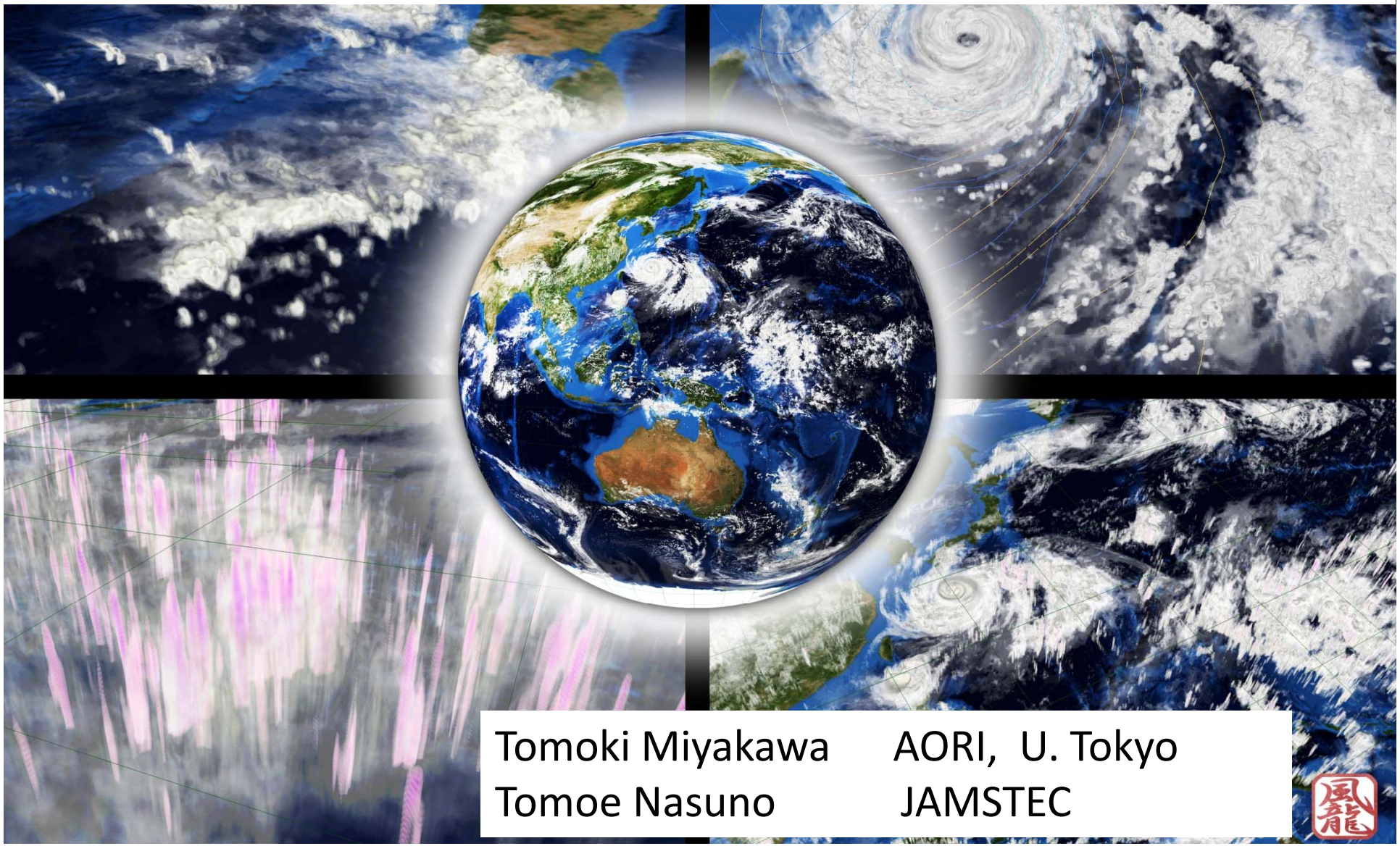
—Global CRM (NICAM)—

Plan and current status of model MJOs/diurnal cycles



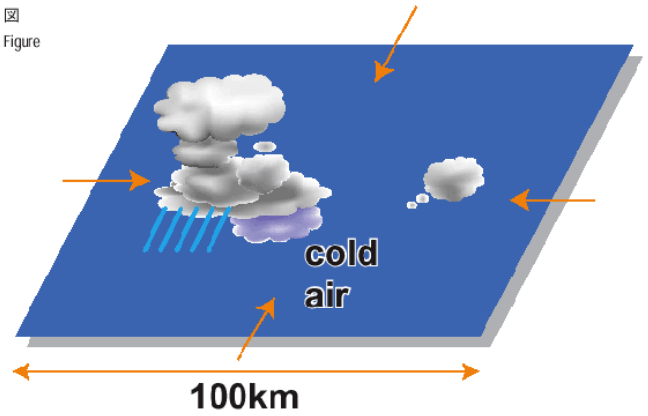
Tomoki Miyakawa AORI, U. Tokyo
Tomoe Nasuno JAMSTEC

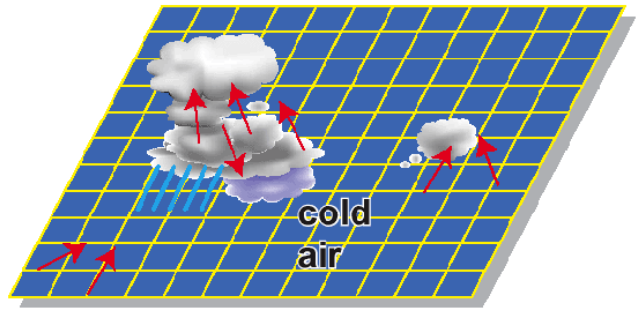
Nonhydrostatic Icosahedarl Atmospheric Model (NICAM)

Satoh et al. (2008, 2014)

Group web page http://nicam.jp

図
Figure





➢ "cloud system resolving"

- global **14 km - 3.5 km** mesh

  Tomita et al.(2005), Miura et al.(2007)
  Miyakawa et al. (2014)

