NIWA
Taihoro Nukurangi

Implementing RAL3 in NZ – performance and plans

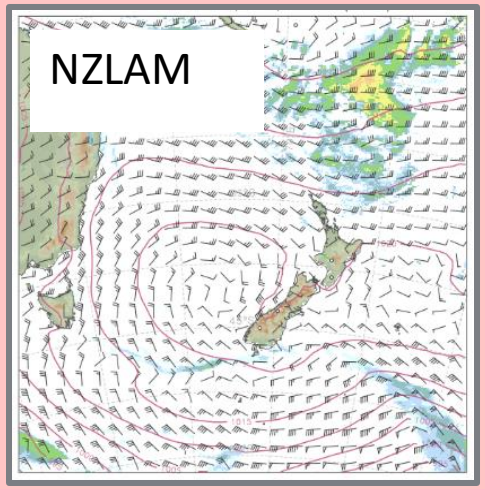
Stuart Moore, Phil Andrews, Ed Yang, Jorge Bornemann, Amir Pirooz, Trevor Carey-Smith, Richard Turner, Tristan Meyers

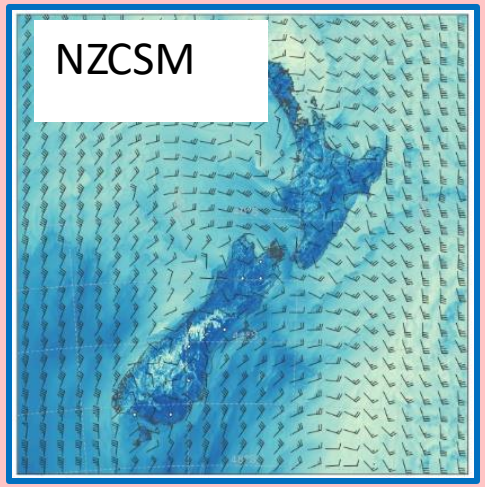
6th Momentum®(UK) Partnership Convective Scale Workshop, Melbourne, Australia, 9-13 September 2024

Climate, Freshwater & Ocean Science

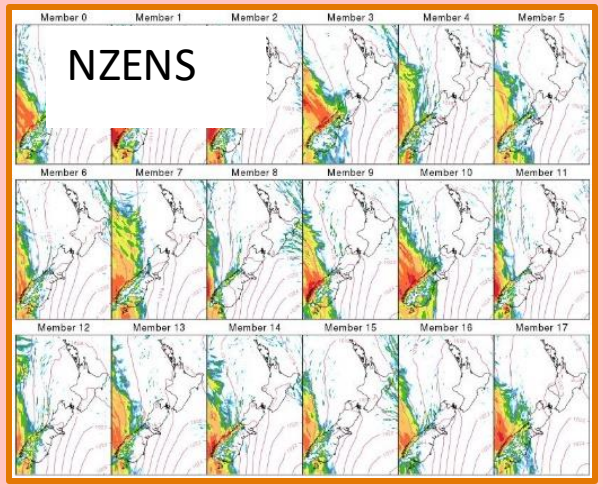
Core NWP model family

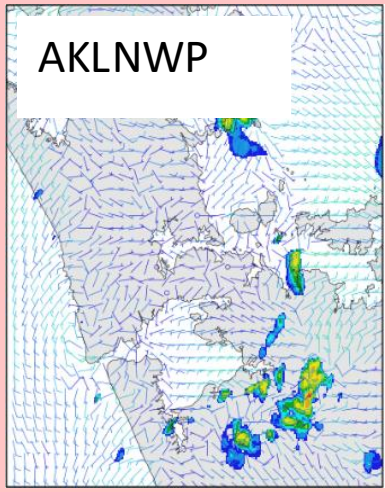
NZLAM
- 4.4km resolution
- 3D-VAR data assimilation
- Met Office Global input
- 72 hour forecast 4x daily





NZCSM
- 1.5km resolution
- *3D-VAR data assimilation*
- NZLAM input
- 48 hour forecast 4x daily





NZENS
- 18 members
- 4.5km resolution
- MOGREPS-G input
- 120 hour forecast 2x daily

AKLNWP
- 1.5km and 0.333km resolution
- NZLAM input
- 36 hour forecast 4x daily

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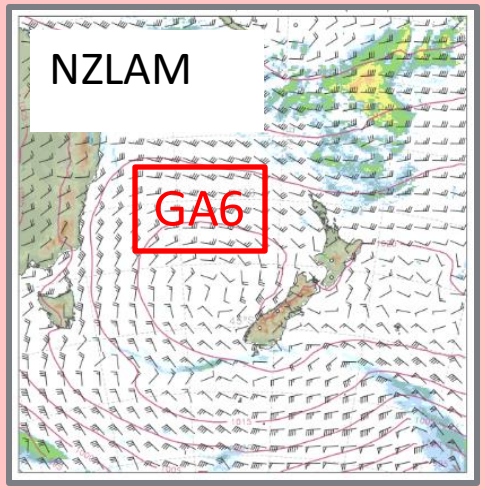

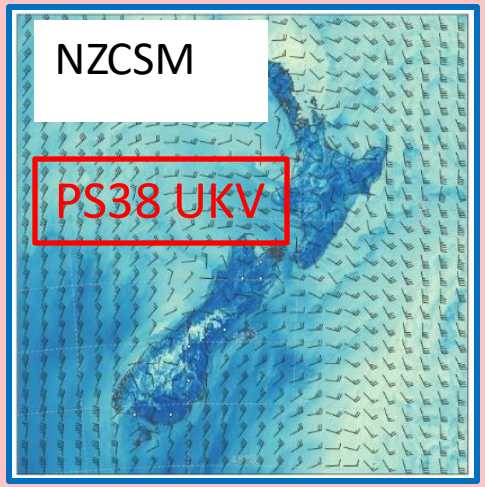

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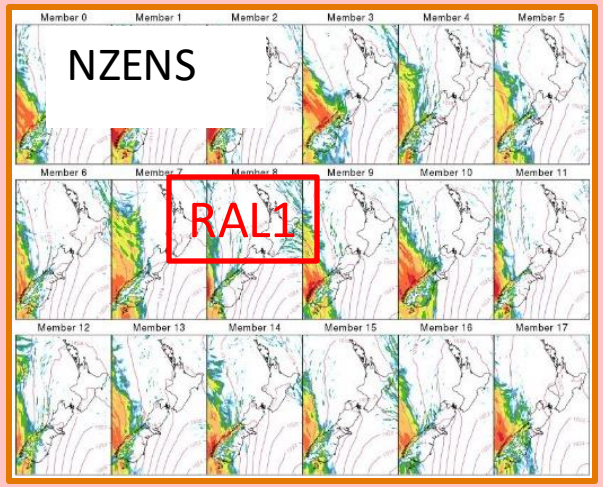

