An evaluation of linear theory based downscaling with ICAR in complex topography

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What is ICAR?

Intermediate

Complexity

Atmospheric

Research

Model

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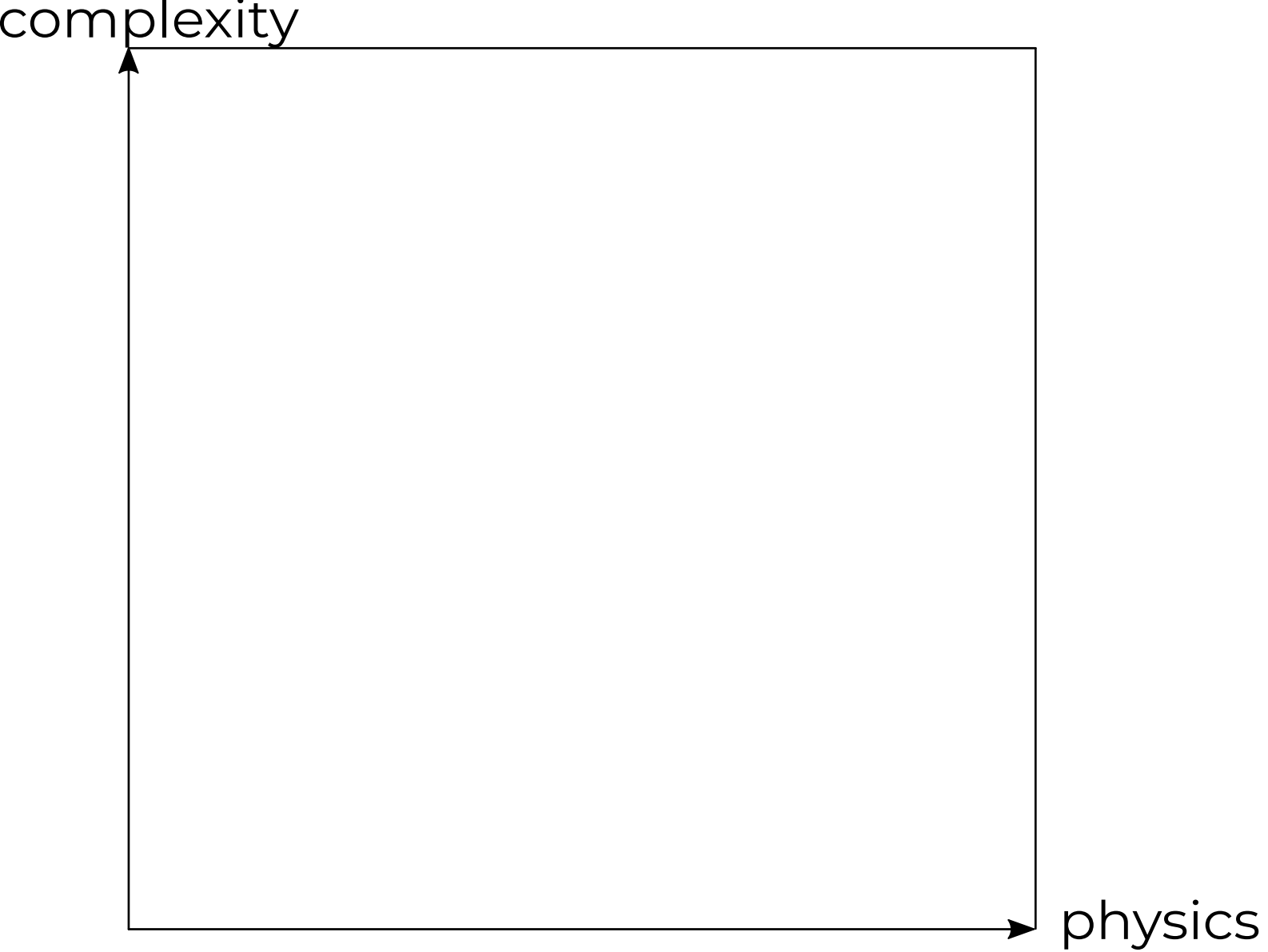
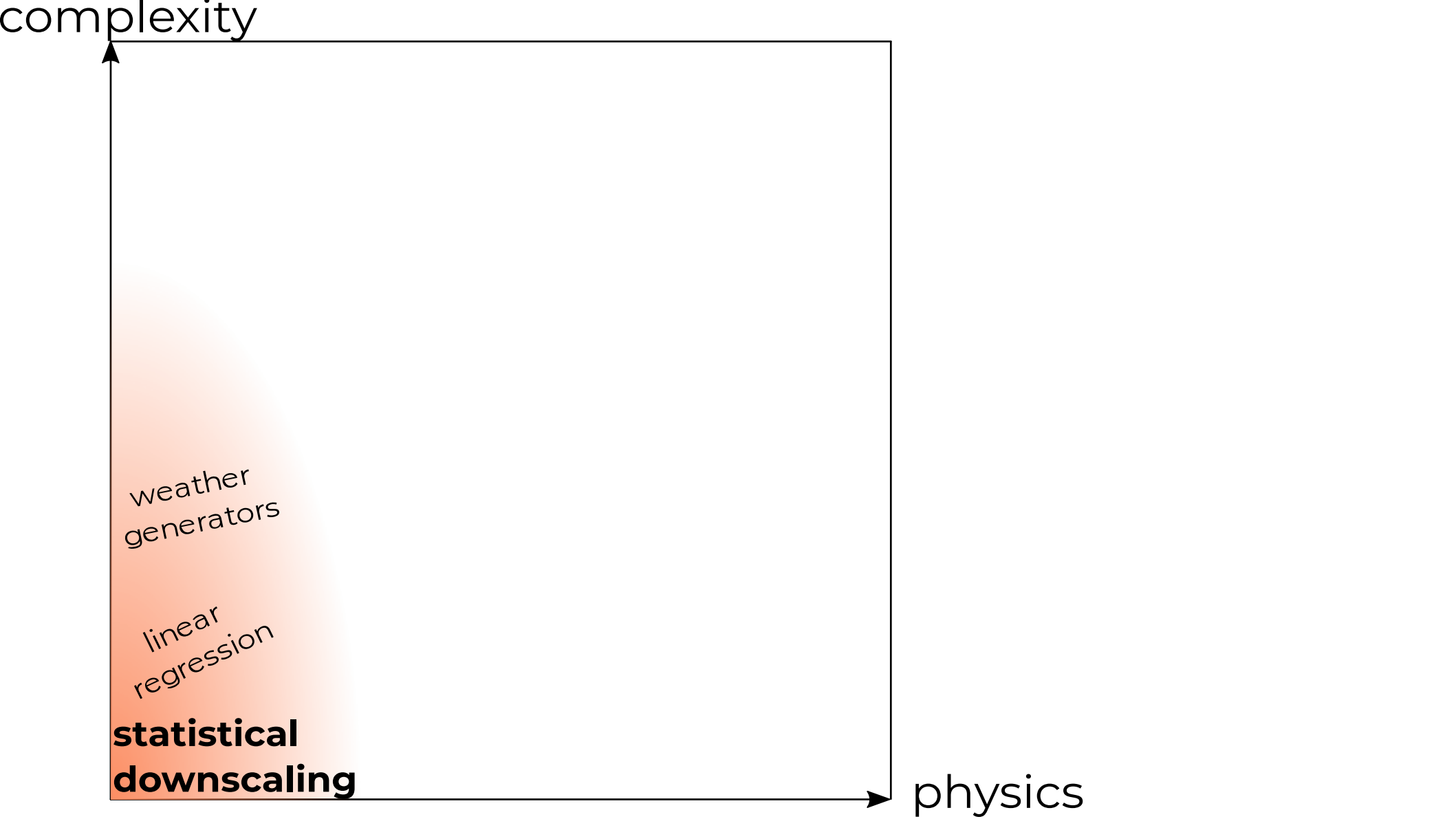
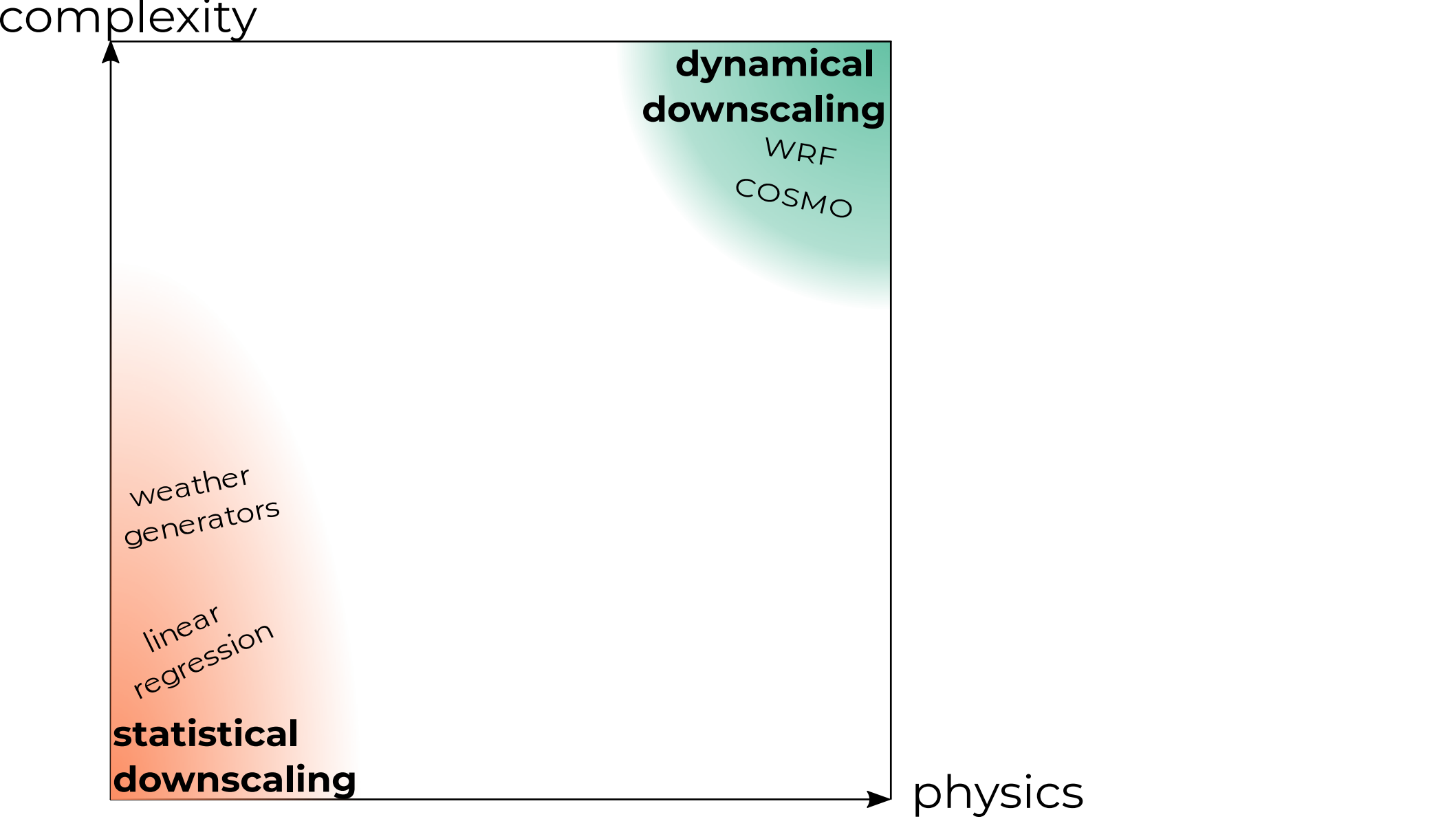
“Intermediate Complexity Downscaling”