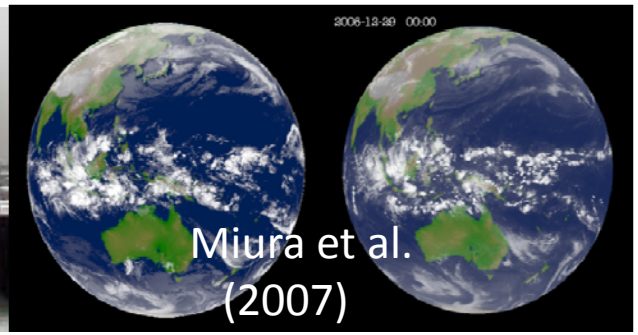
➢ "cloud-resolving"

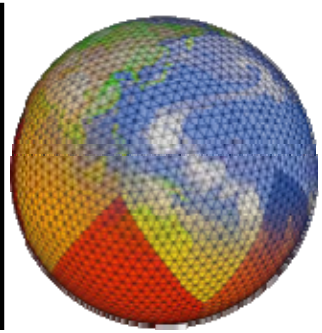
- global **870 m** mesh

  Miyamoto et al. (2013, GRL)

➢ "cloud-not-resolving"

- global **220 km – 28 km** mesh
- Turn on/off cumulus parameterization

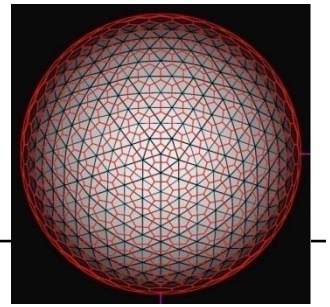




NICAM

Satoh et al. (2008、2014)

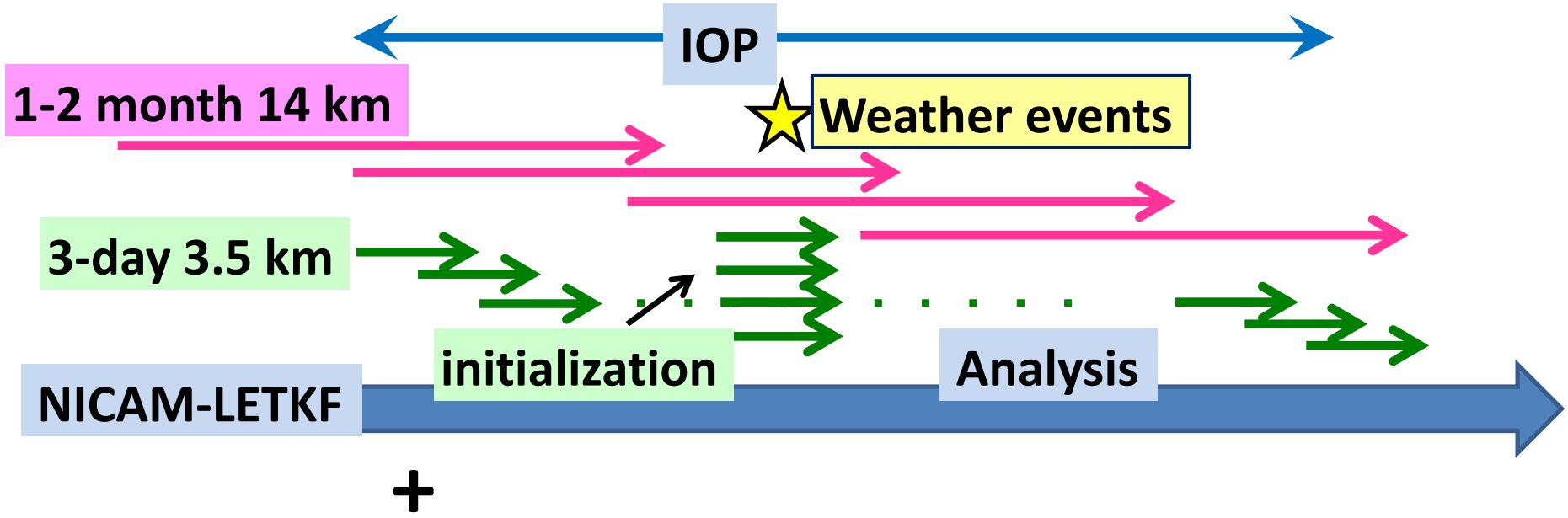
■ Dynamics	
governing equations	Fully compressible non-hydrostatic system
spatial discretization horizontal grid vertical grid topography	Finite Volume Method Icosahedral grid (Tomita et al. 2001, 2002) Lorenz grid Terrain-following coordinate
conservation	Total mass, total energy Satoh (2002, 2003)
temporal scheme	Slow mode － explicit scheme （RK2, RK3） Fast mode － Horizontal Explicit Vertical Implicit scheme
■ Physics	
radiation	MSTRNX / MSTRNX-AR5 (Sekiguchi and Nakajima, 2008)
cloud physics	Grabowski(1998); NSW6(Tomita 2008); NDW6(Seiki et al 2013)
shallow clouds boundary layer	MY level 2 (Mellor and Yamada 1982; Noda et al. 2010) or MYNN level 2.5 or 3 (Nakanishi and Niino 2006)
surface flux	Louis(1979), Uno et al.(1995)
Land surface processes	Bucket or MATSIRO
Ocean	Specified sst or mixed-layer slab ocean or COCO (full ocean)



NICAM (tentative) plan for YMC

1. 1~2 month ensemble simulation (~14 km, 20 members)
2. 3-day simulation（ 3.5 km） (test with stretched grid)