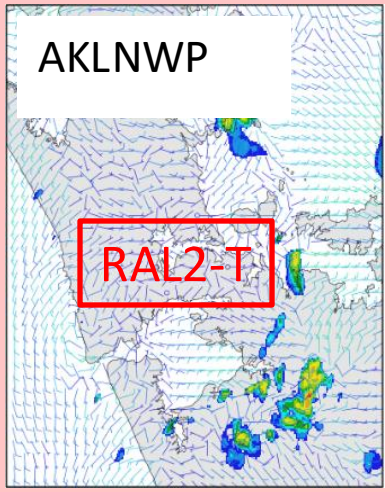

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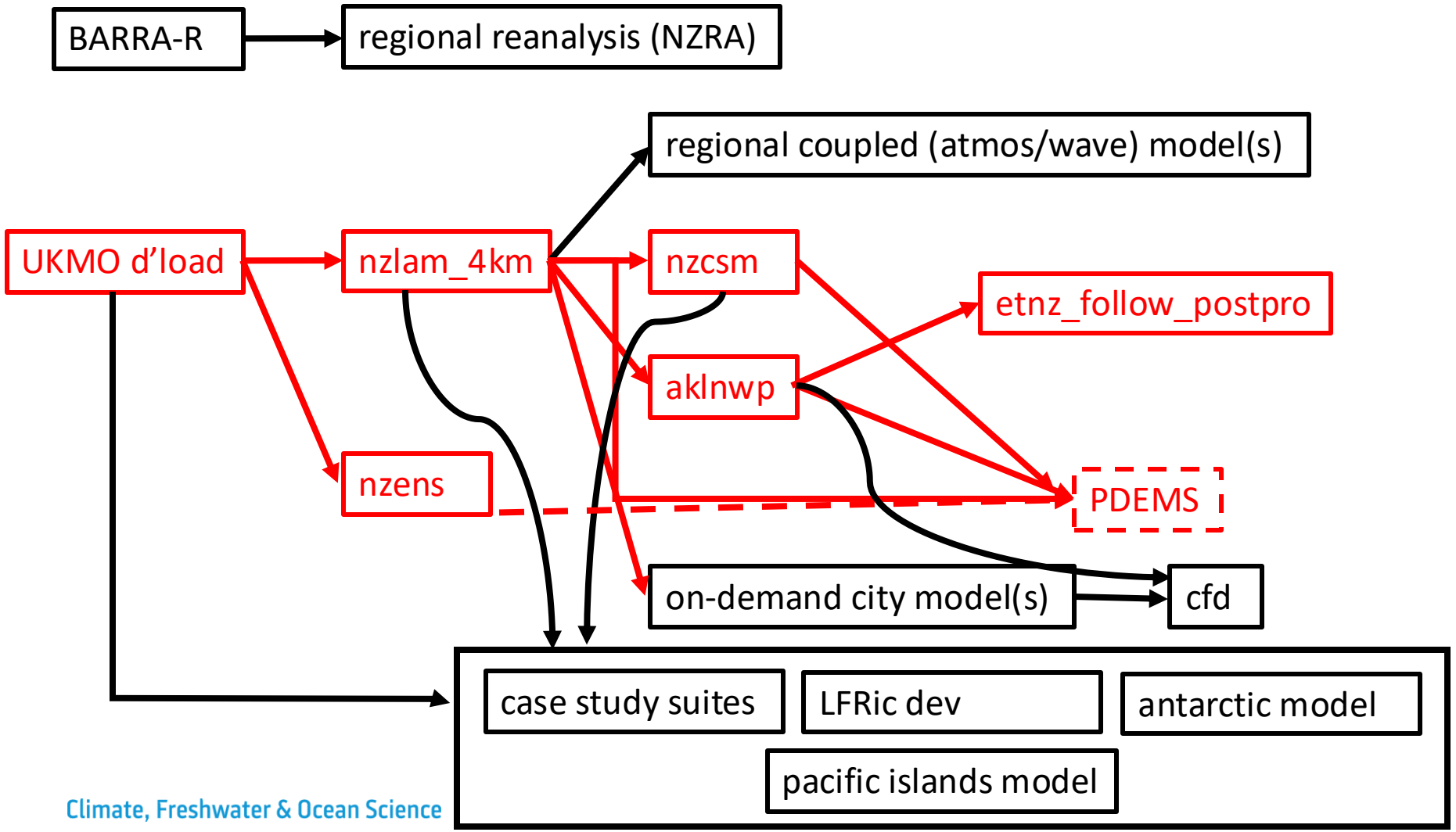
OFFICIAL

NWP Workflows (operational and research)



Research

Operations

Does not include post-processing research workflows nor does it show the links to downstream modelling suites (hydrology, wave etc.) which are driven from a combination of NZLAM, NZCSM and Auckland Model and NZENS (ensemble).

