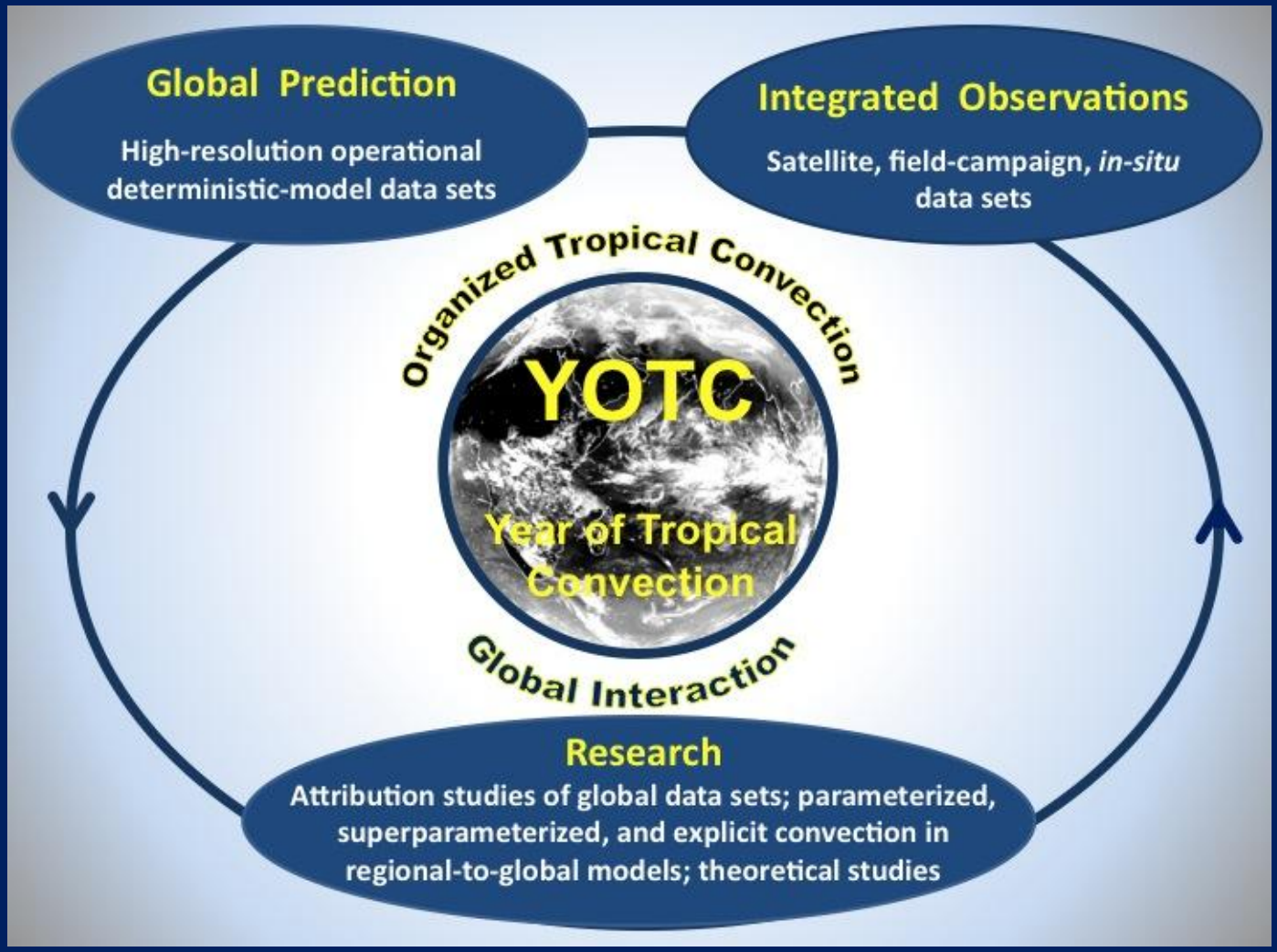
Modeling Resources

Mitch Moncrieff, NCAR



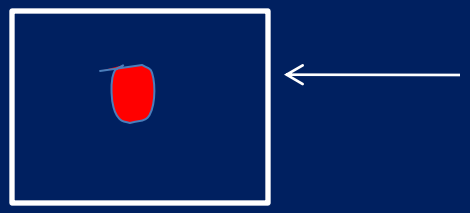
Modeling Resources

- Parameterized global models (weather & climate)
- Superparameterized global models
- Nested regional climate/tropical channel models
- CRMs: resolved mesoscale dynamics
- Theoretical-dynamical models: continuum