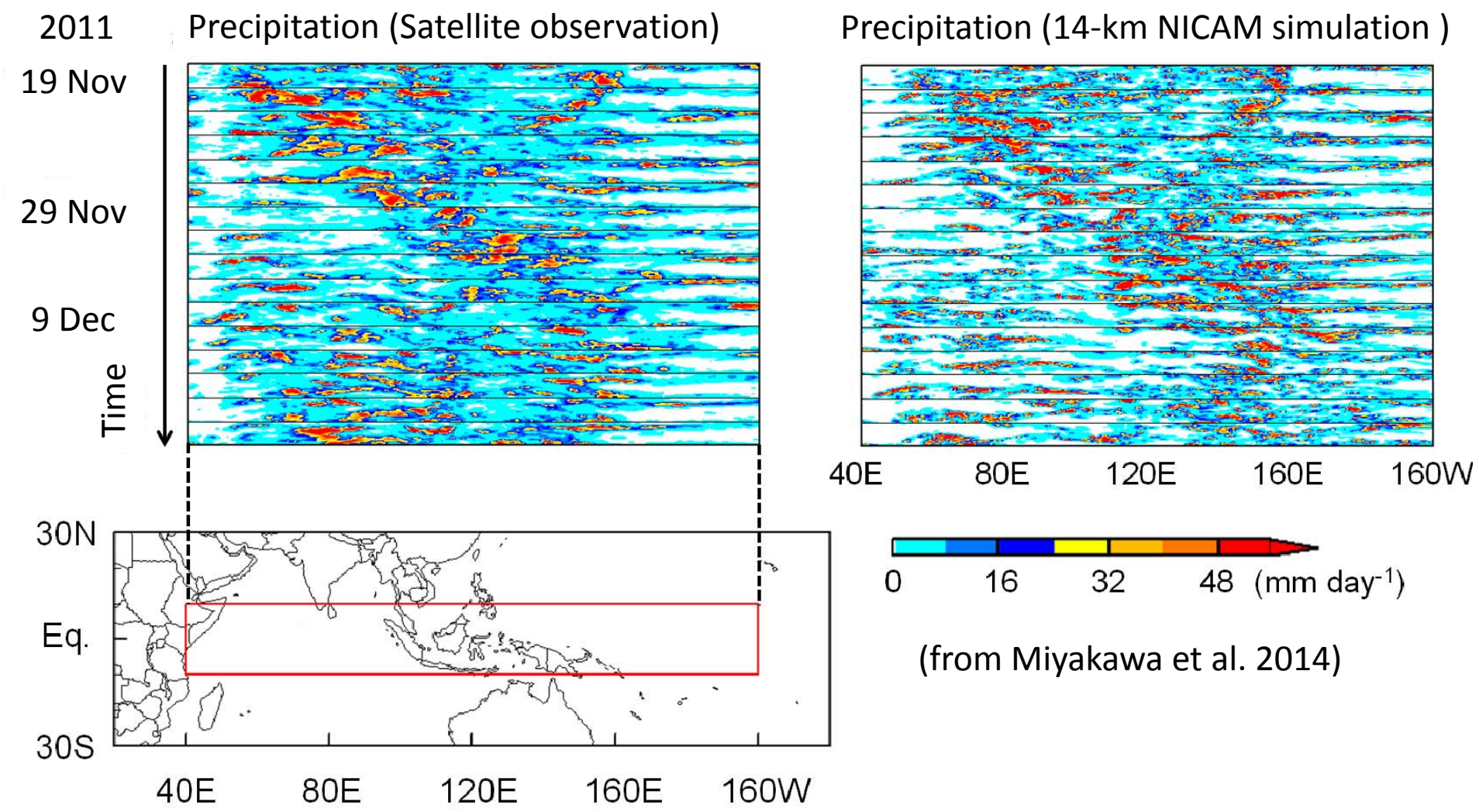
+ Data Assimilation（NICAM-LETKF; developing@Riken）



3. Science fiction simulations
4. Ocean coupled simulations?

- Data are to be shared for field operations and research use.

1) Real MJO case: Hindcast of CINDY2011/DYNAMO MJO event



(from Miyakawa et al. 2014)

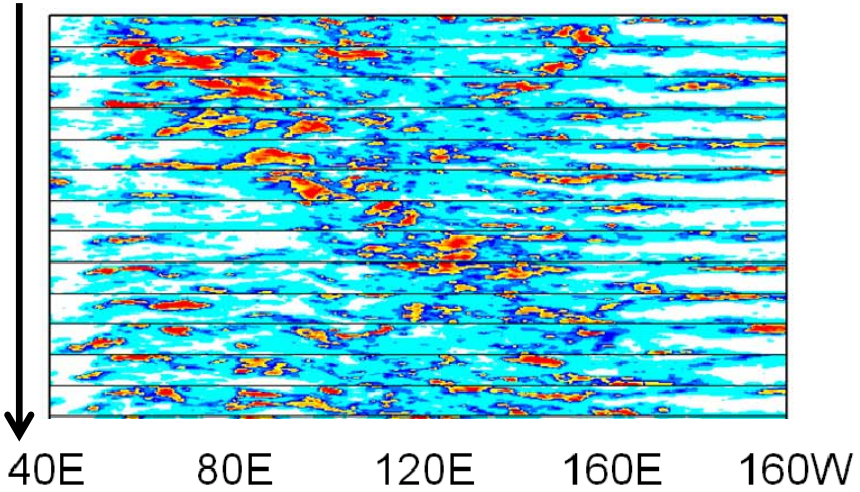
NICAM produces nice MJO if we are fairly lucky.

We'd like to know if the interaction with MC is realistic or not.

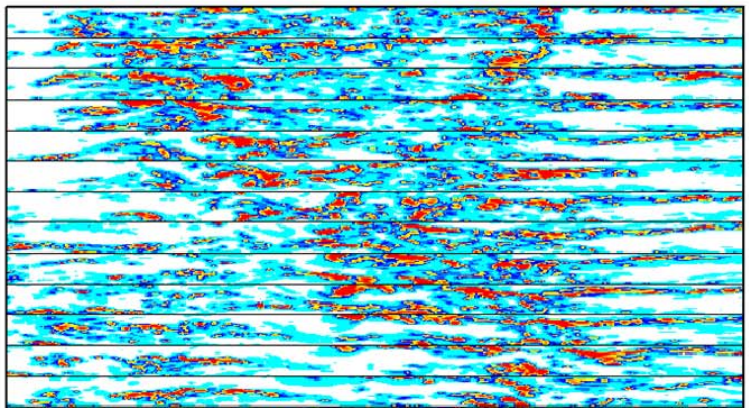
1) Real MJO case: Different resolutions

2011

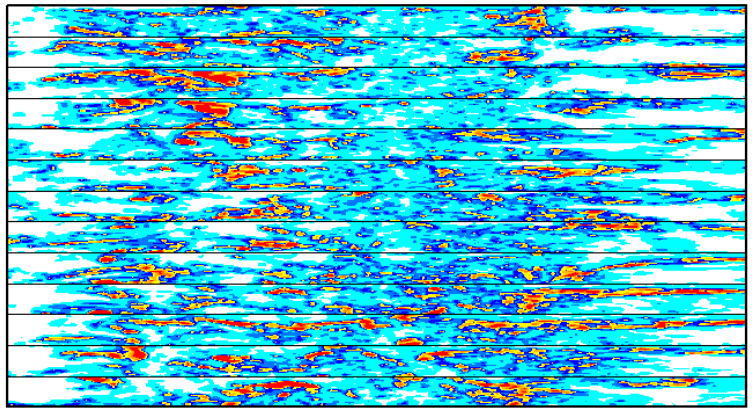
Satellite observation (TRMM)