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Gen4 HPC

NEW ZEALAND / ENVIRONMENT

NIWA unveils new climate and weather modelling supercomputer

8:36 am on 13 August 2024

Share this

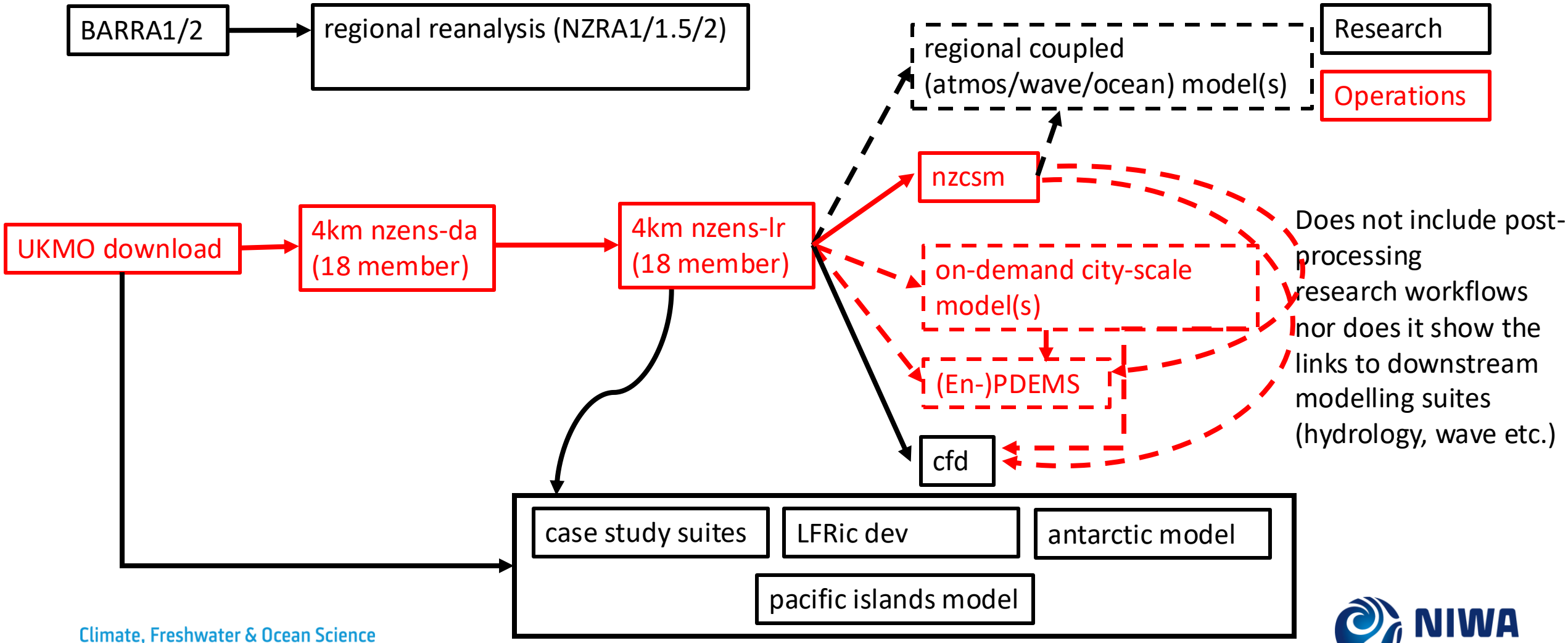
Eloise Gibson, Climate Change Correspondent
Eloise.Gibson@rnz.co.nz

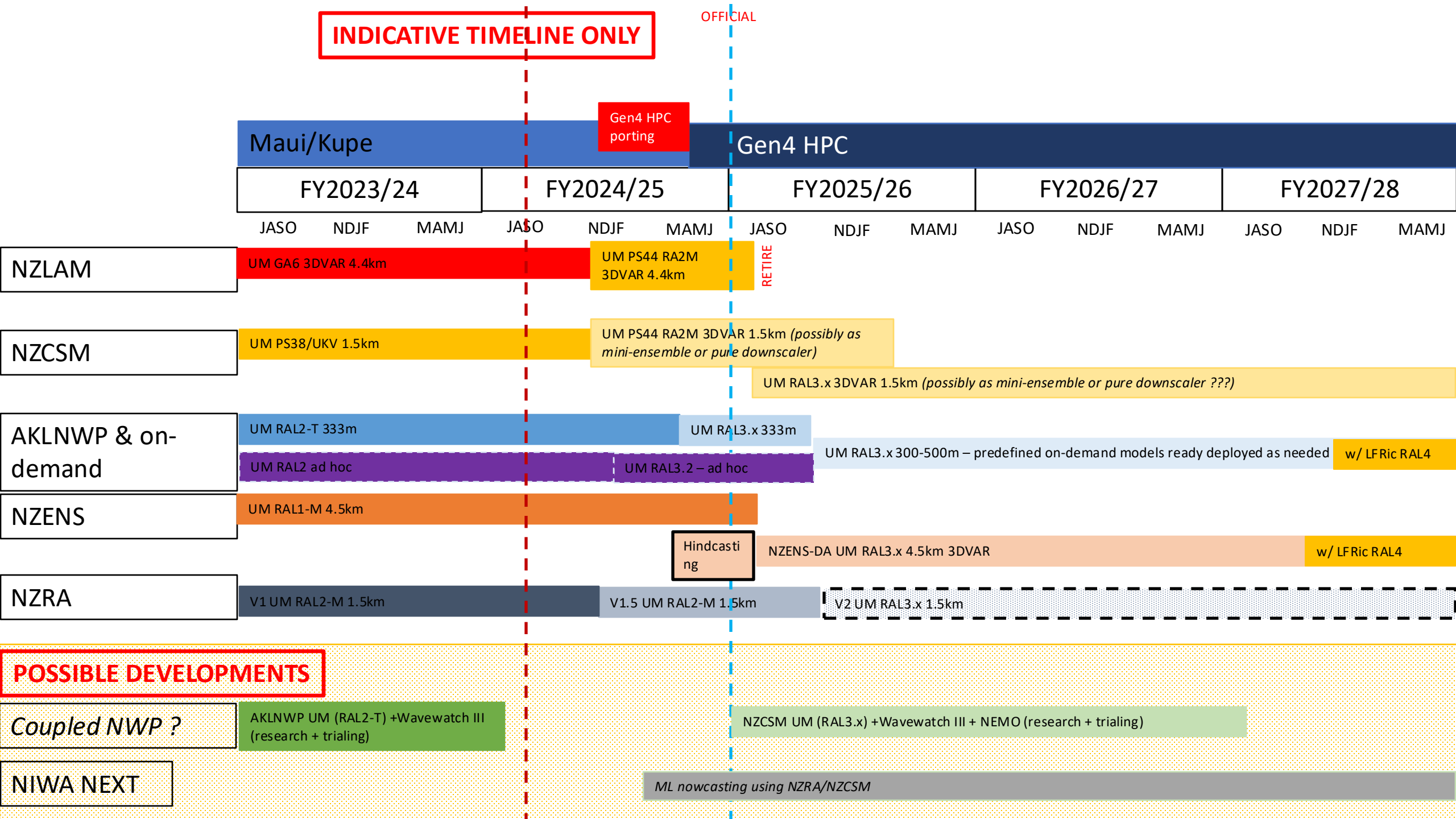
Judith Collins Minister for Research, Science and Innovation cuts the ribbon for NIWA's new high performance computer at one of CDC's Auckland data centres.