Representing cloud systems of dynamical scale L in numerical models of grid-length

a) Conventional parameterization

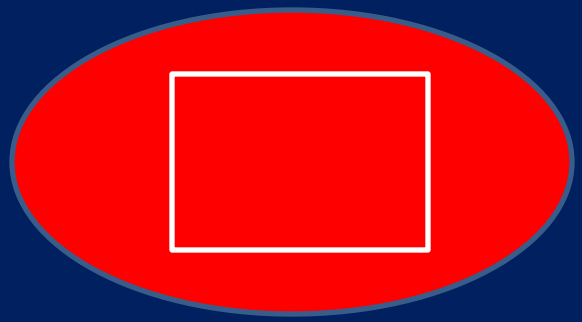
Cumulus



$\Delta \ll L$

b) Hybrid (parameterized & explicit) convection

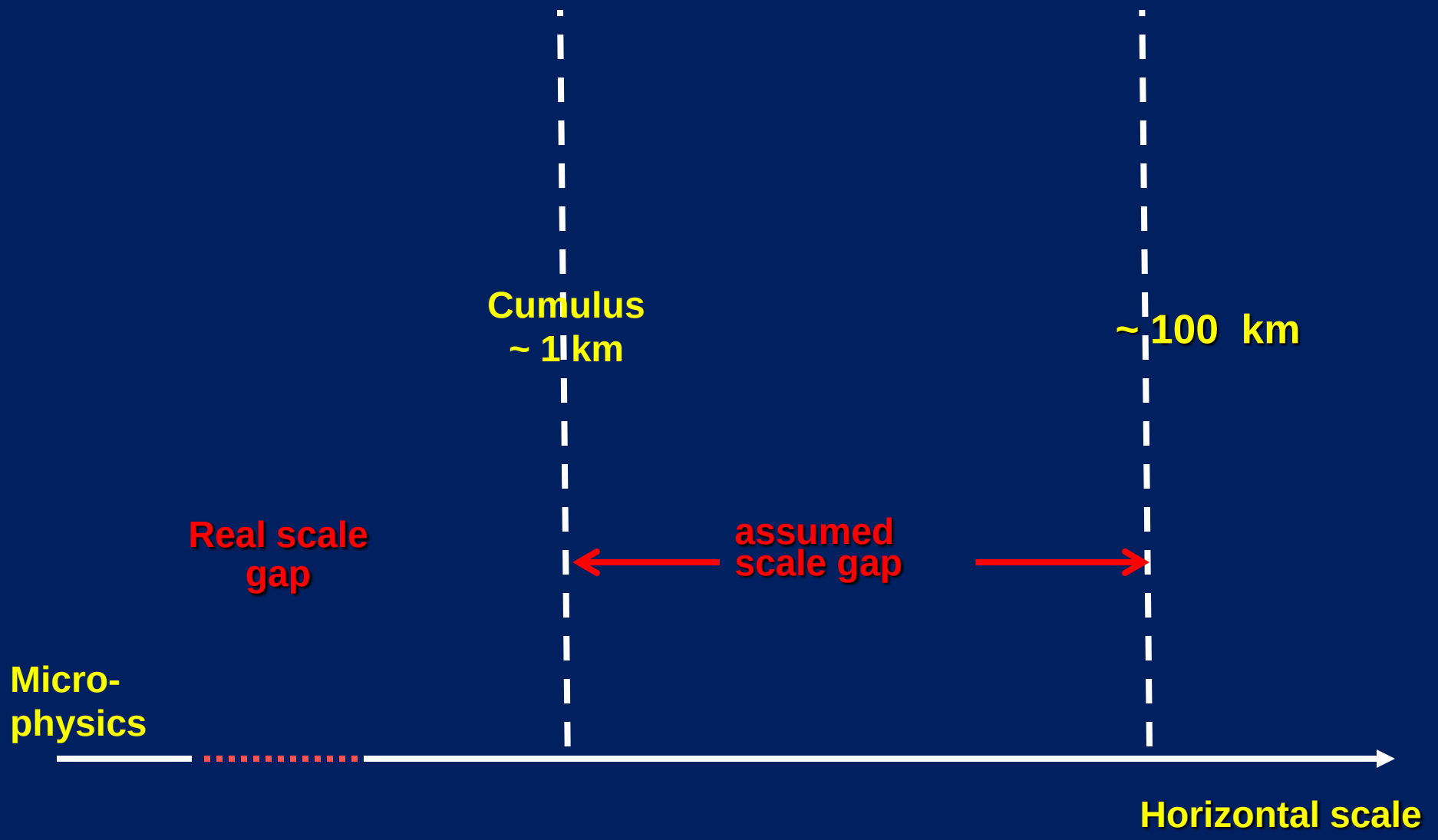
Cloud systems