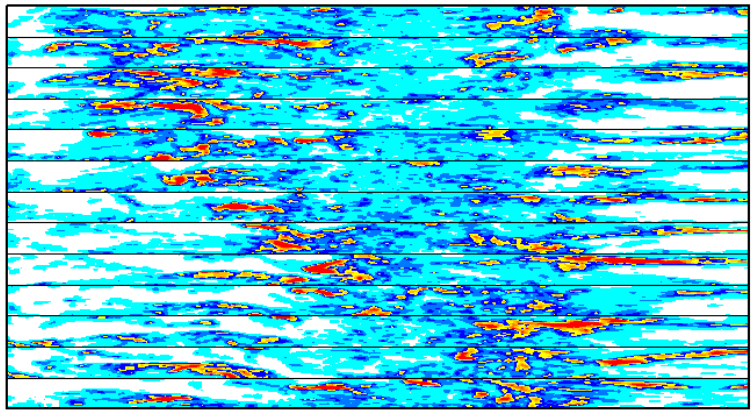
14-km NICAM



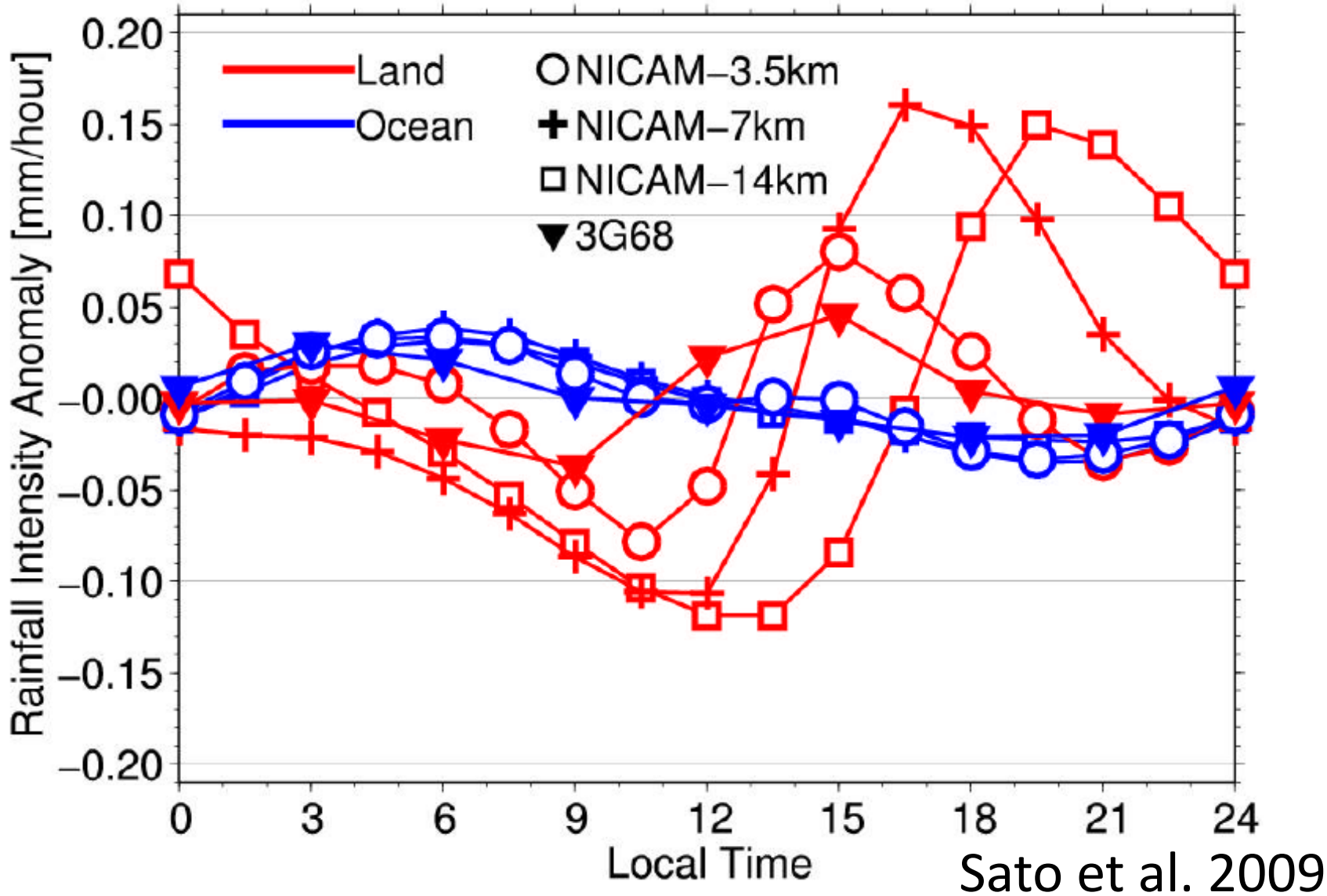
7-km NICAM



3.5-km NICAM



2) Diurnal cycle



Sato et al. 2009

2) Diurnal cycle

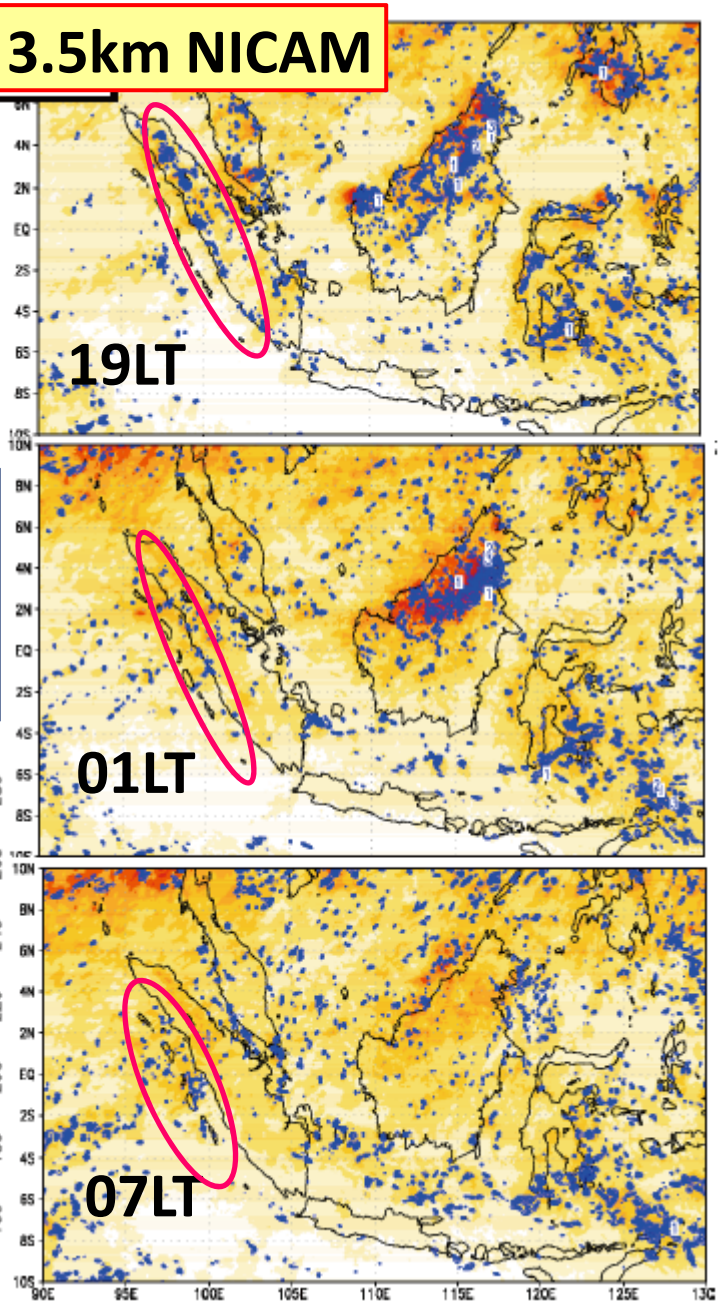
global 3.5km NICAM

Precip: blue
OLR: color

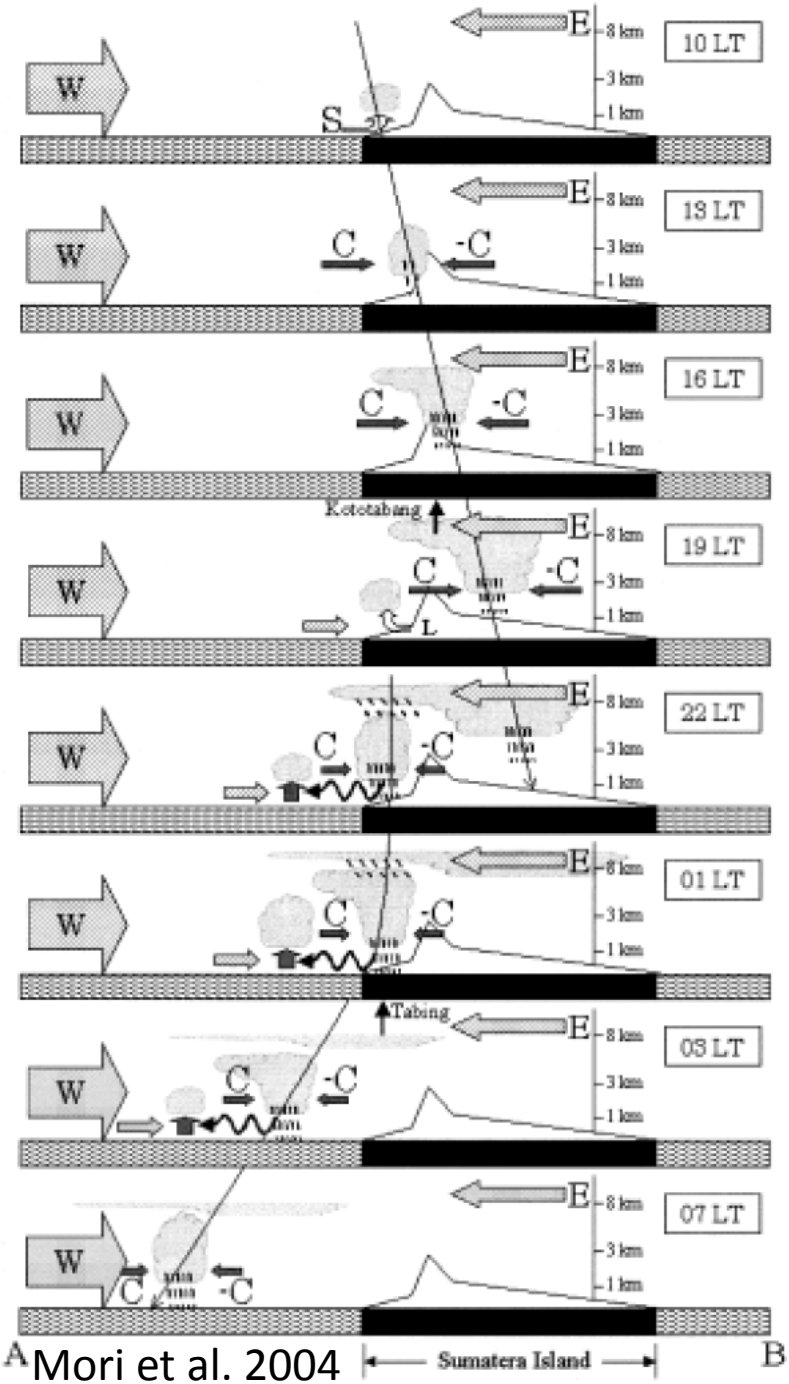
Precip along Mountains