Arriving this SH summer

measure of compute	Maui	Kupe	Maui+Kupe	each site	Primary+Sec
compute nodes	464	104	568	160	320
compute cores	18,560	4,160	22,720	30,720	61,440
system memory (GB)	66,816	9,984	76,800	122,880	245,760
memory per core (GB)	3.6	2.4	3.4	4.0	4.0
peak teraflops	1,425	319	1,745	1,180	2,359
Unified Model performance	*0.82*	*0.18*	*1.00*	*1.75*	*3.50*

Future NWP Workflows (operational and research)




INDICATIVE TIMELINE ONLY
OFFICIAL
Maui/Kupe
Gen4 HPC porting
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FY2023/24
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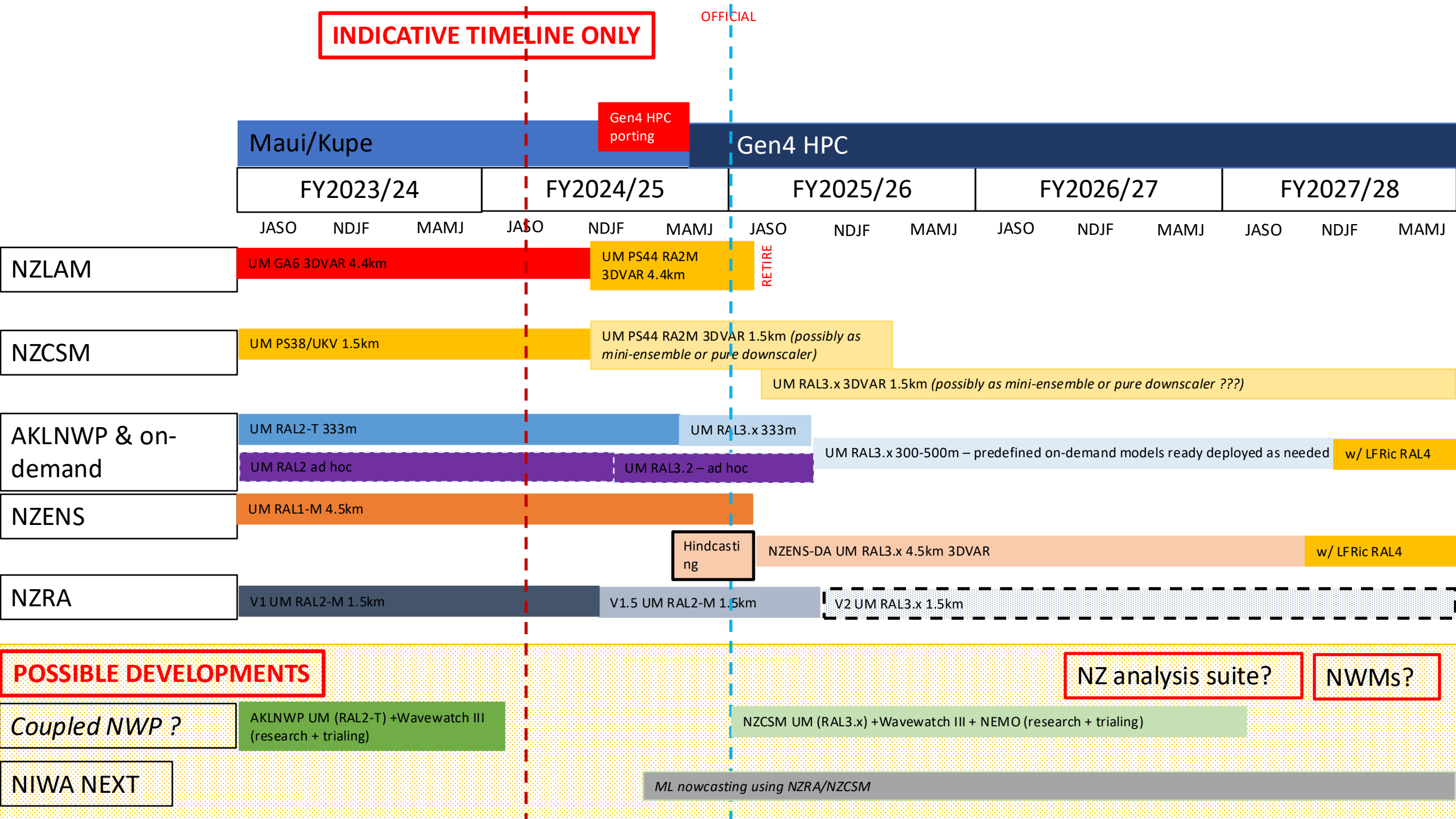
JASO NDJF MAMJ JASO NDJF MAMJ JASO NDJF MAMJ JASO NDJF MAMJ JASO NDJF MAMJ
NZLAM
UM GA6 3DVAR 4.4km
UM PS44 RA2M 3DVAR 4.4km
RETIRE
NZCSM
UM PS38/UKV 1.5km
UM PS44 RA2M 3DVAR 1.5km (possibly as mini-ensemble or pure downscaler)
UM RAL3.x 3DVAR 1.5km (possibly as mini-ensemble or pure downscaler ???)