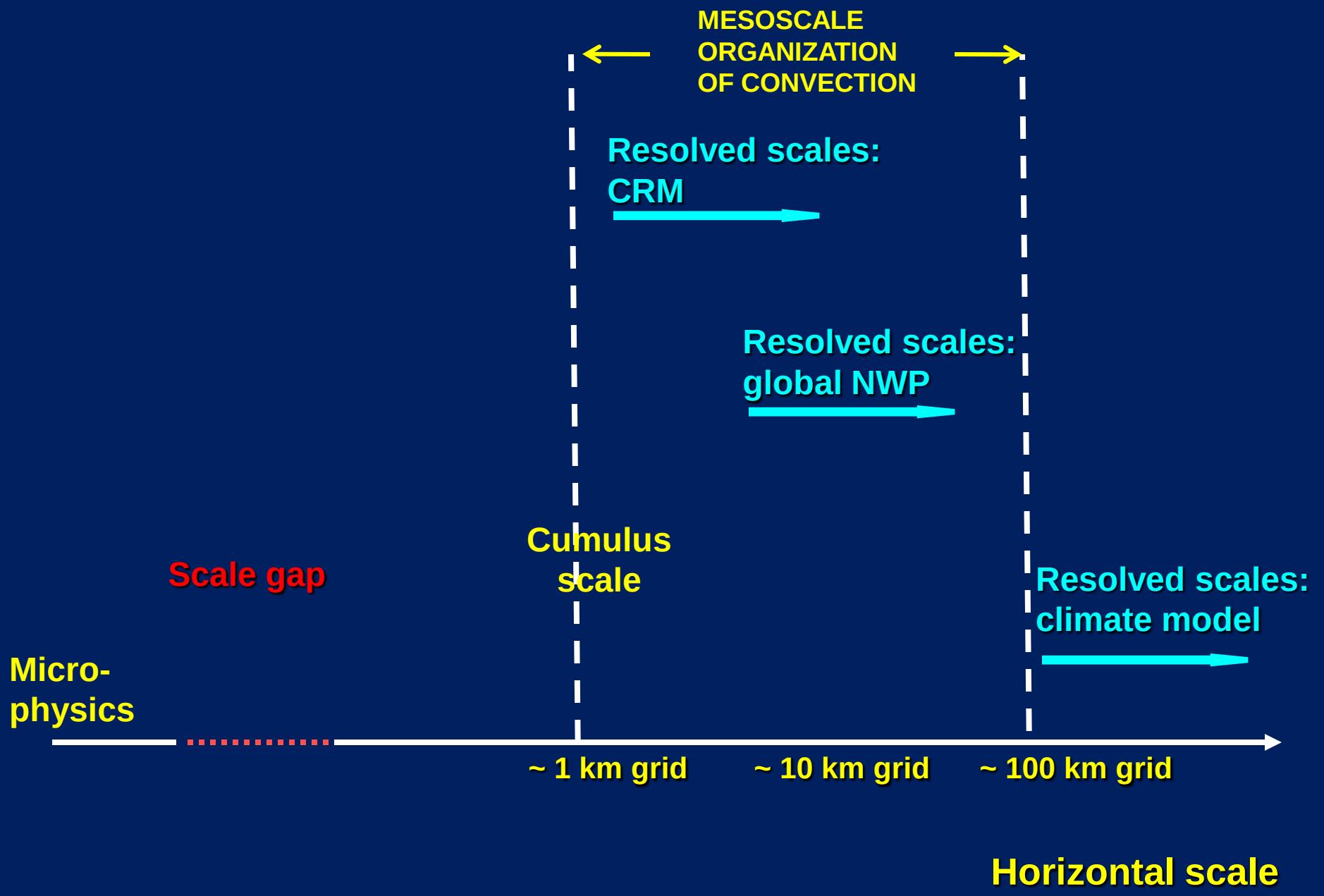
$\Delta \sim L$

c) CRM: explicit mesoscale dynamics

$\Delta \gg L$



Contemporary Parameterization



Model hierarchy

NCAR Nested Regional Climate/Tropical Channel Model

NCRM/TCM and YOTC

- **Links mesoscale convective organization with large-scale circulation of the tropics**