Propagation toward Inland / Coast lines

Precip offshore



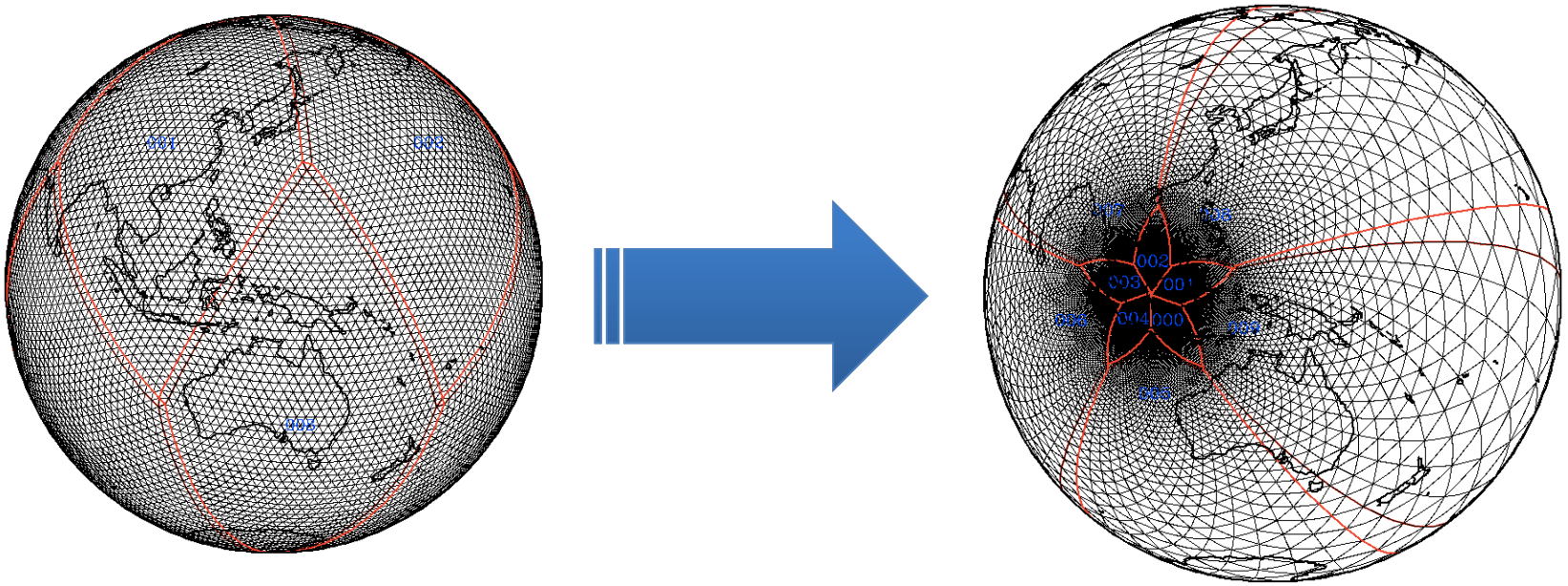
Analysis by M. Fujita



Mori et al. 2004

2) Diurnal cycle: Stretched simulations

3.5 km NICAM has OK diurnal cycles,
but with plenty room for improvement.



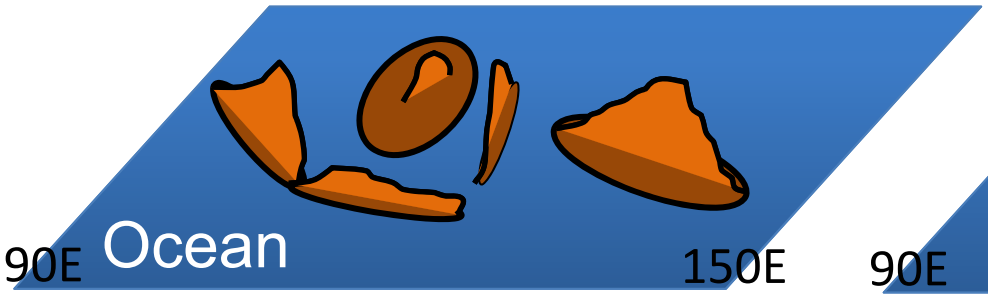
Quick & cheap tests to optimize the model for