complexity
physics


complexity
weather generators
linear regression
statistical downscaling
physics


complexity
dynamical downscaling
WRF
COSMO
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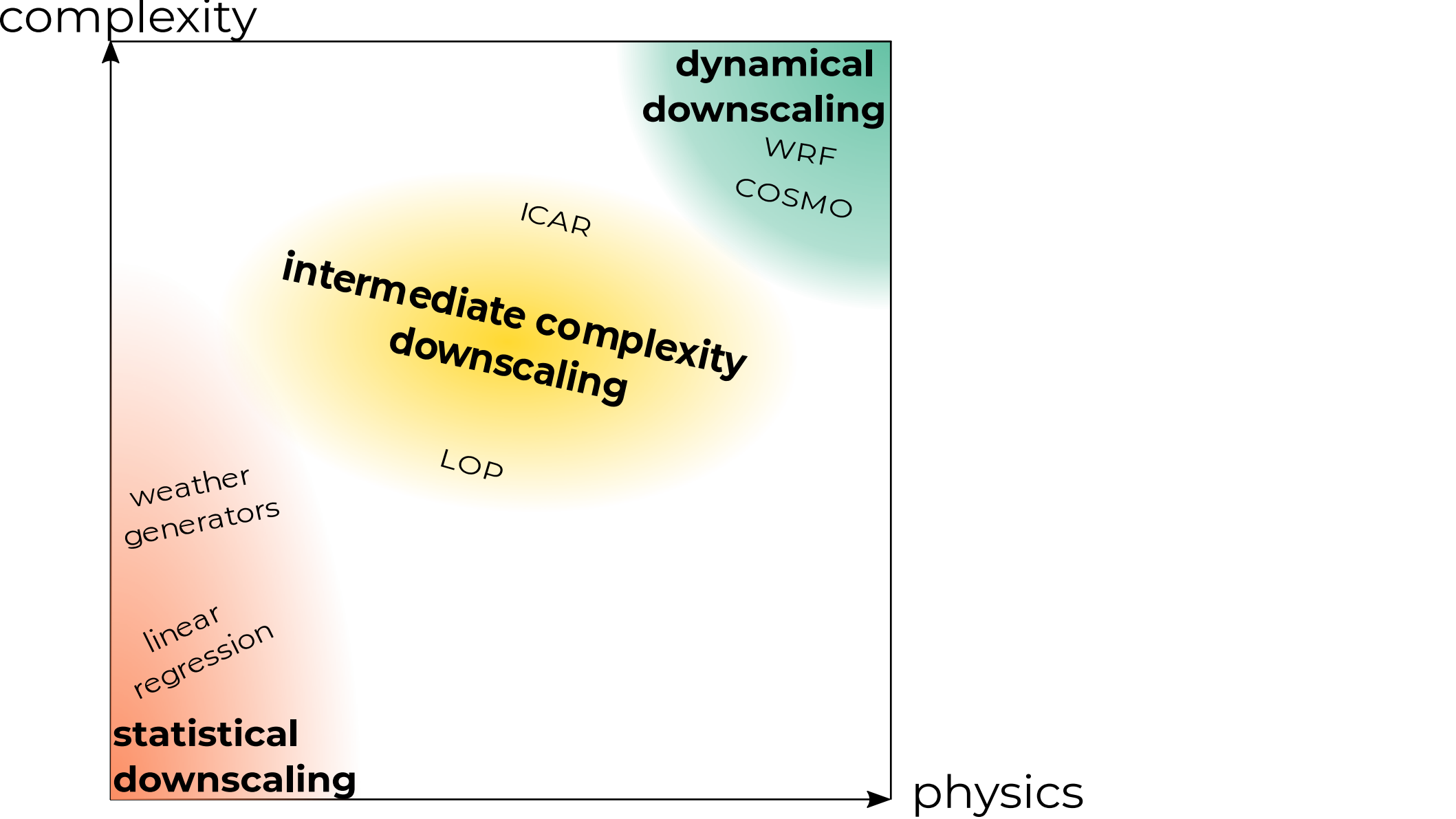
complexity
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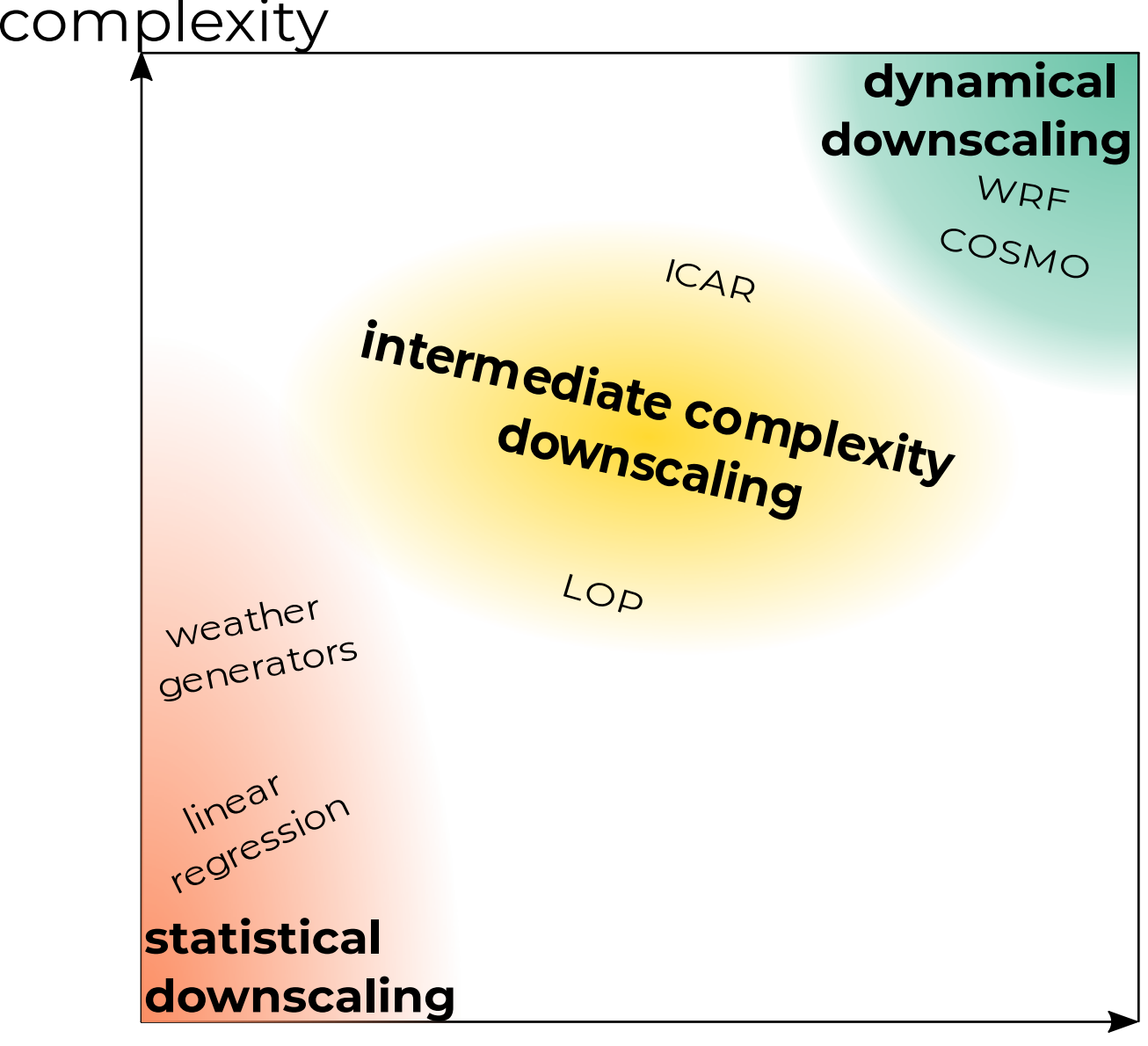
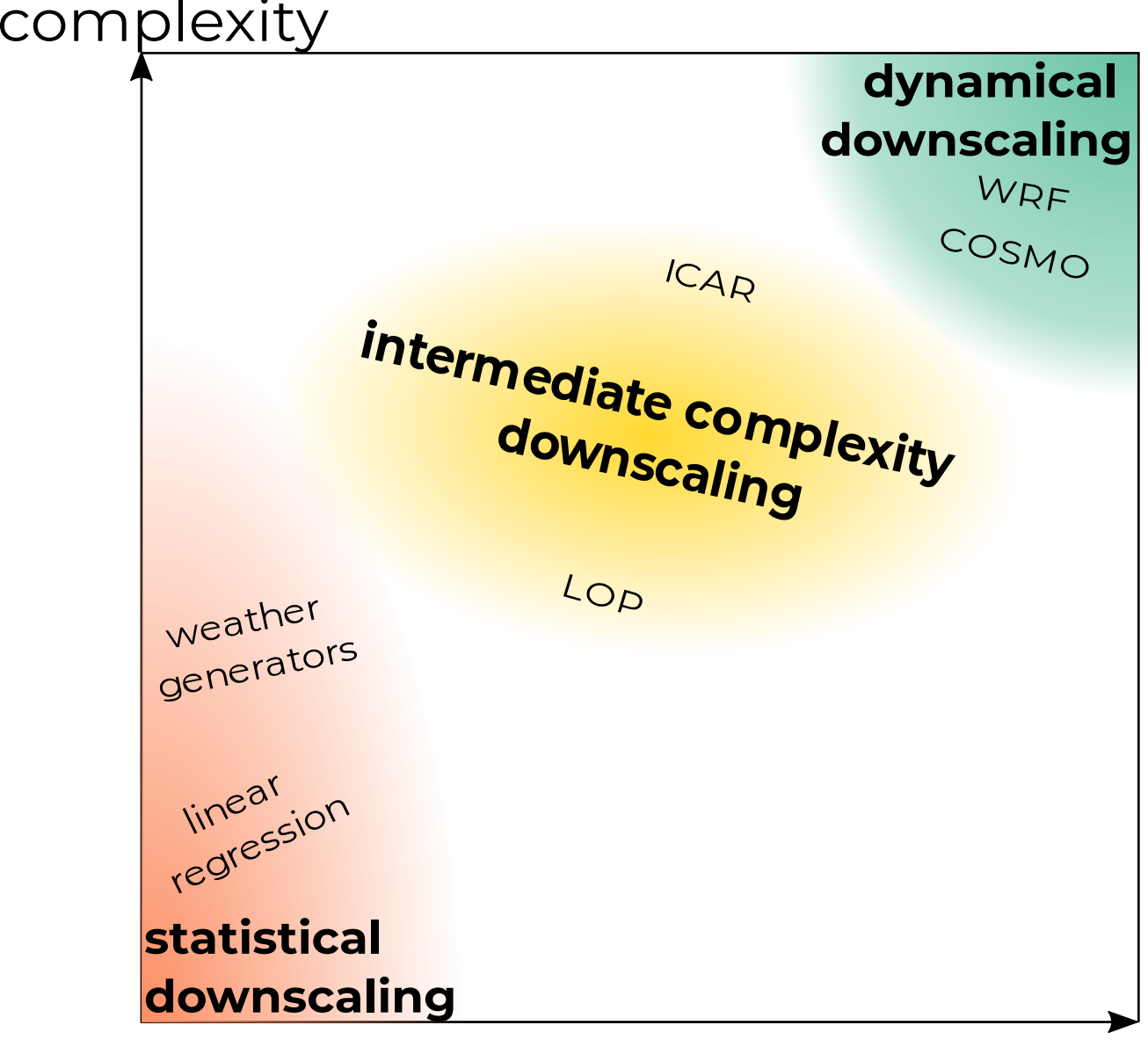