- **Addresses:**

- *Parameterized, hybrid, explicit representations* of tropical convection

- Upscale cascade *hypothesis*

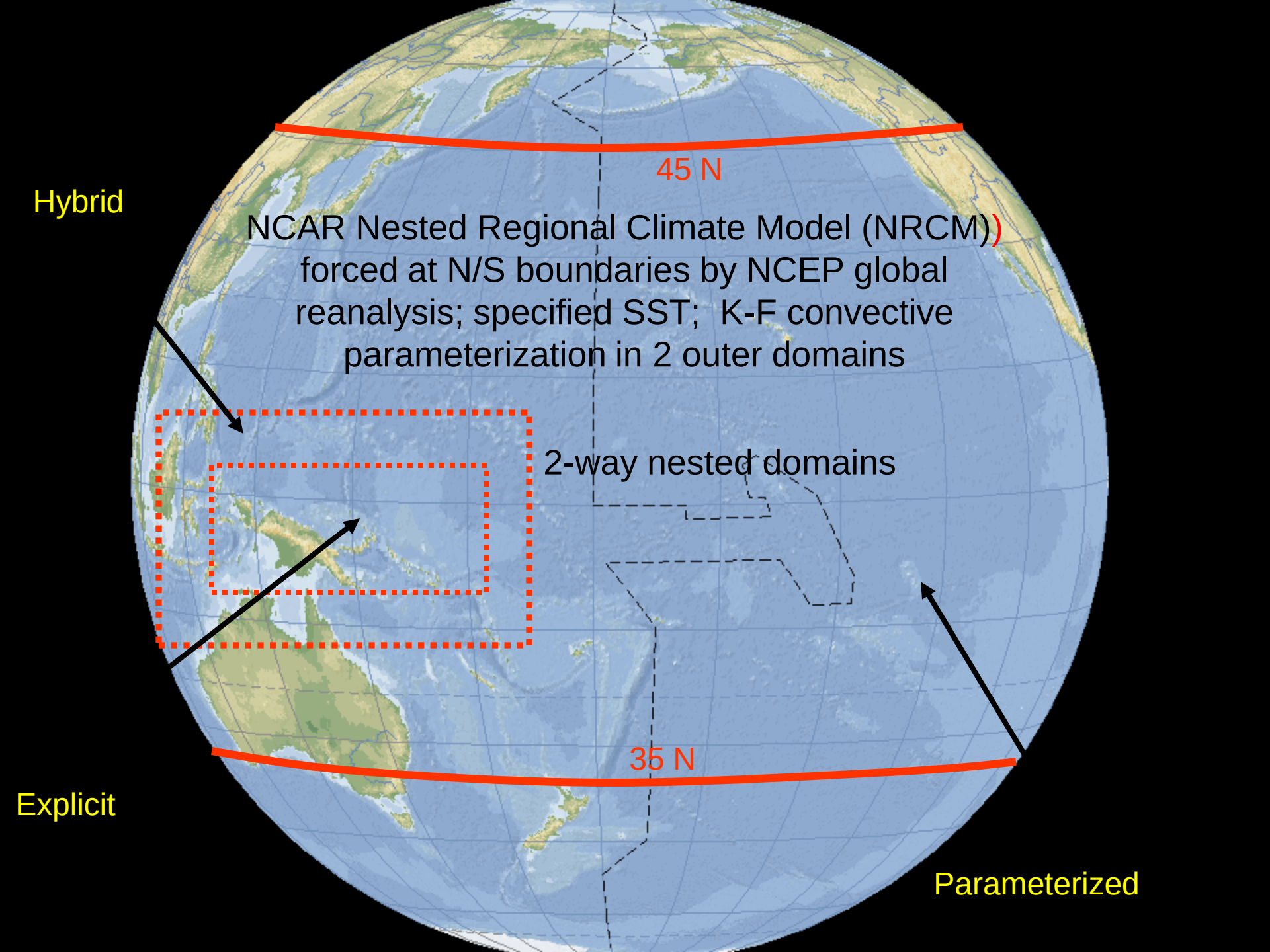
- Extratropical excitation hypothesis

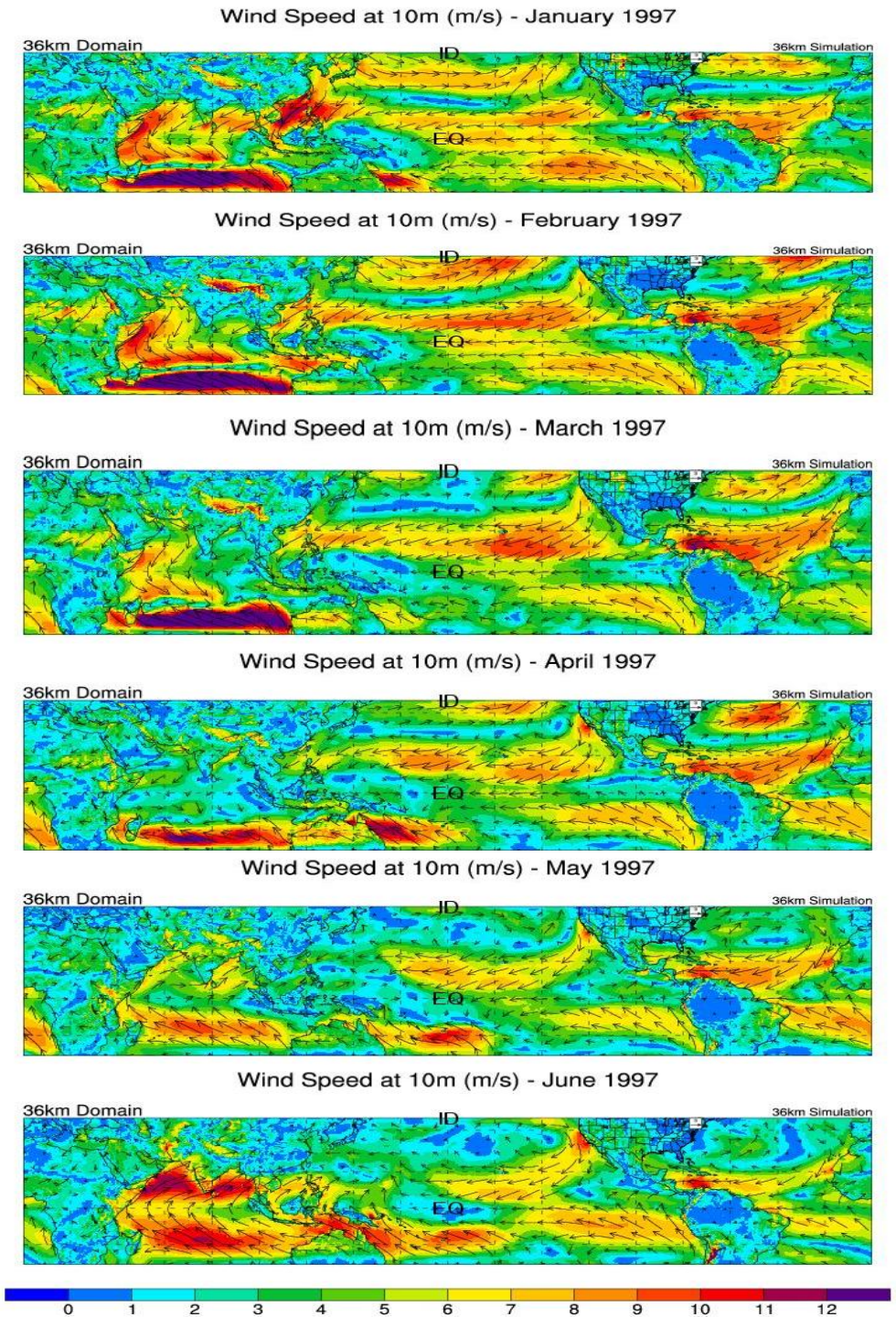
- Cetain weather-climate issues

Theoretical-dynamical models support the upscale cascade hypothesis but this hypothesis remains to be conclusively demonstrated