MC diurnal circulations can be carried out.

3) Science fiction simulation (Takasuka et al. 2015, SOLA)

Aqua-planet + various MC (220 km NICAM)

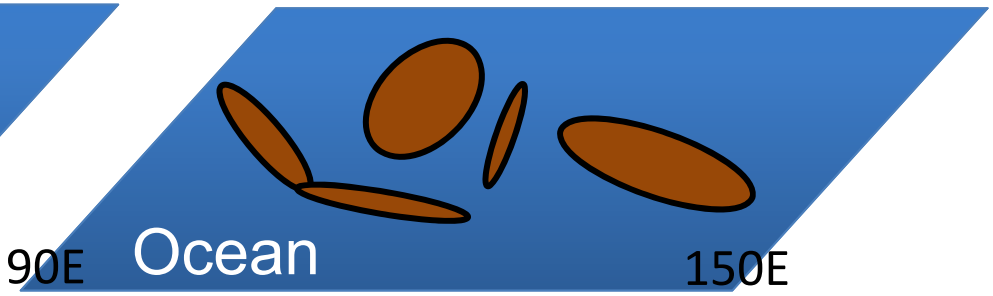
(1) MARITIME

MC elevation and land-sea masks in the full model



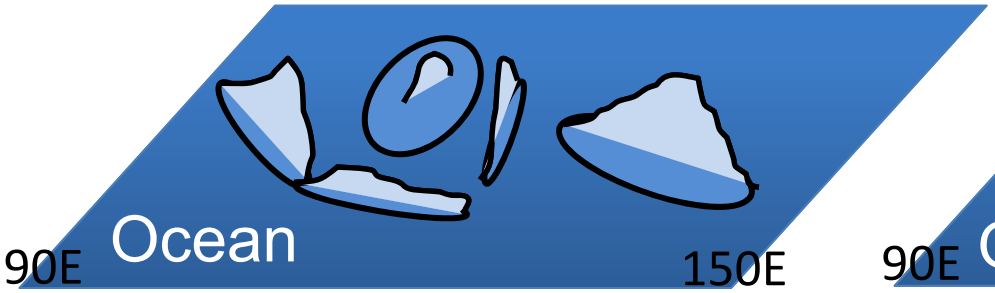
(2) NOTOPO

Only MARITIME land-sea masks (no elevation)