What is ICAR?

Physics based

- 3D model
- simplified wind-field
  - linear mountain-wave theory
- advects atmospheric quantities
  - e.g. moisture and heat
- employs microphysics
  - e.g. Thompson MP



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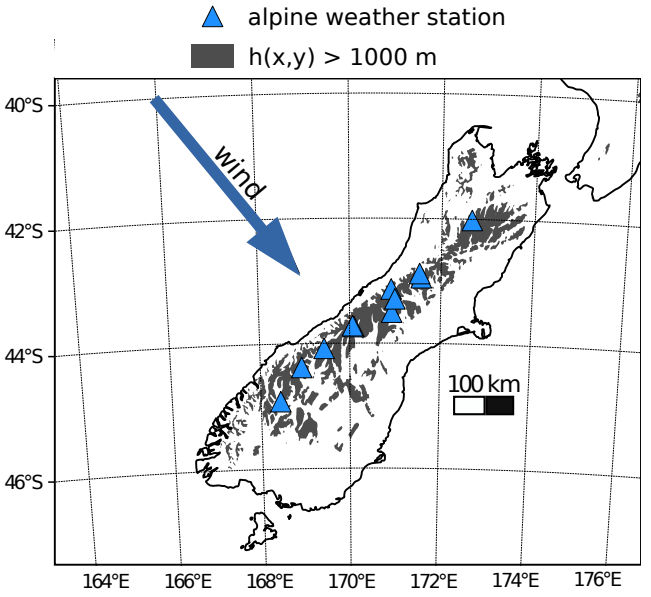
Computationally cheap

- ≈1/100th of core hours compared to WRF

An Evaluation of ICAR

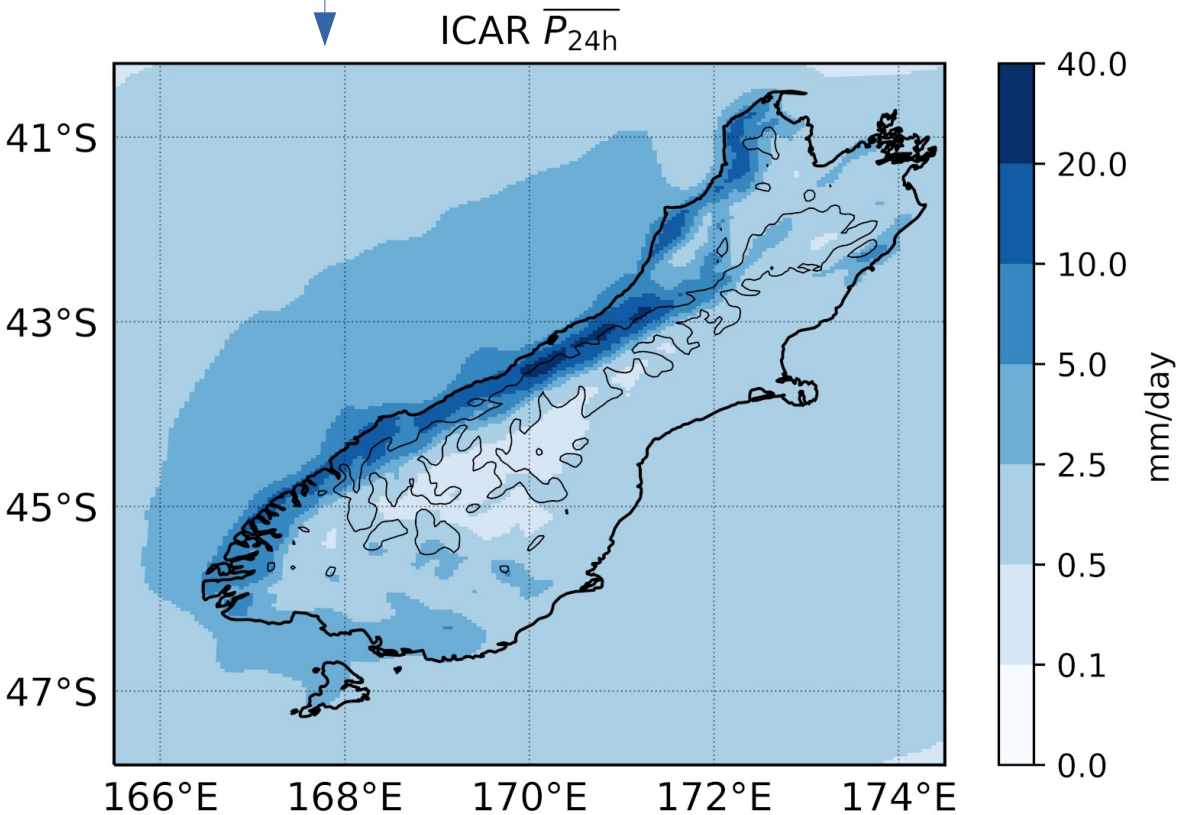
- South Island of New Zealand
  - Alpine Range (Southern Alps) data from 11 weather stations
  - “simple” synoptic situation



