Convective and stratiform processes in a convection permitting model over the Maritime Continent

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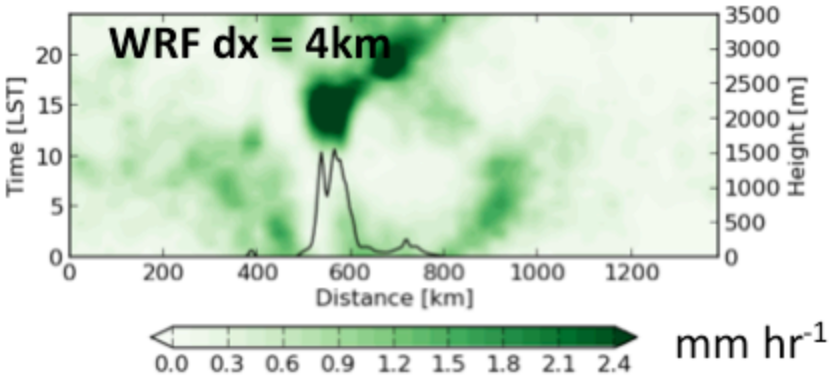
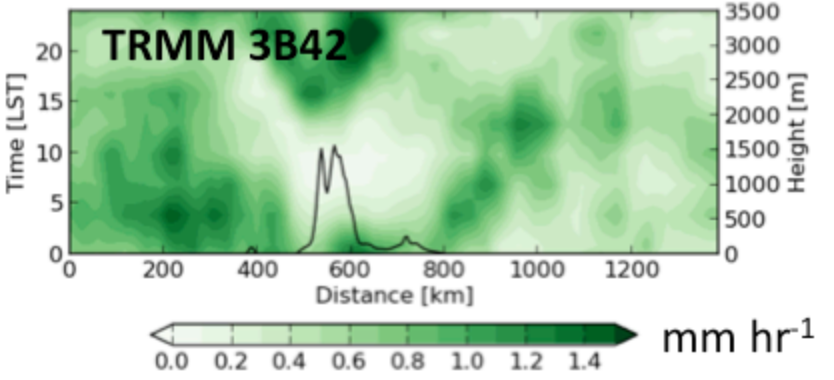
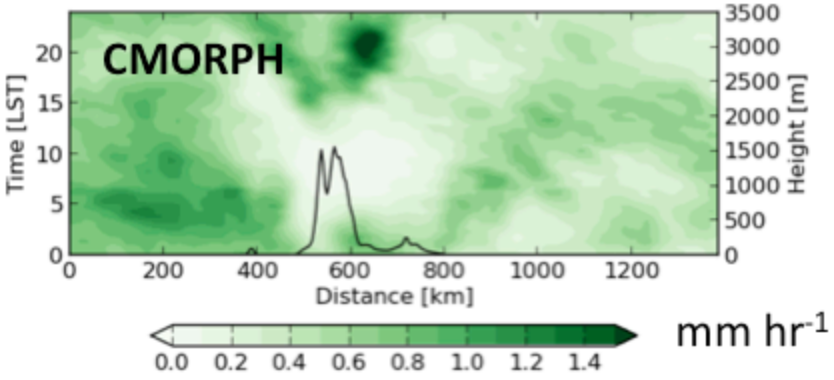
THE UNIVERSITY OF MELBOURNE

Simulated and Observed Diurnal Precipitation Cycle: Sumatra







Most physical processes represented, but ….