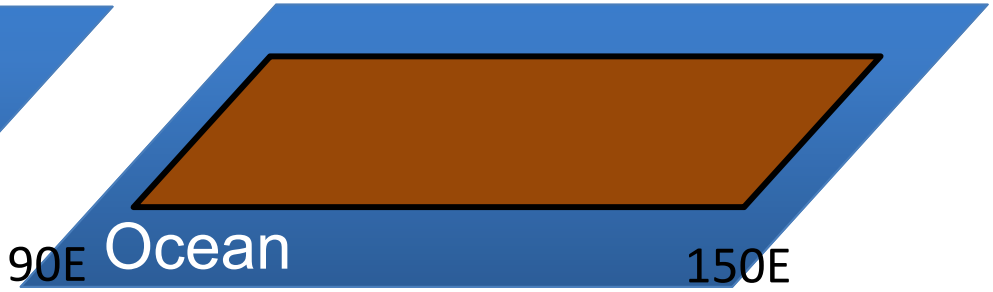
(3) MARIOCN

MC elevation and sea surface



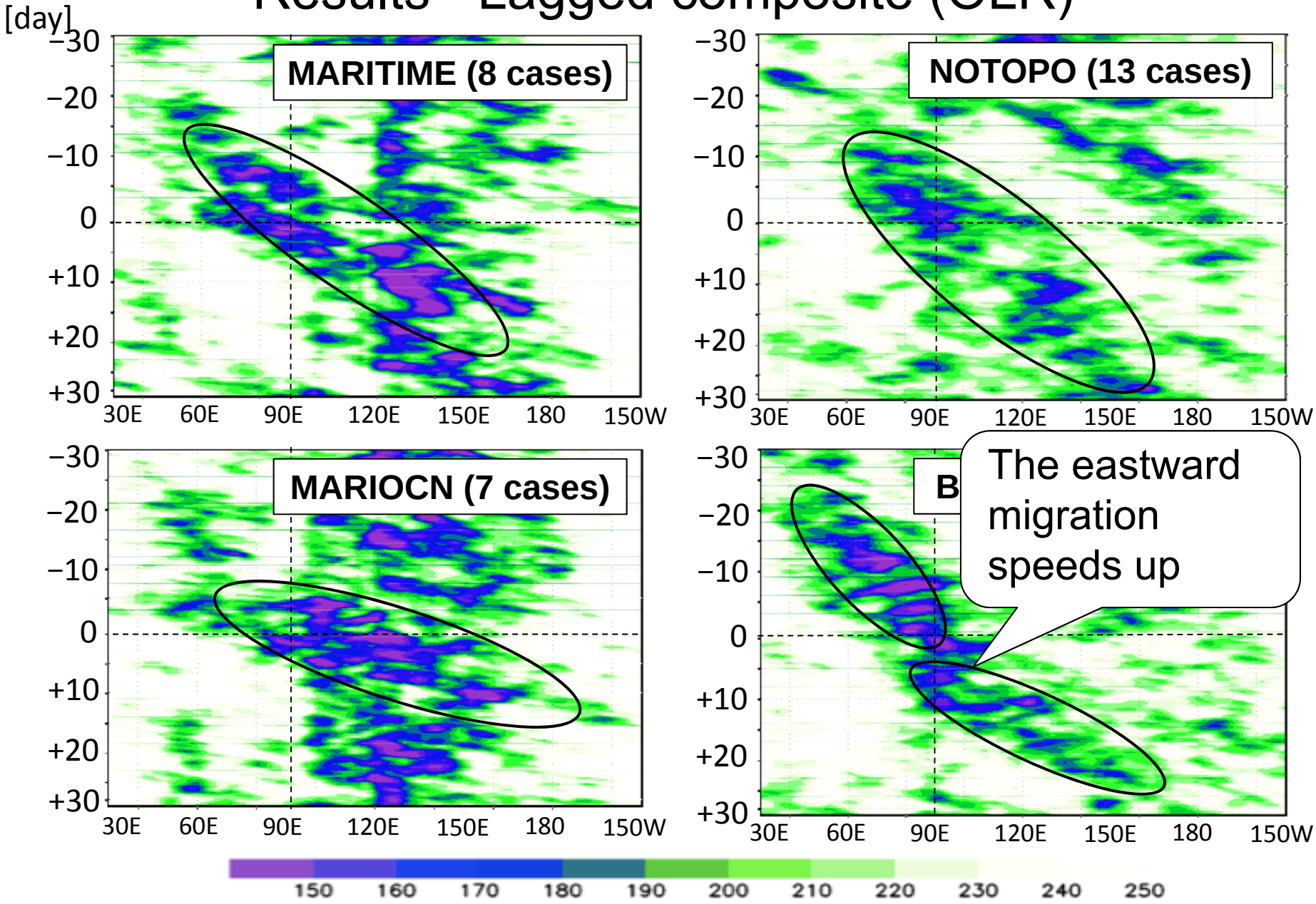
(4) BIGFLAT

Broad flat rectangular land

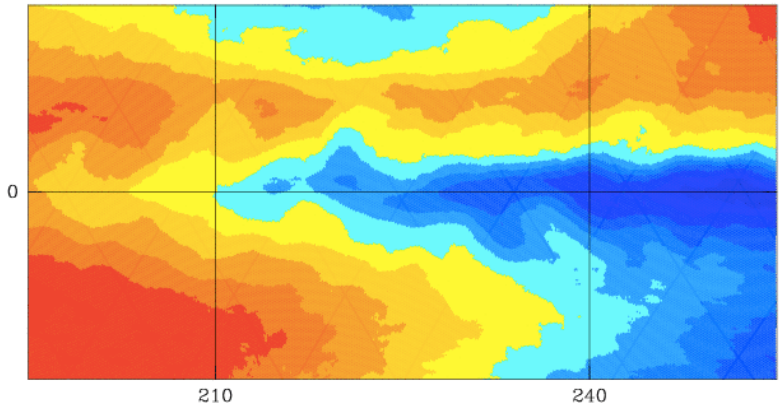


3) Science fiction simulation (Takasuka et al. 2015, SOLA accepted)