- Added value over the forcing Dataset?
  - Yes BUT… (more later)

ICAR precipitation patterns

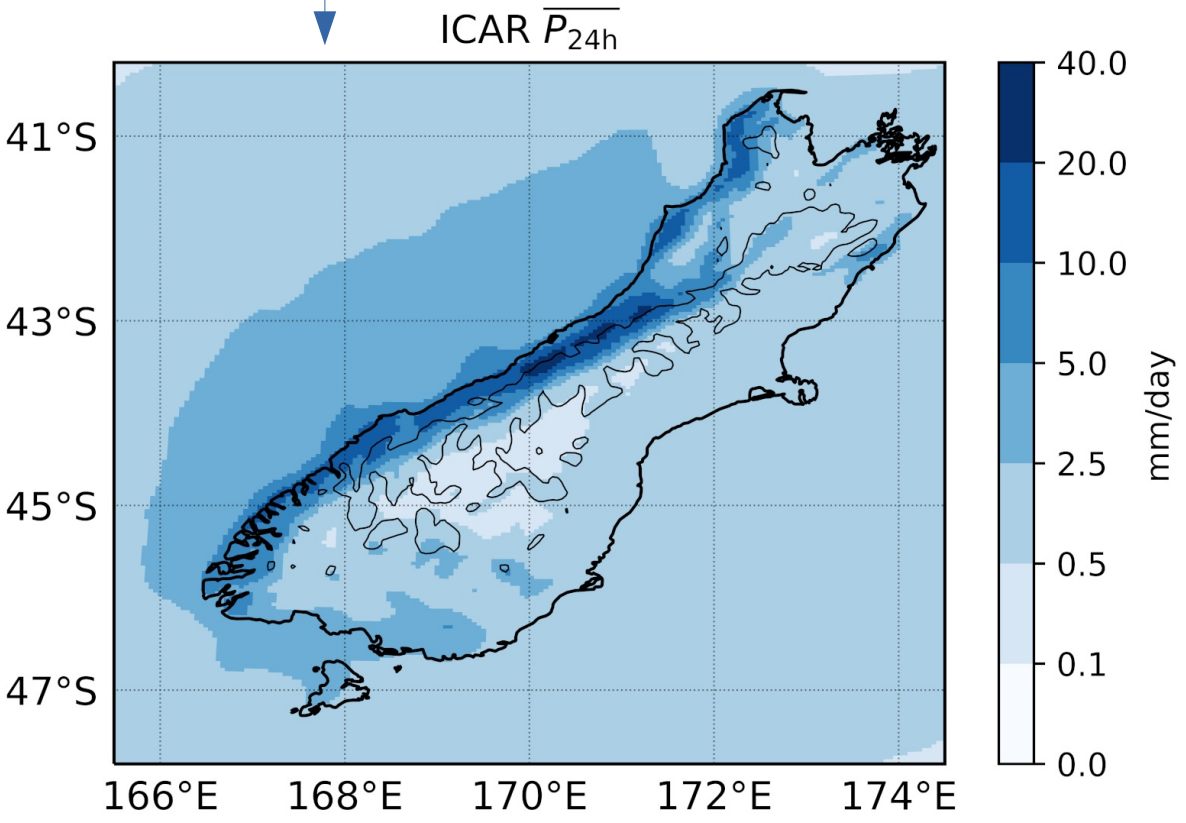
total daily mean precipitation

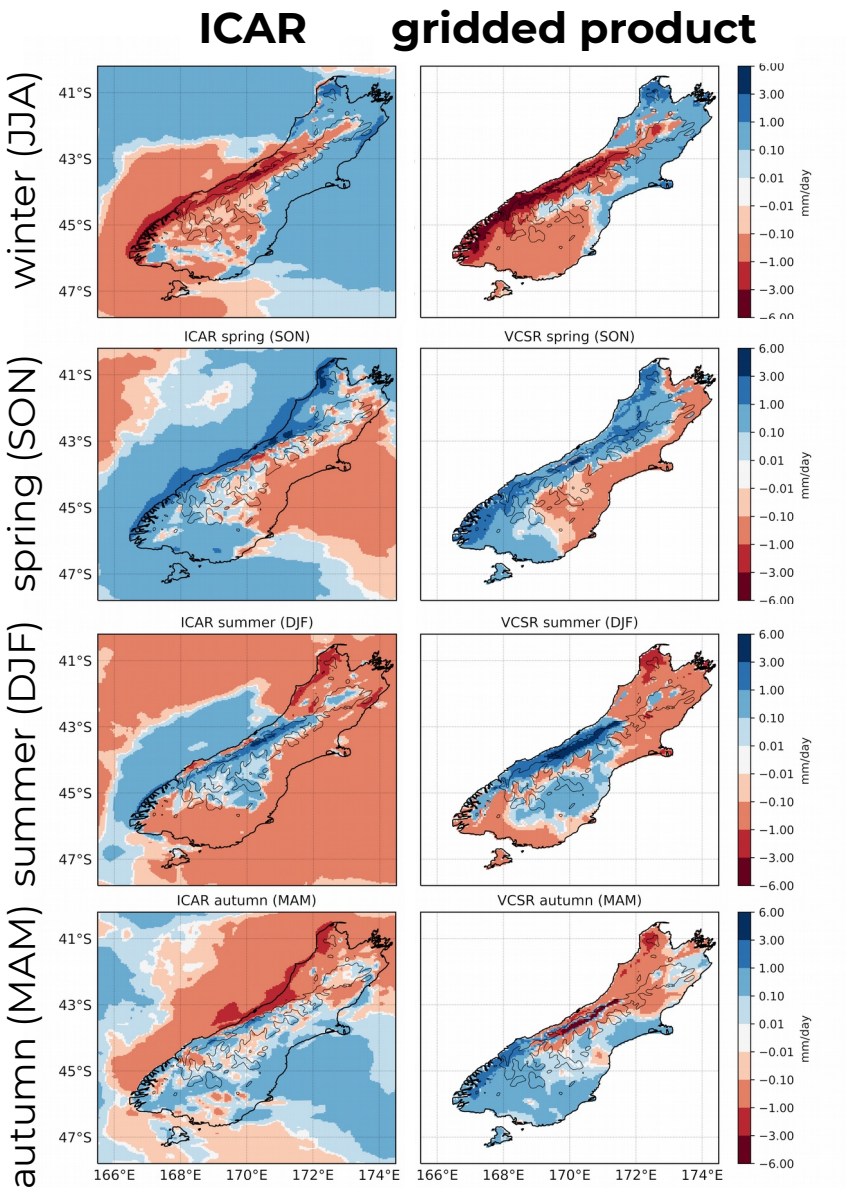


ICAR precipitation patterns

total daily mean precipitation

seasonal deviation from daily mean precipitation