in full-physics prediction models – but the existence of a theoretical basis for cascade is encouraging

TCM configuration

- Based on NCAR WRF
- Meridional boundary conditions supplied by NCEP global analysis, specified SST
- 36-km grid in outer domain (run for 10 years)
- 12-km (run for a year) and 4-km inner domains placed over Maritime Continent (run for 6 months)
- Kain-Fritsch *convective parameterization* in outer and 12-km domains, *explicit convection* in 4-km domain


Hybrid
45 N
NCAR Nested Regional Climate Model (NRCM))
forced at N/S boundaries by NCEP global
reanalysis; specified SST; K-F convective
parameterization in 2 outer domains
2-way nested domains
35 N
Explicit
Parameterized



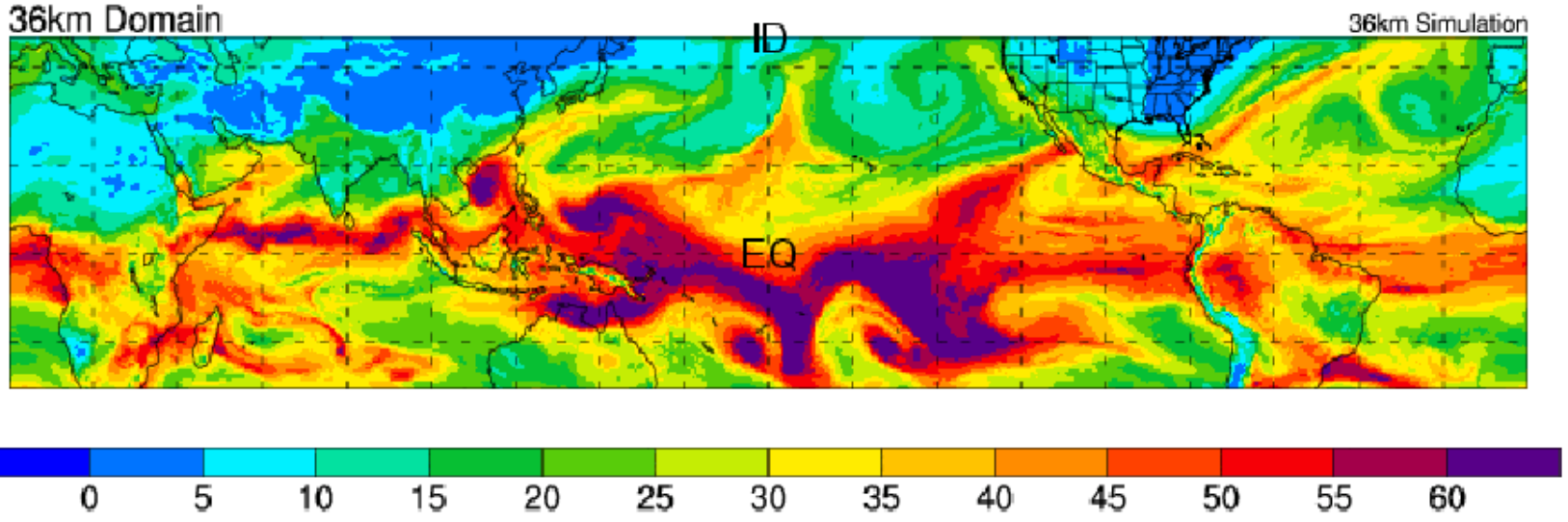
Seasonal Cycle of 10-m wind

(Jan - June 1997)