Errors in timing and amplitude of diurnal cycle

Different amounts of widespread rain

Vincent & Lane 2017

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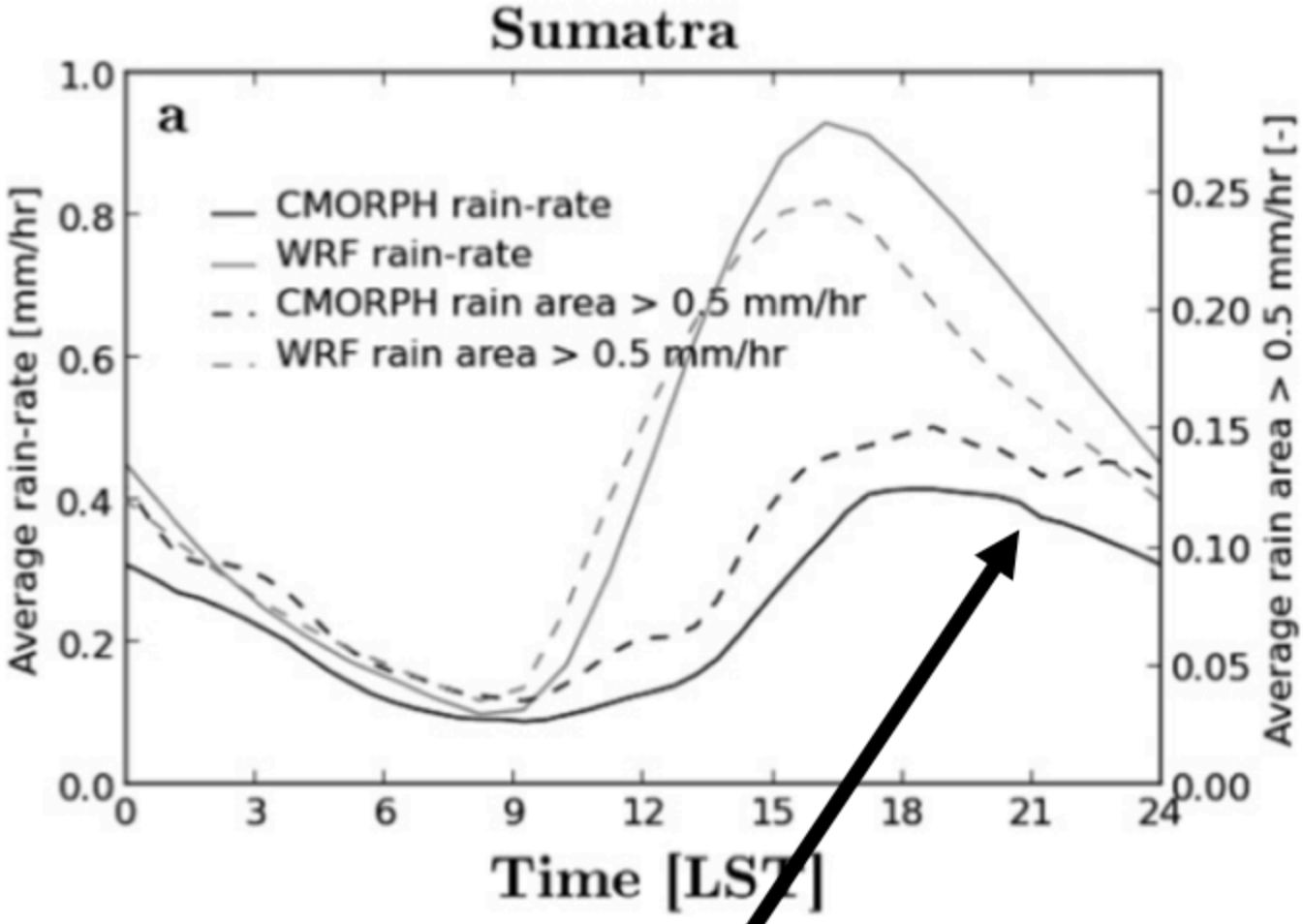
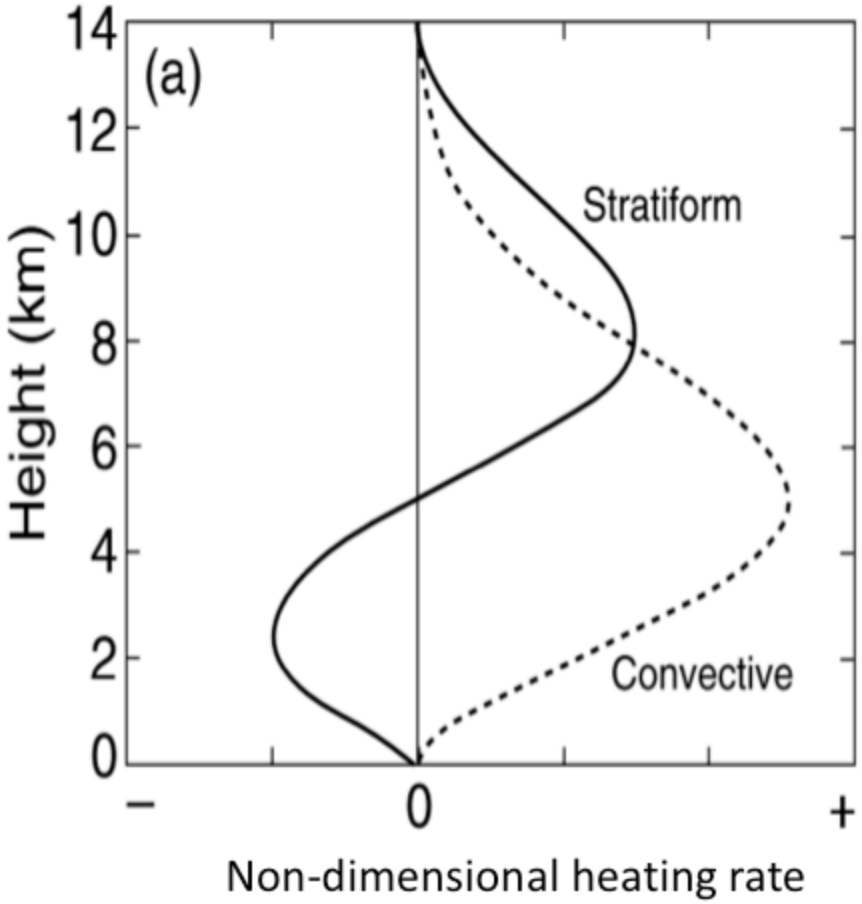