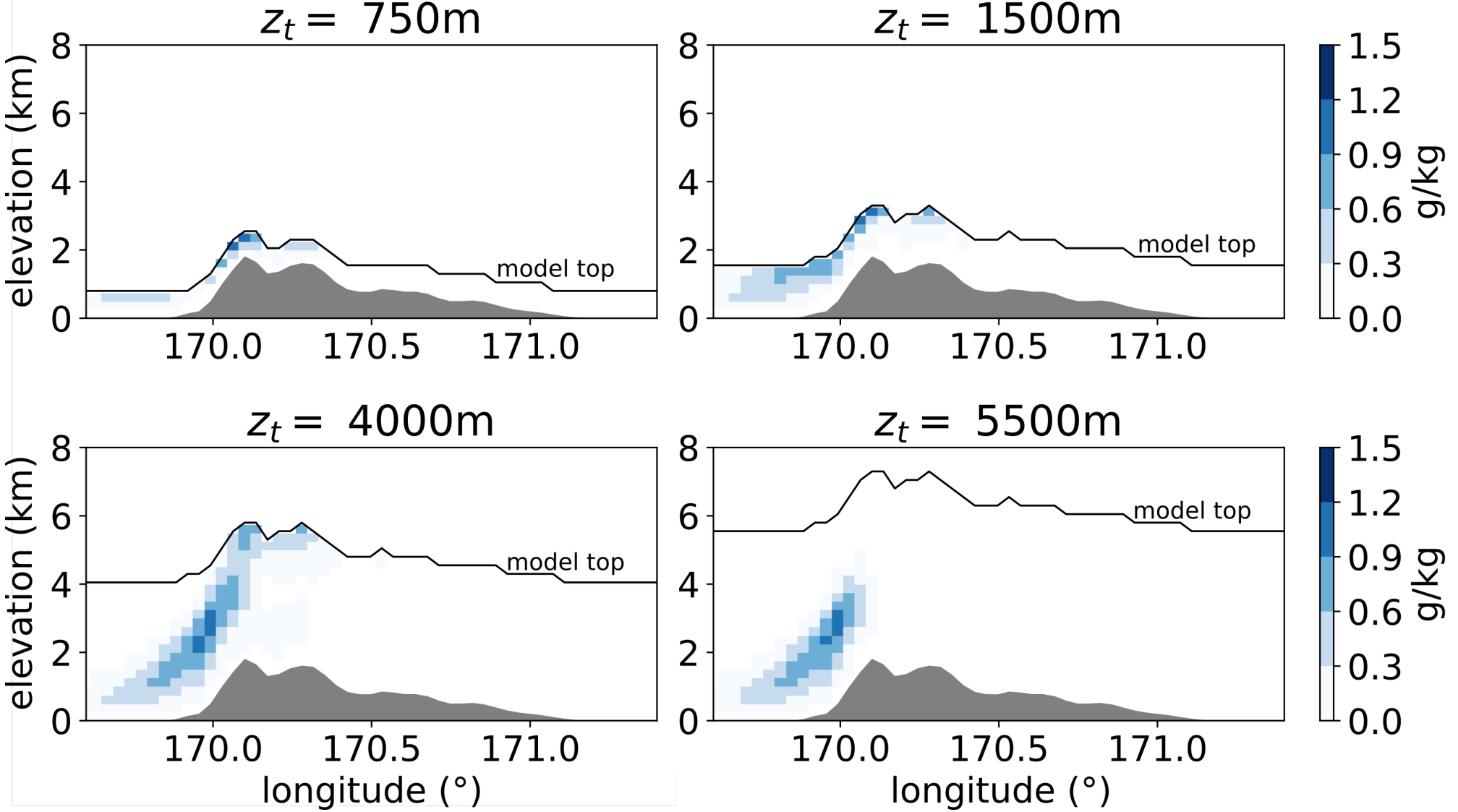


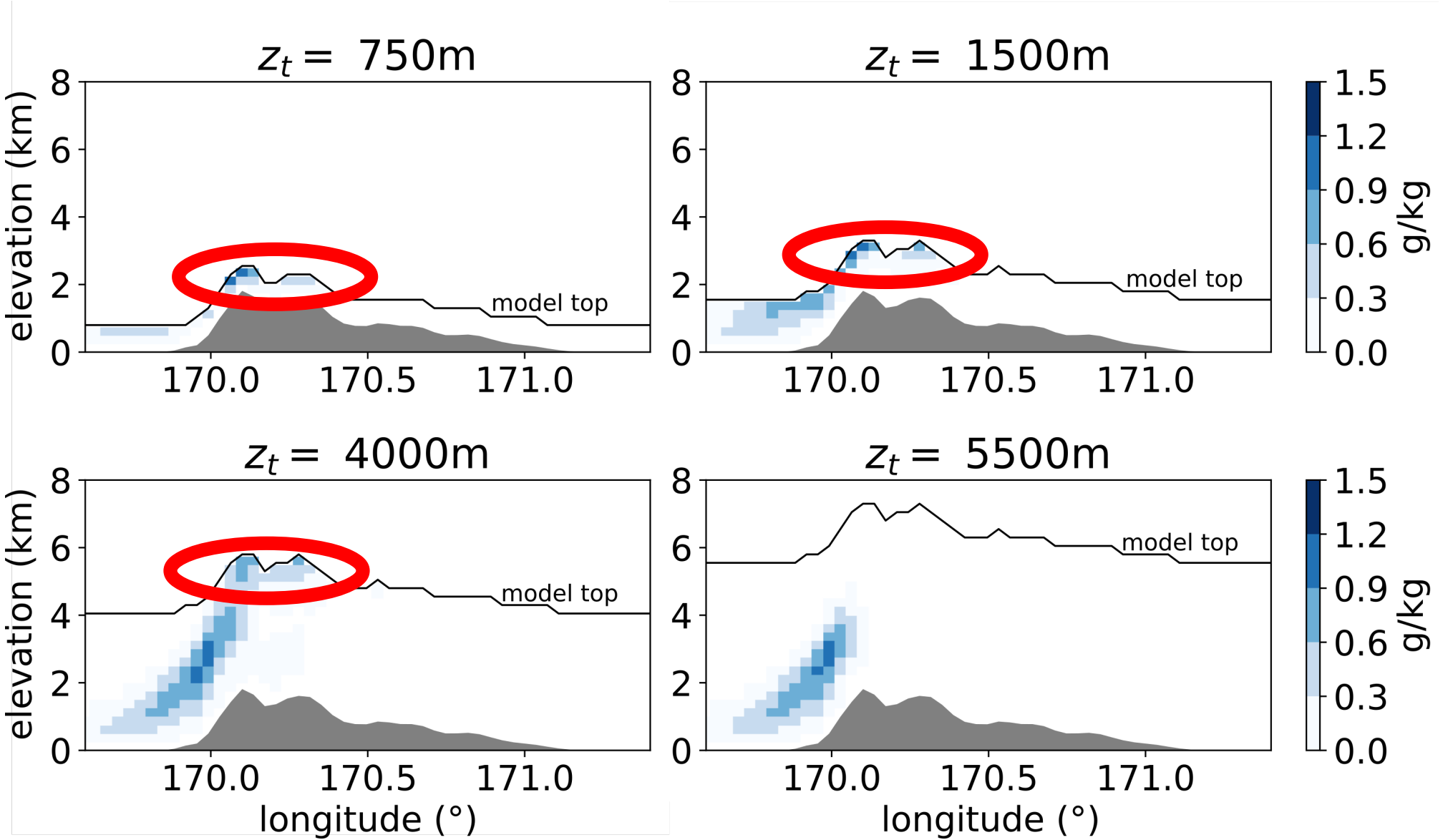


Does it work?

Yes but...

- still to be considered as in development
- more evaluation/understanding needed!
- apply with care!
- avoid pitfalls (see poster)


$z_t =$ 750m
$z_t =$ 1500m
$z_t =$ 4000m
$z_t =$ 5500m
elevation (km)
longitude (°)
model top
0
2
4
6
8
170.0
170.5
171.0
1.5
1.2
0.9
0.6
0.3
0.0
g/kg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So what’s going on here?

- Numerical artifacts at top boundary

- Solutions, references and more details shown at the poster!


Thank you!