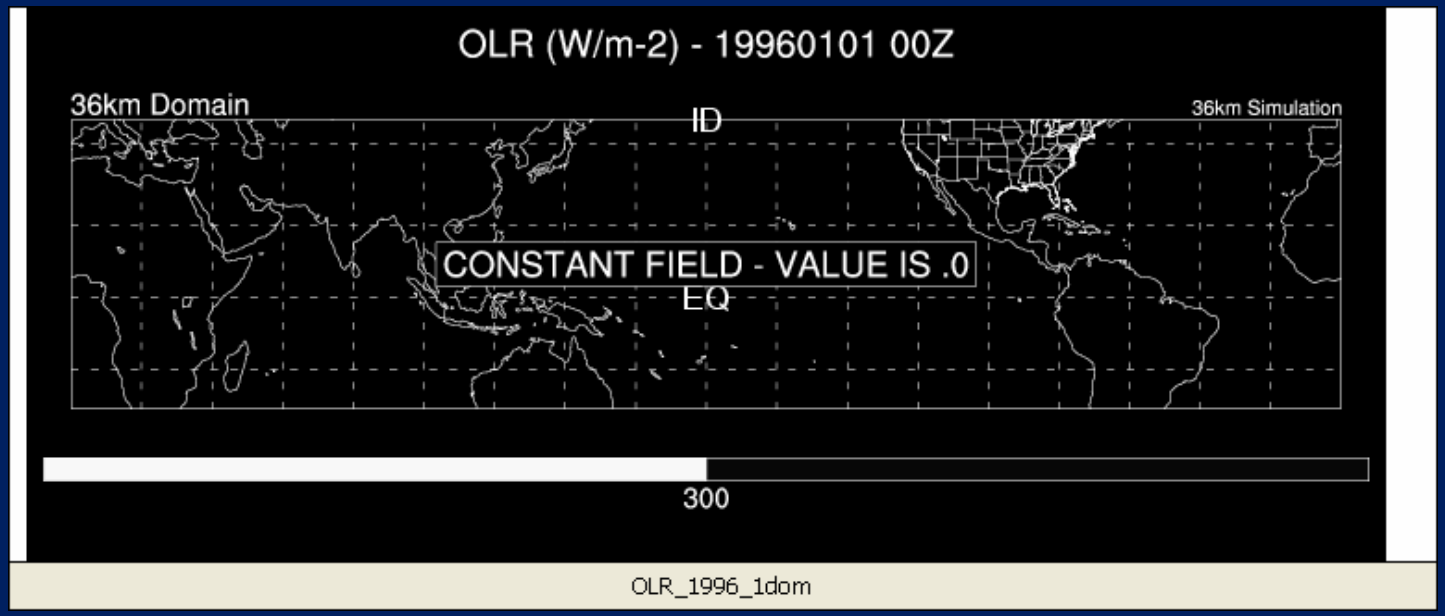
Asian winter & Australasian summer monsoon

- E. Pacific trade winds
- Atlantic trade winds
- Tropical cyclone bombardment of southern boundary alleviated by moving boundary south to 45S

PW (mm) - 19980101 00Z



PW_199801_1dom.avi


OLR (W/m-2) - 19960101 00Z
36km Domain
ID
36km Simulation
CONSTANT FIELD - VALUE IS .0
EQ
300
OLR_1996_1dom

MJOs in TCM

- **Weaker than in reality**

- **Higher resolution (12 km and 4 km) nested domains did little to improve MJO … except for cases identified with extratropical excitation**

  Possible explanation: inner domains over the Maritime Continent amplified the diurnal cycle which disrupted organized convection and MJO propagation

- **Parameterized convection in outer domain *biases the mean state* and the environments of the inner domains**

Weather-climate intersection research