Rain-rate decreases while rain-area flattens out

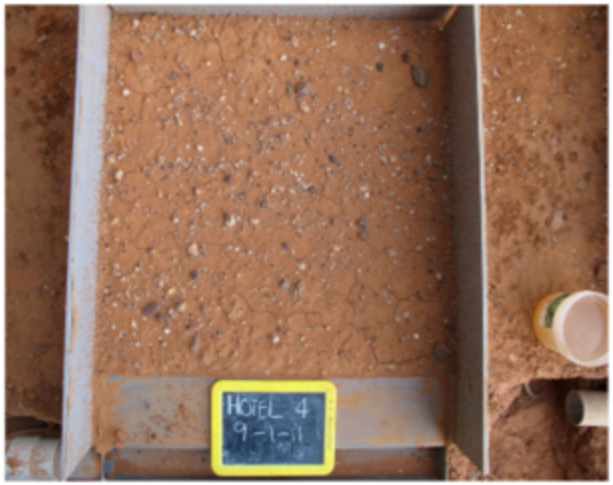
Vincent & Lane 2017

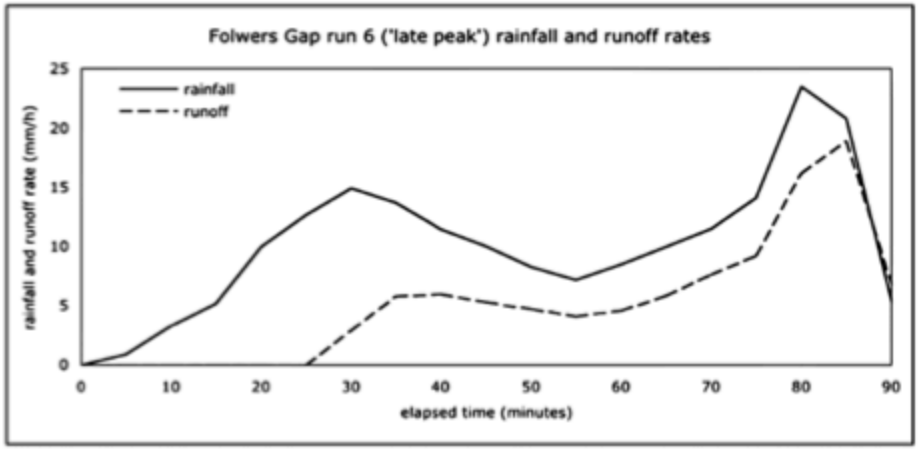
The type of rain affects latent heating

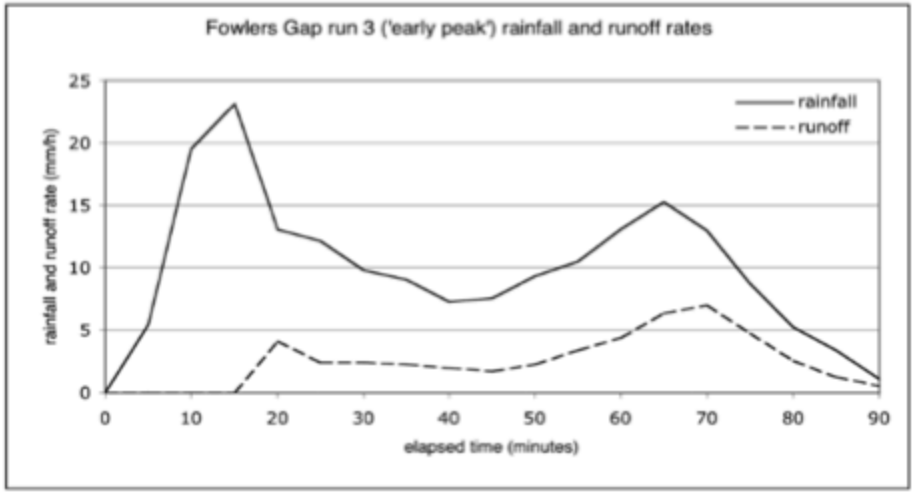


Houze Jr, R. A. (2004). Mesoscale Convective Systems. Reviews of Geophysics, 42, 143.