AKLNWP & on-demand
UM RAL2-T 333m
UM RAL3.x 333m
UM RAL3.x 300-500m – predefined on-demand models ready deployed as needed
w/ LFRic RAL4
UM RAL2 ad hoc
UM RAL3.2 – ad hoc
NZENS
UM RAL1-M 4.5km
Hindcasting
NZENS-DA UM RAL3.x 4.5km 3DVAR
w/ LFRic RAL4
NZRA
V1 UM RAL2-M 1.5km
V1.5 UM RAL2-M 1.5km
V2 UM RAL3.x 1.5km
POSSIBLE DEVELOPMENTS
Coupled NWP ?
AKLNWP UM (RAL2-T) +Wavewatch III (research + trialing)
NZCSM UM (RAL3.x) +Wavewatch III + NEMO (research + trialing)
NIWA NEXT
ML nowcasting using NZRA/NZCSM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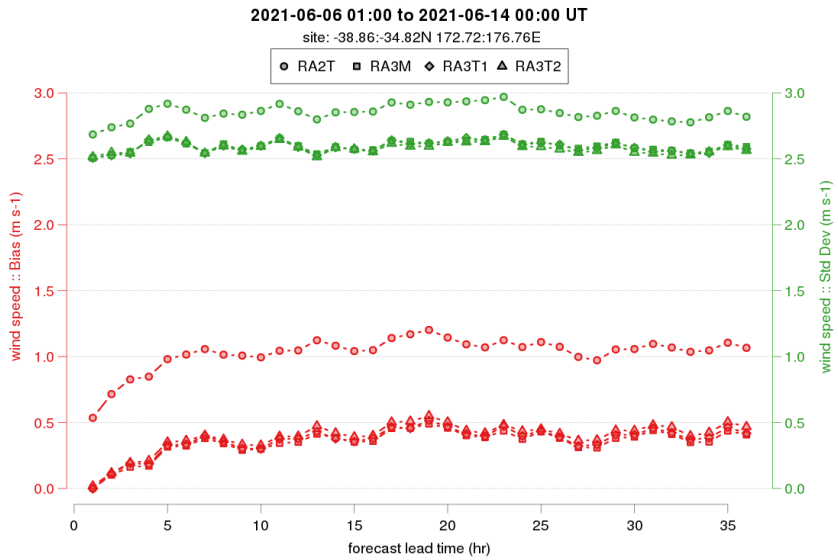
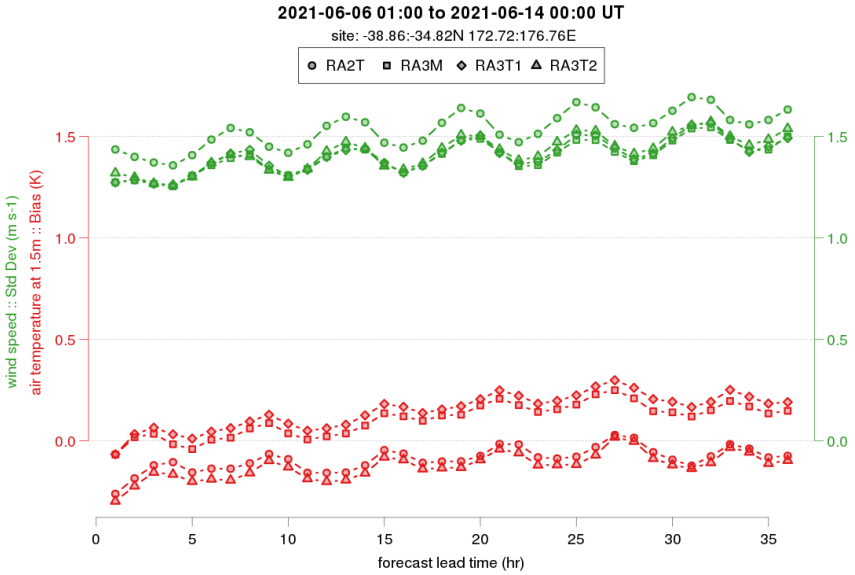
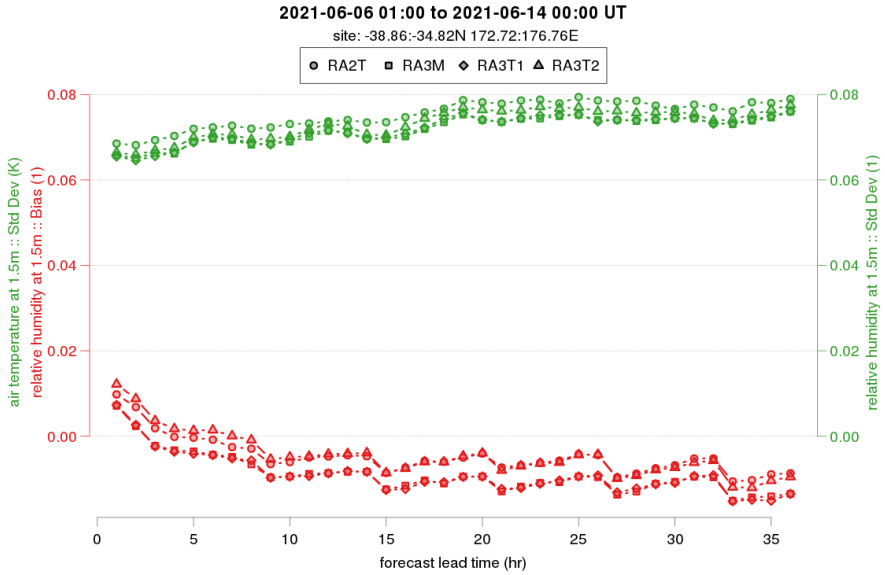
POSSIBLE DEVELOPMENTS
NZ analysis suite?
NWMs?
Coupled NWP ?
AKLNWP UM (RAL2-T) +Wavewatch III (research + trialing)
NZCSM UM (RAL3.x) +Wavewatch III + NEMO (research + trialing)
NIWA NEXT
ML nowcasting using NZRA/NZCSM