Results - Lagged composite (OLR)

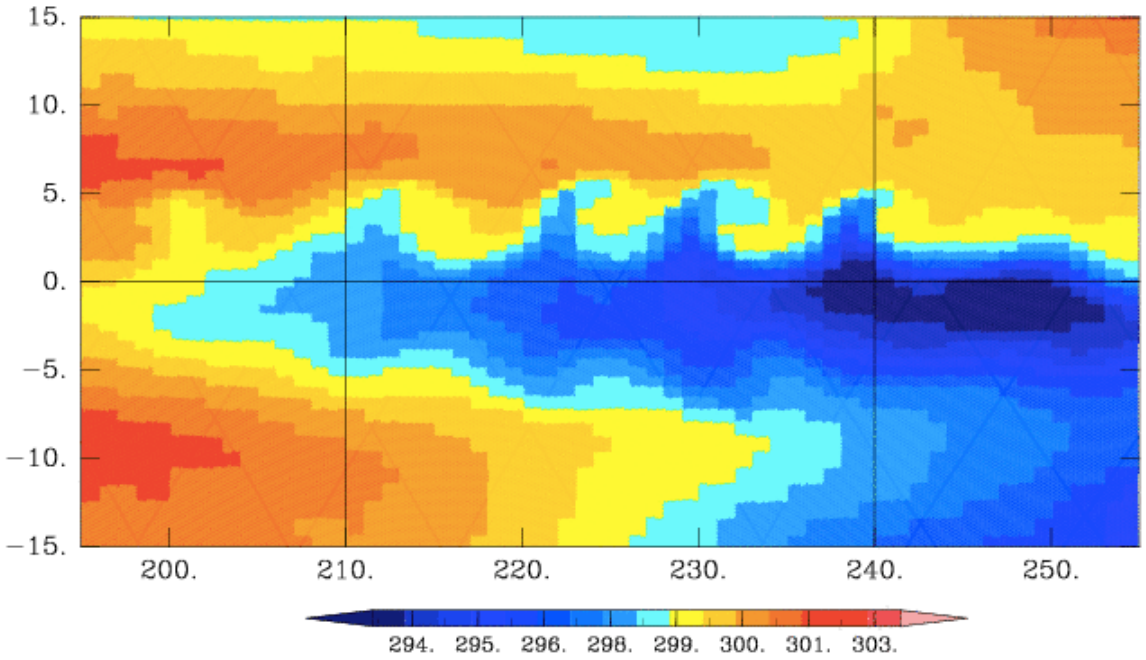


4) Ocean coupled simulation



Eastern Pacific getting better.

MC ? Not yet.
1x1 deg ocean not enough for through flows.



Higher resolution version under development.

With some luck it may become ready in time for YMC.

NICAM (tentative) plan for YMC

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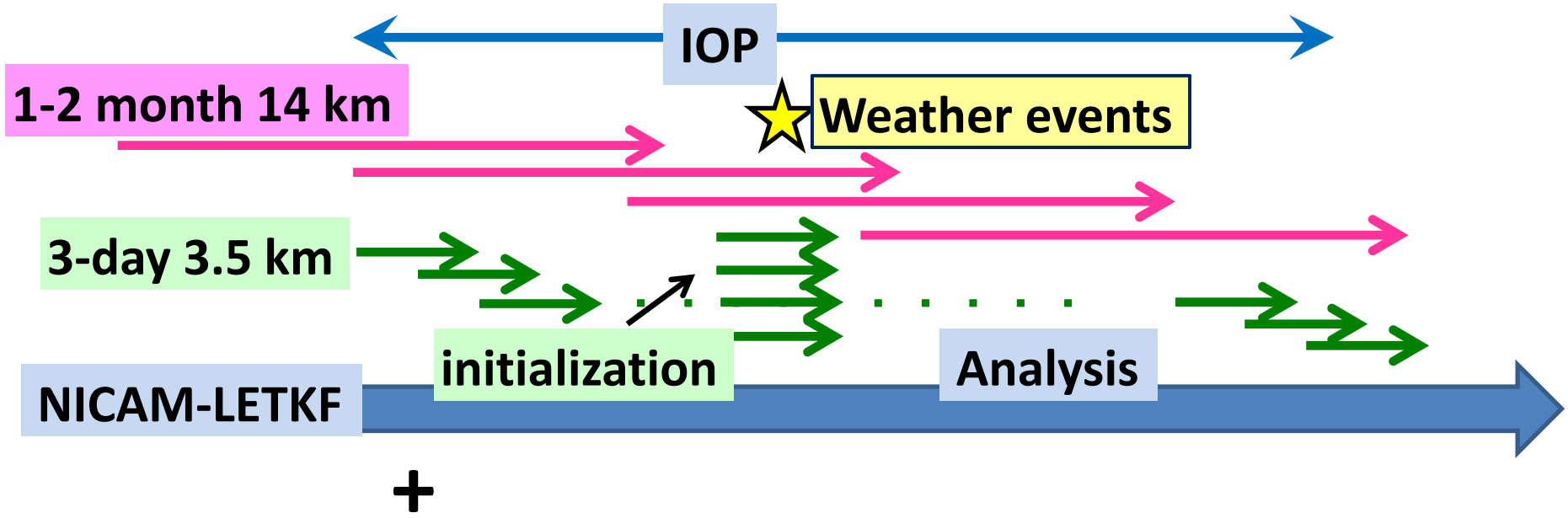

+

3. Science fiction simulations
4. Ocean coupled simulations?

- Data are to be shared for field operations and research use.

Can provide:

- ➢ Consistent 3-D dataset
  (1-2 months at 14 km, ~3 days at 3.5 km)
- ➢ Idealized experiments (removal of MC, etc.)
- ➢ Preliminary ocean coupled simulations?

Want:

- ➢ Feedbacks
  - Please tell us in what way the model failed.
    ... preferably with implications of why.
    (missing process?)
    - diurnal cycles/ offshore travelling systems
- ➢ New, crazy ideas for idealized experiments.

Earth simulator
JAMSTEC

K computer
RIKEN AICS

AORI, Univ. Tokyo

Thank you!

SPIRE Field 3 (hp130010)
JSPS 15K17757