The type of rain affects the local hydrological outcome



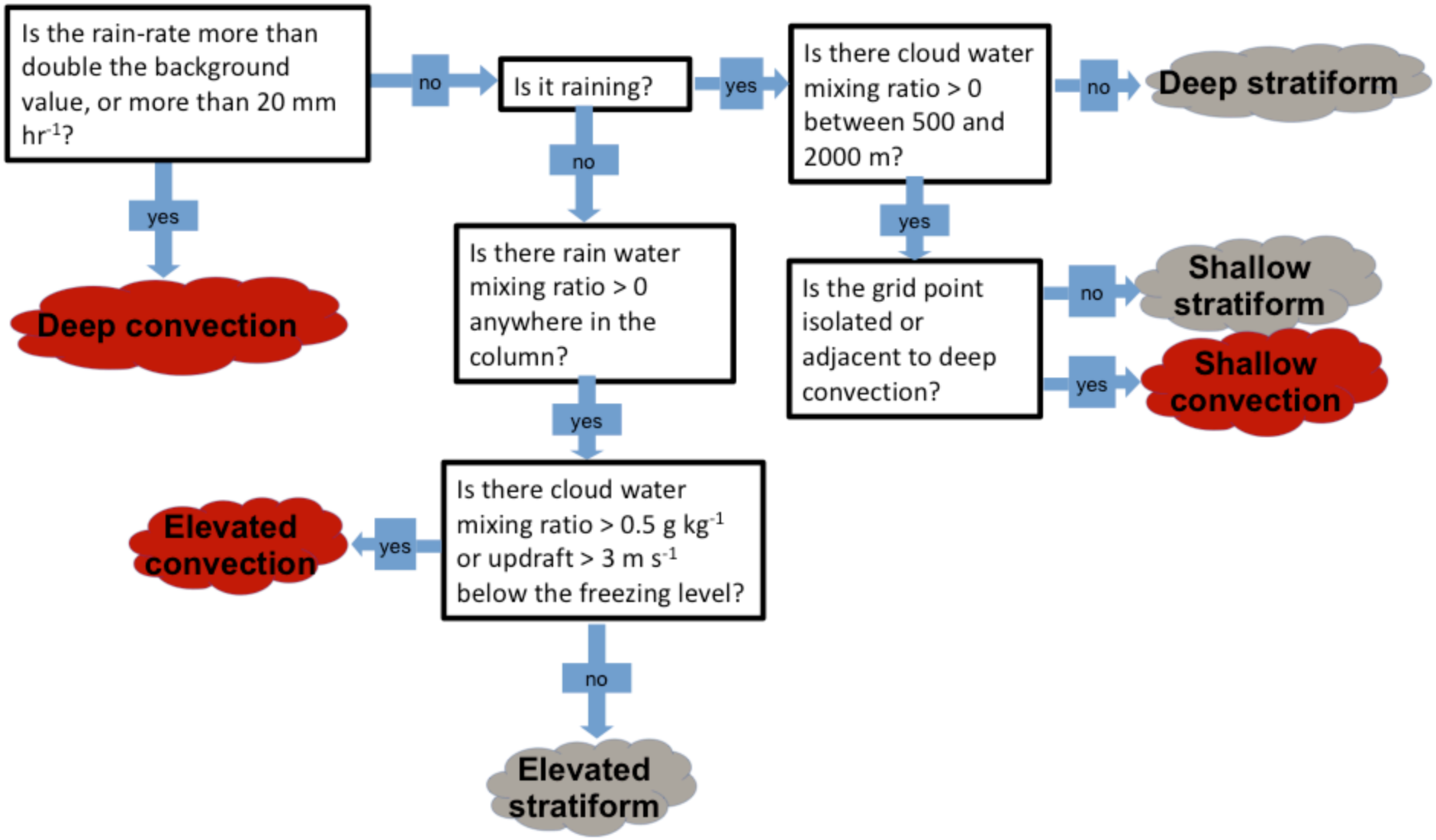




Dunkerley, D (2012) Effects of rainfall intensity fluctuations on infiltration and runoff: rainfall simulation on dryland soils, Fowlers Gap, Australia. Hydrol. Process. 26, 2211–2224