(Early) RAL3 real-time trial

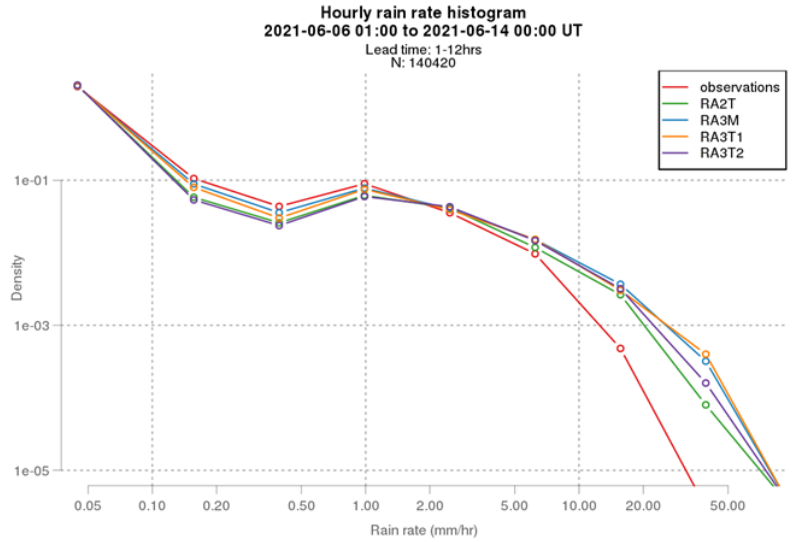






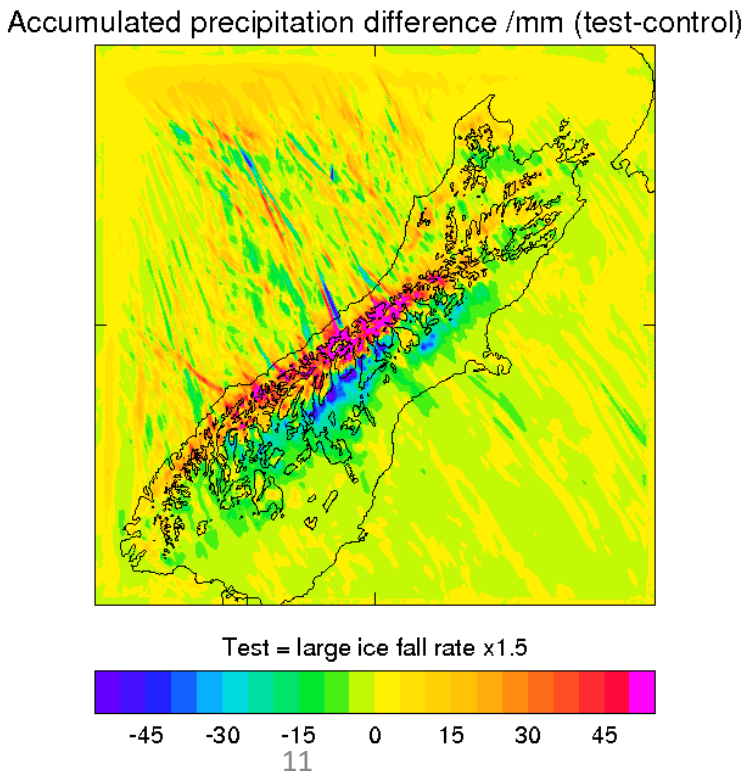
Based on ***limited*** 1.5km Auckland Model runs…

- ✓Improved mean wind speed bias in RAL3
- ✓RAL3M and RAL3Tp1 improved temperature bias
- ✓RAL3 gives better fit than RAL2 at lighter rain intensities
- ✗More precipitation in RAL3 at higher intensities



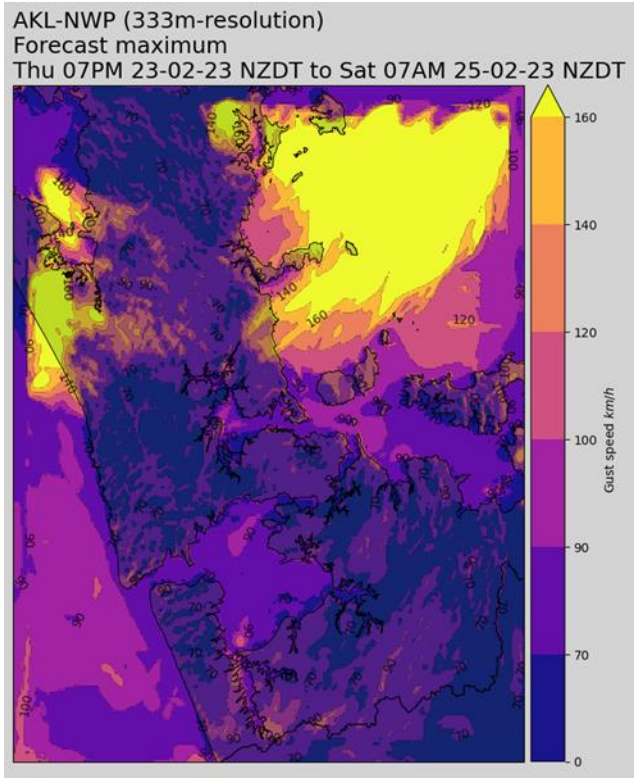
Key issues to focus on

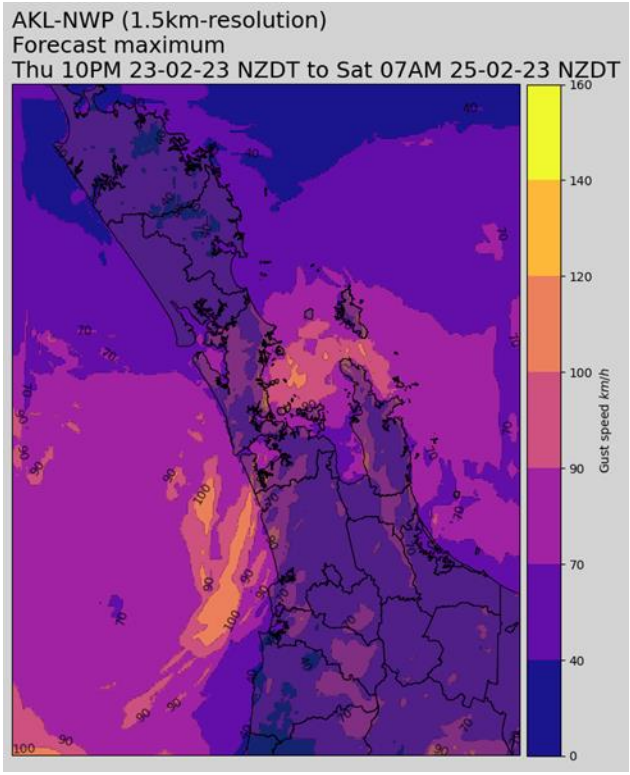
- Spillover over Southern Alps
- https://code.metoffice.gov.uk/trac/roses-u/ticket/55



