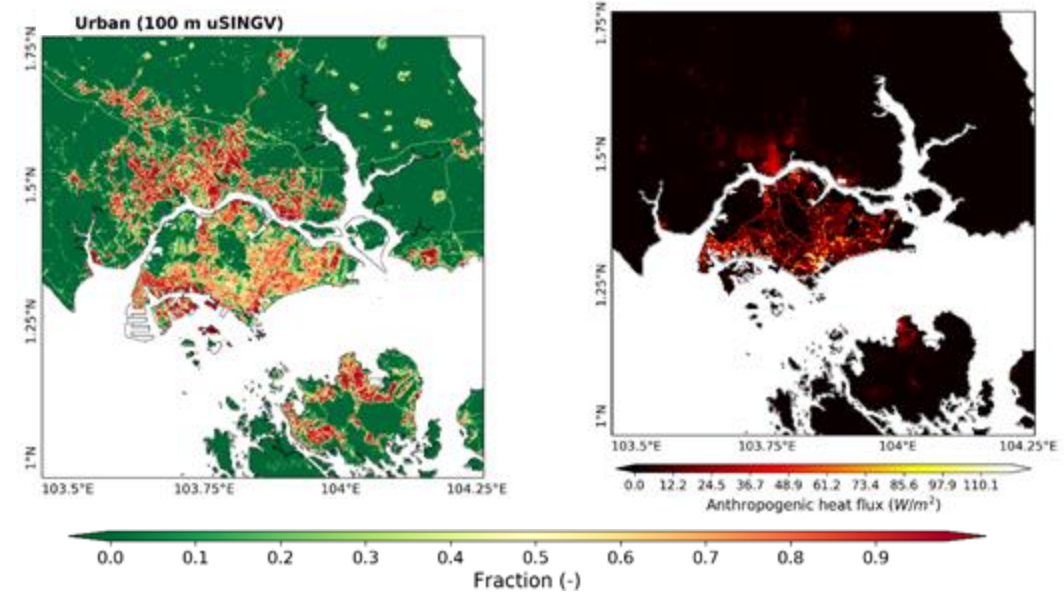
Summary

- LFRic-RAL3 set-up and tested at CCRS
- 1-month long experiment (48h forecasts)
- Similar results to UM, so far
- Outgoing Longwave shows some differences
- Next steps:
  - Evaluate both models against obs
  - Upgrade LFRic version to be same as other partners
  - Upgrade the global-UM driving model - currently GA6
  - Test with EC ics & lbcs (as in SINGV)

Longer term …

- Partnership activity on Next-gen tropical, urban-scale modelling

Urban Fraction



Anthropogenic Heat

- Sub-km resolution LFRic grids
- Local land-use & AH data
- Urban-parameterizations (physical & ML)
- observations