Separation of diabatic heating by rainfall type

Based on Shige et al. (2004) / Lang et al. (2003)



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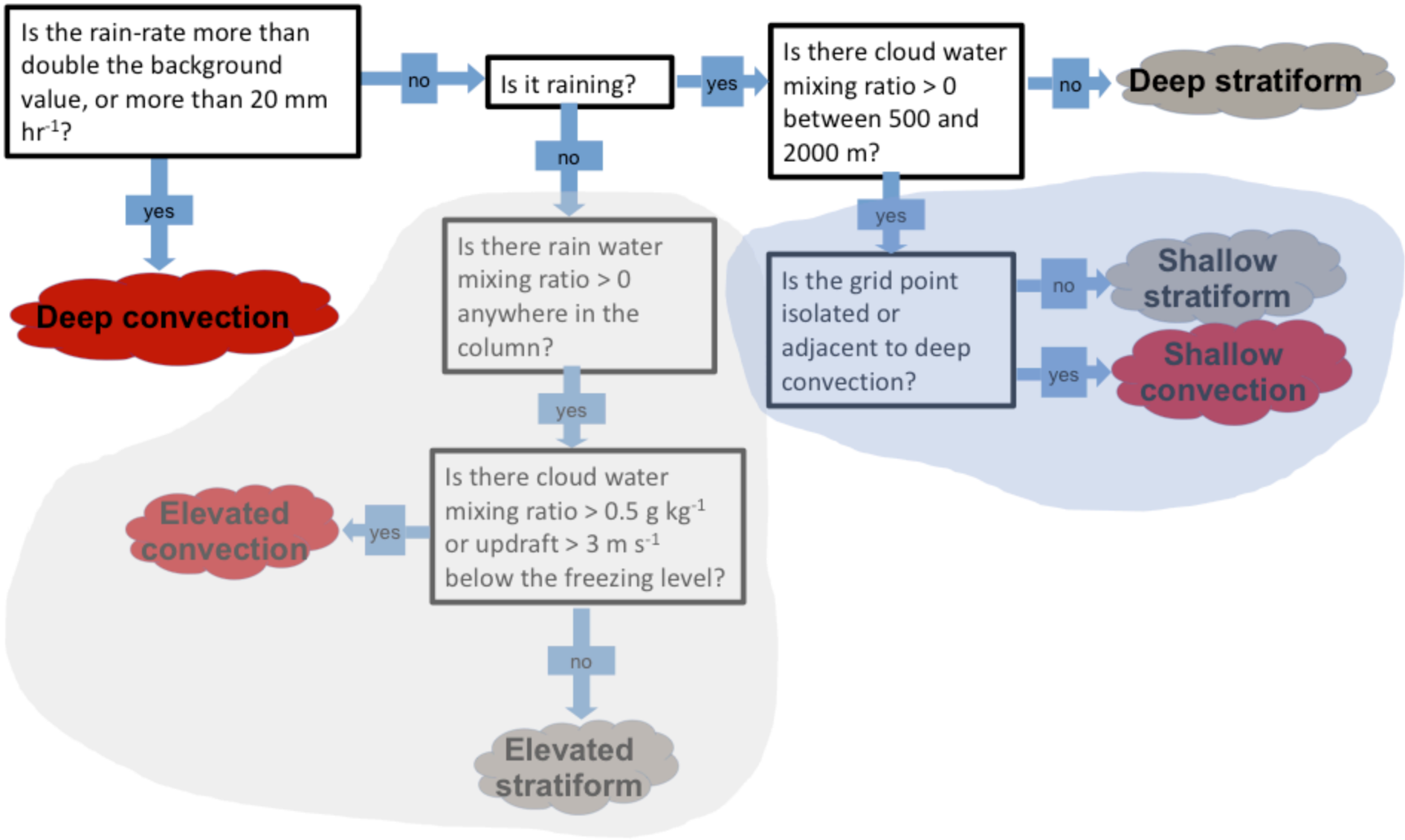
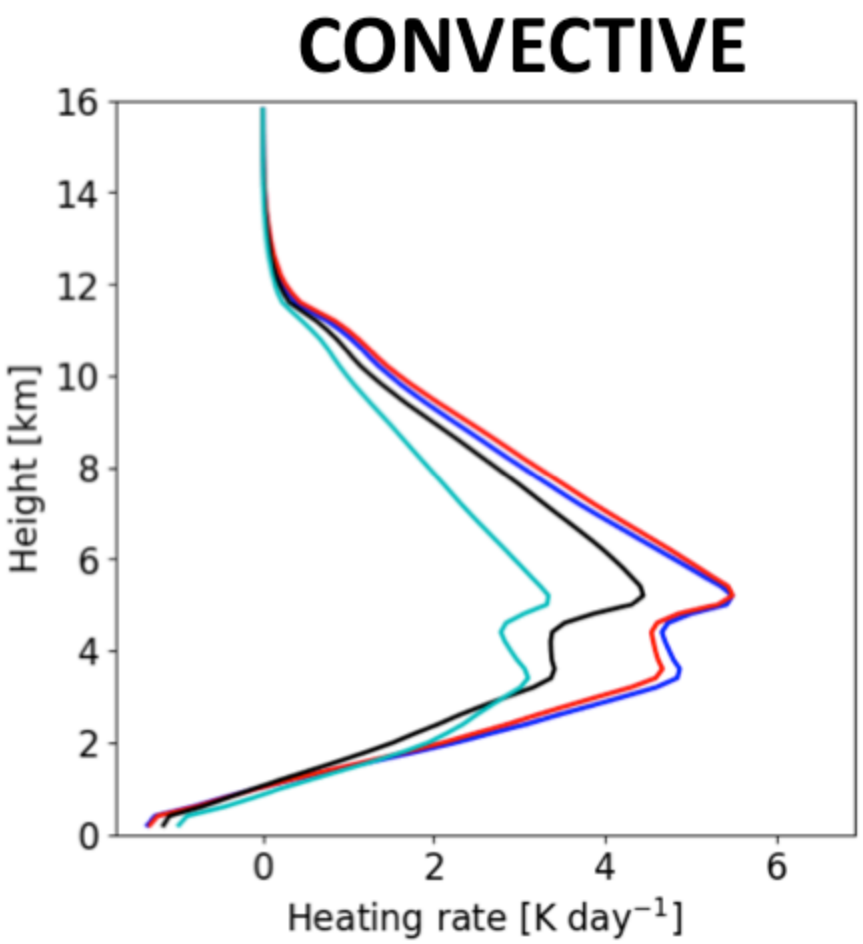
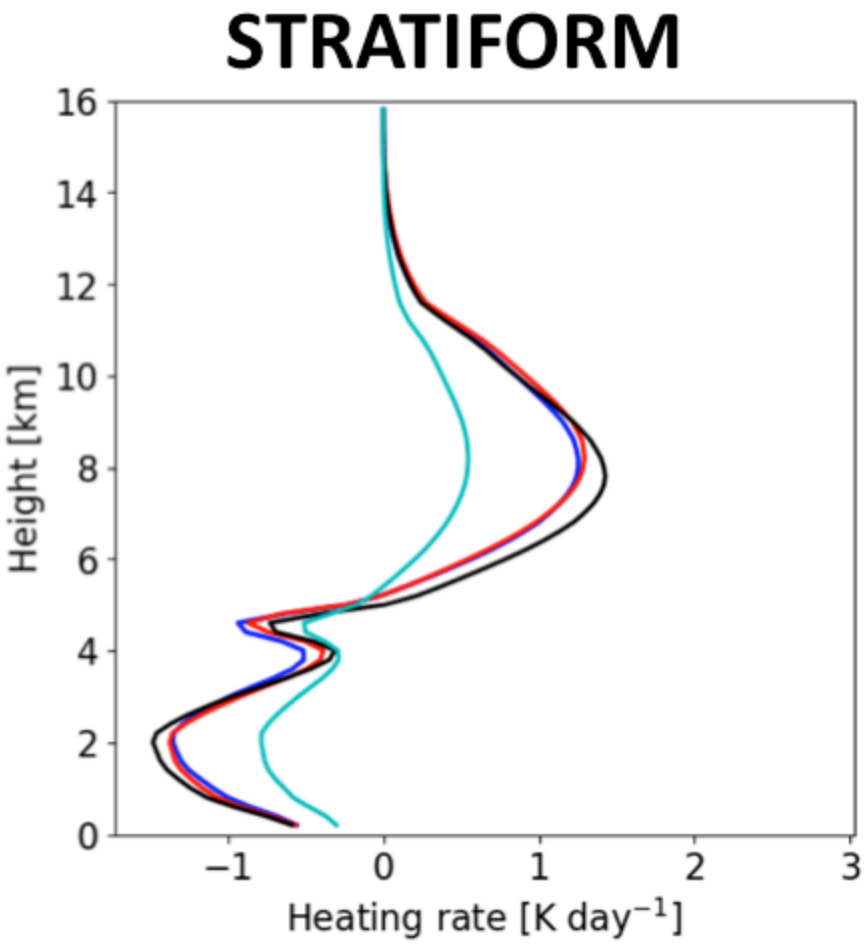