Key issues to focus on

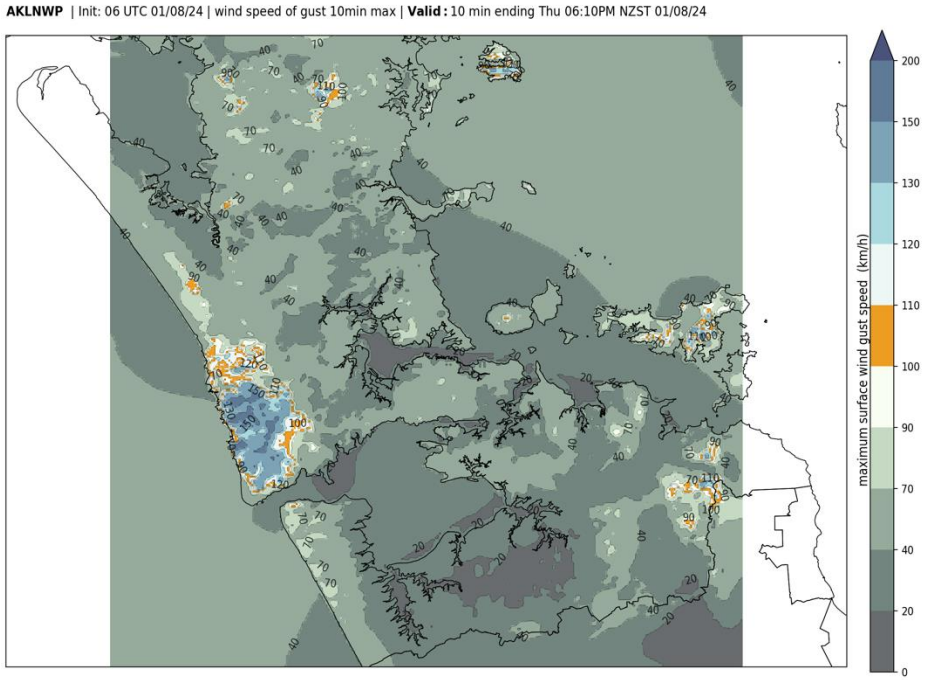
- Auckland Model excessive gusts

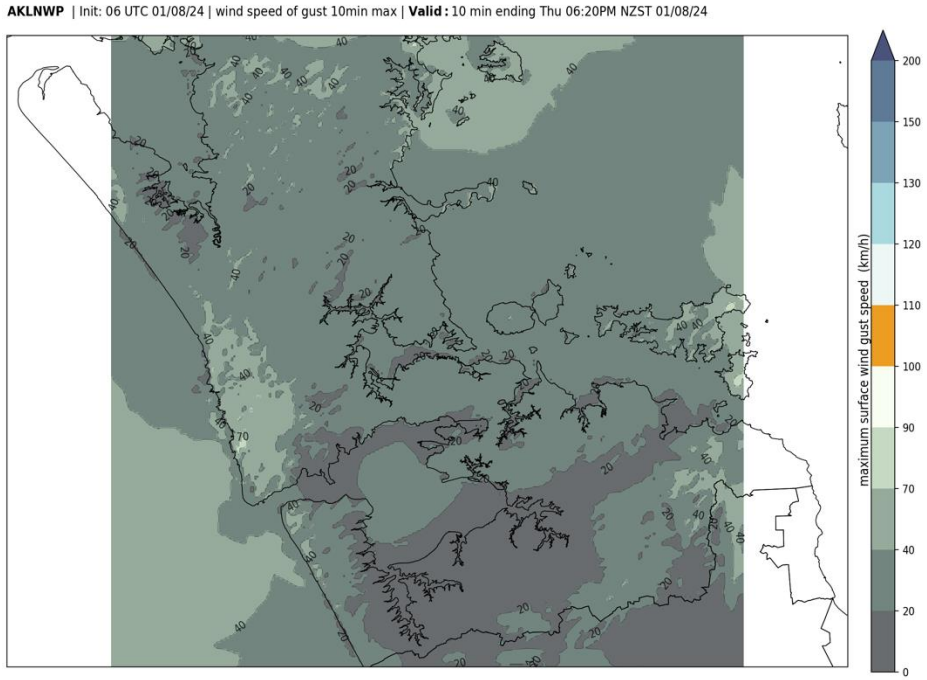




Key issues to focus on

- Auckland Model reconfiguration





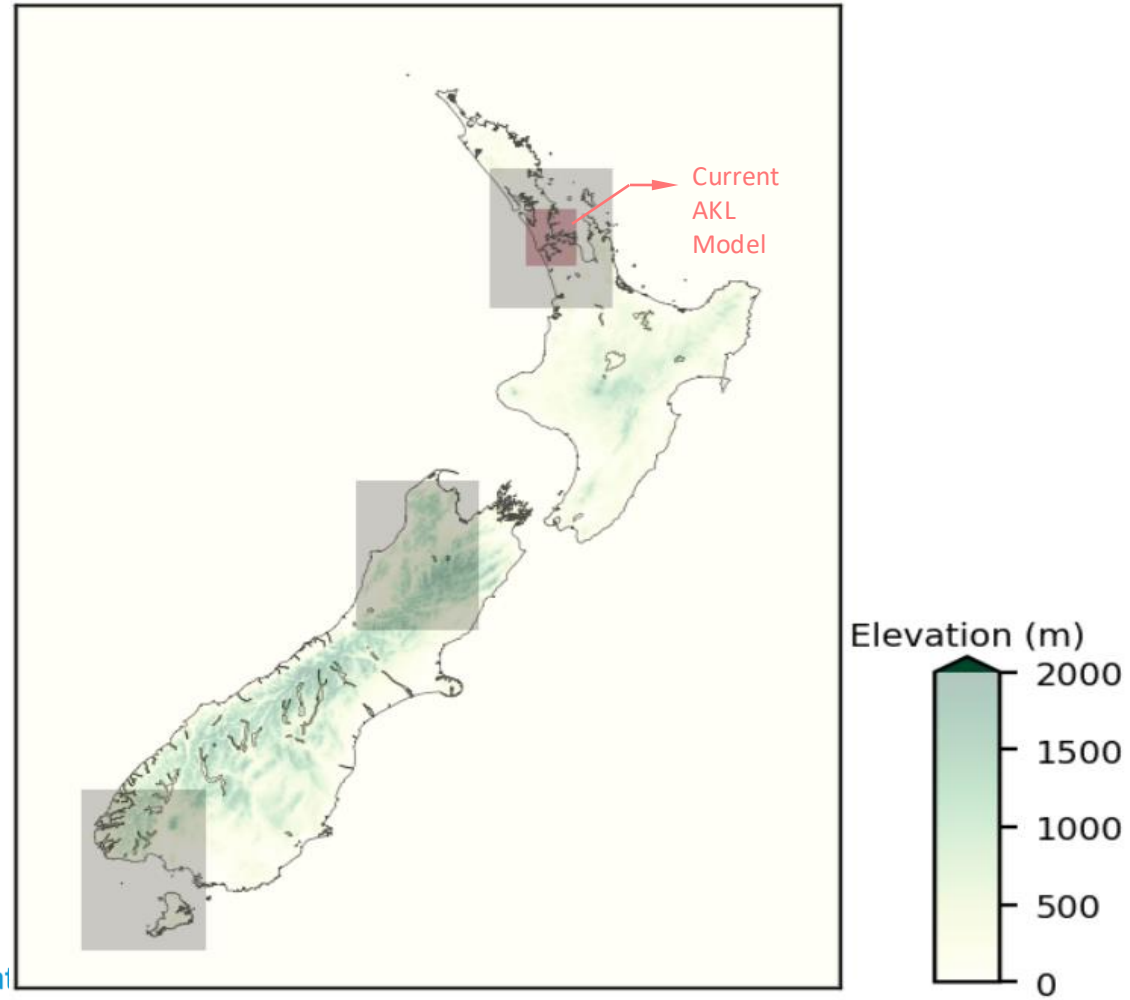
On-demand sub-km model plans

Open questions:

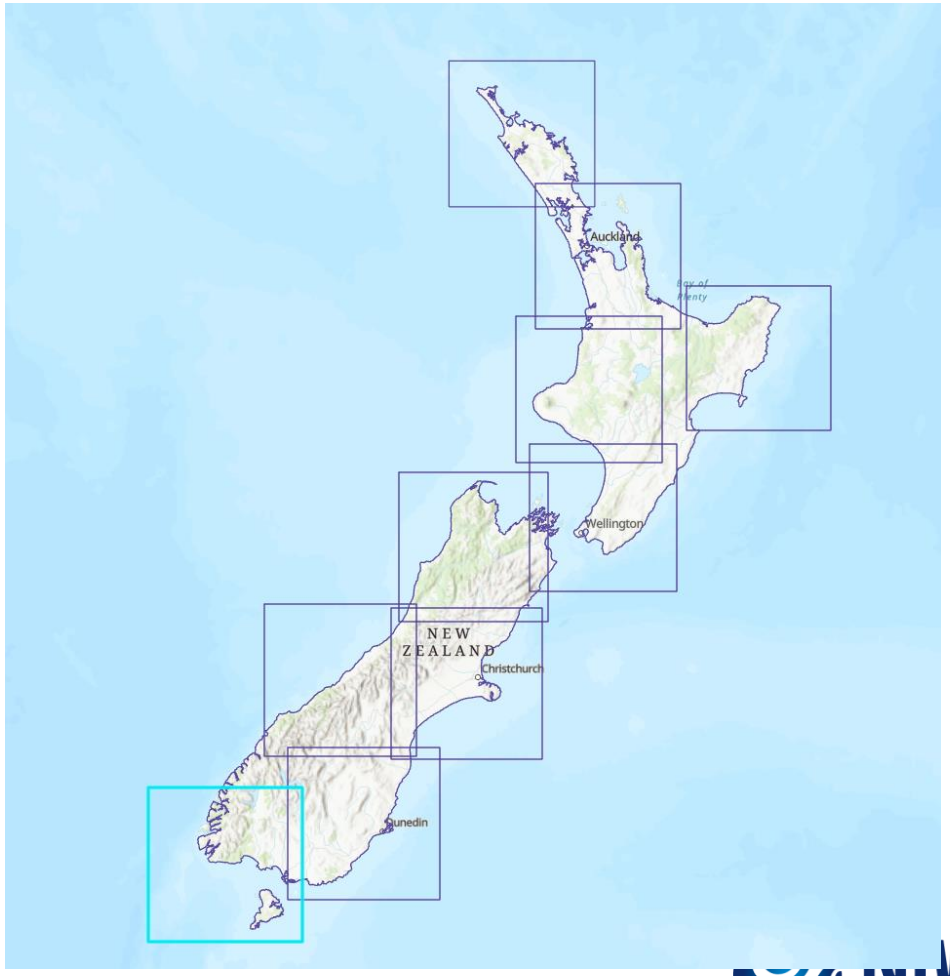
- How many domains needed?
- Common configuration for all, or custom depending on region covered?
- Horizontal/vertical resolution? Science config? Run length? Output needs?
- How are they triggered/driven?
- How often are they run? Would some be wanted permanently (AKL/WLG/CHC/DUN)?
- Deterministic vs ensemble set up?

On-demand sub-km model plans

Test domains



Possible domains?



Thank you

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