Average latent heating from dx = 4 km simulations over Sumatra

10 Years of Austral summer simulations

MJO 2
MJO 3
MJO 4
MJO 7

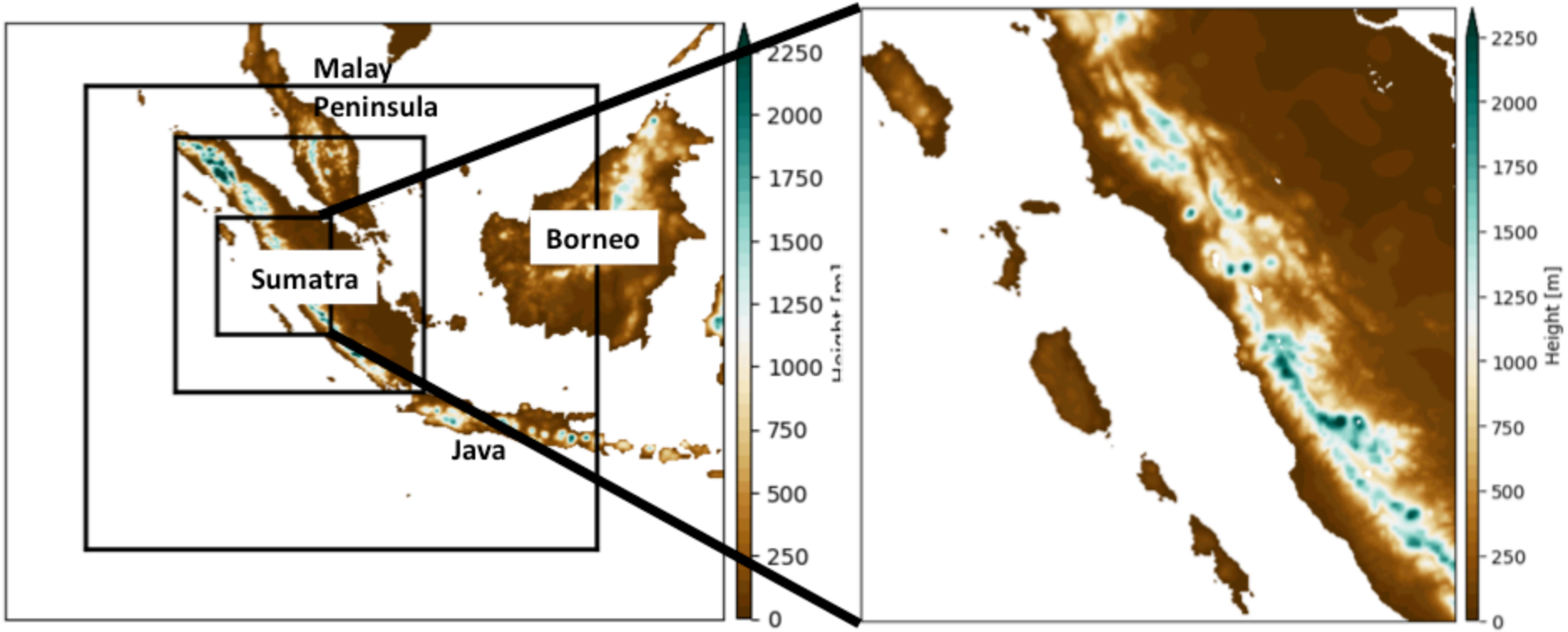
Resolution dependence of convective-stratiform evolution

dx = 12 km, 4km, 1.33 km, 444 m

Inner three domains are convective-permitting

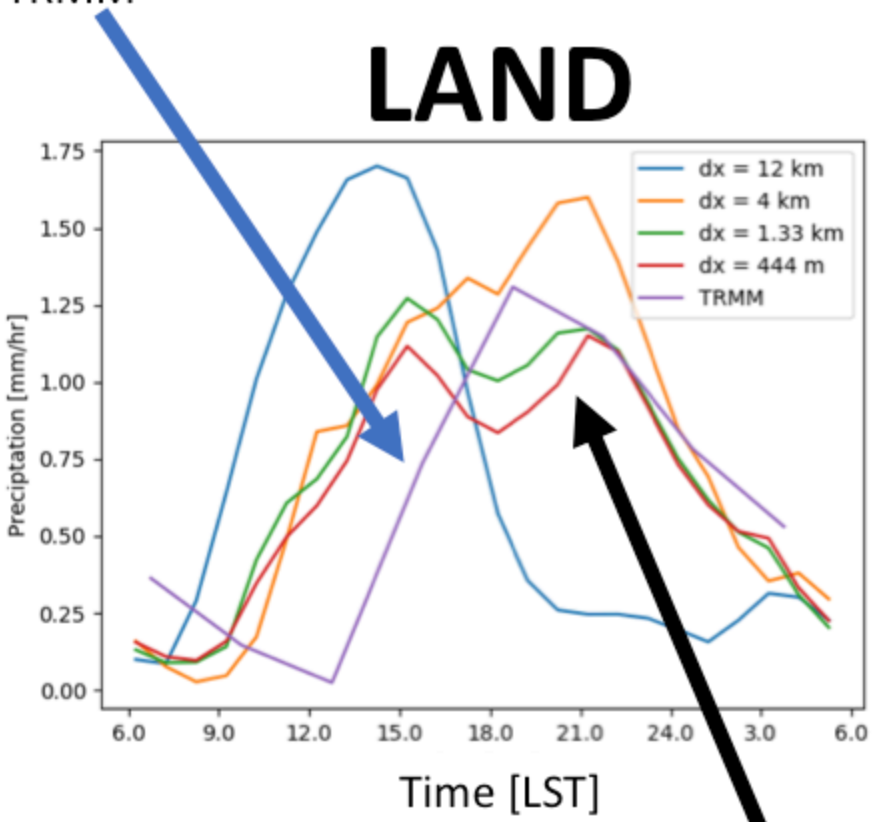
2 days simulation (so far) during MJO active period in November 2017

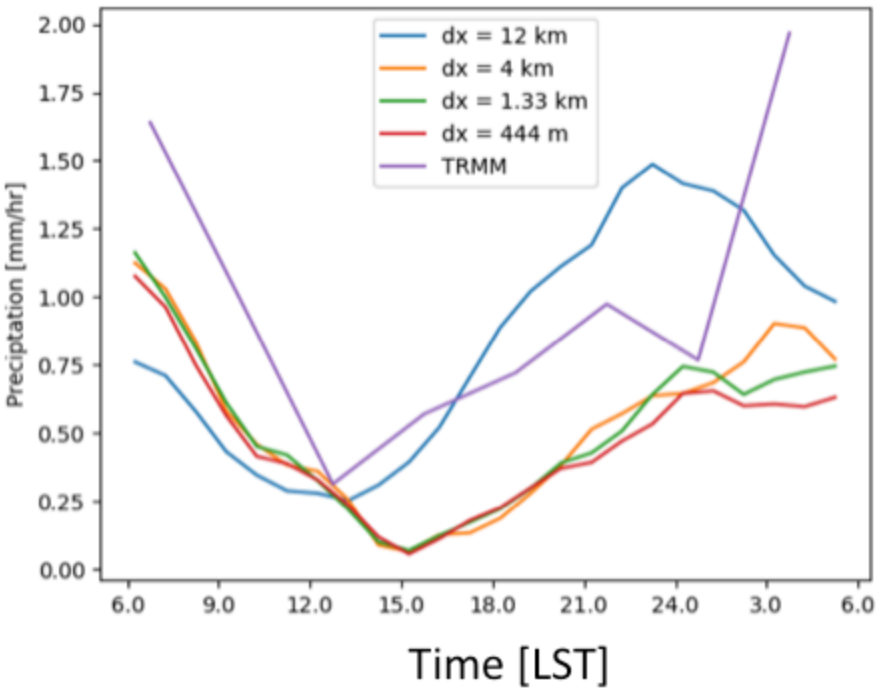
MYJ PBL Scheme
WSM6 MP Scheme
BM Cu scheme (12km only)
NOAH LS Scheme
RRTM / Goddard radiation



Average diurnal precipitation cycle over land and sea

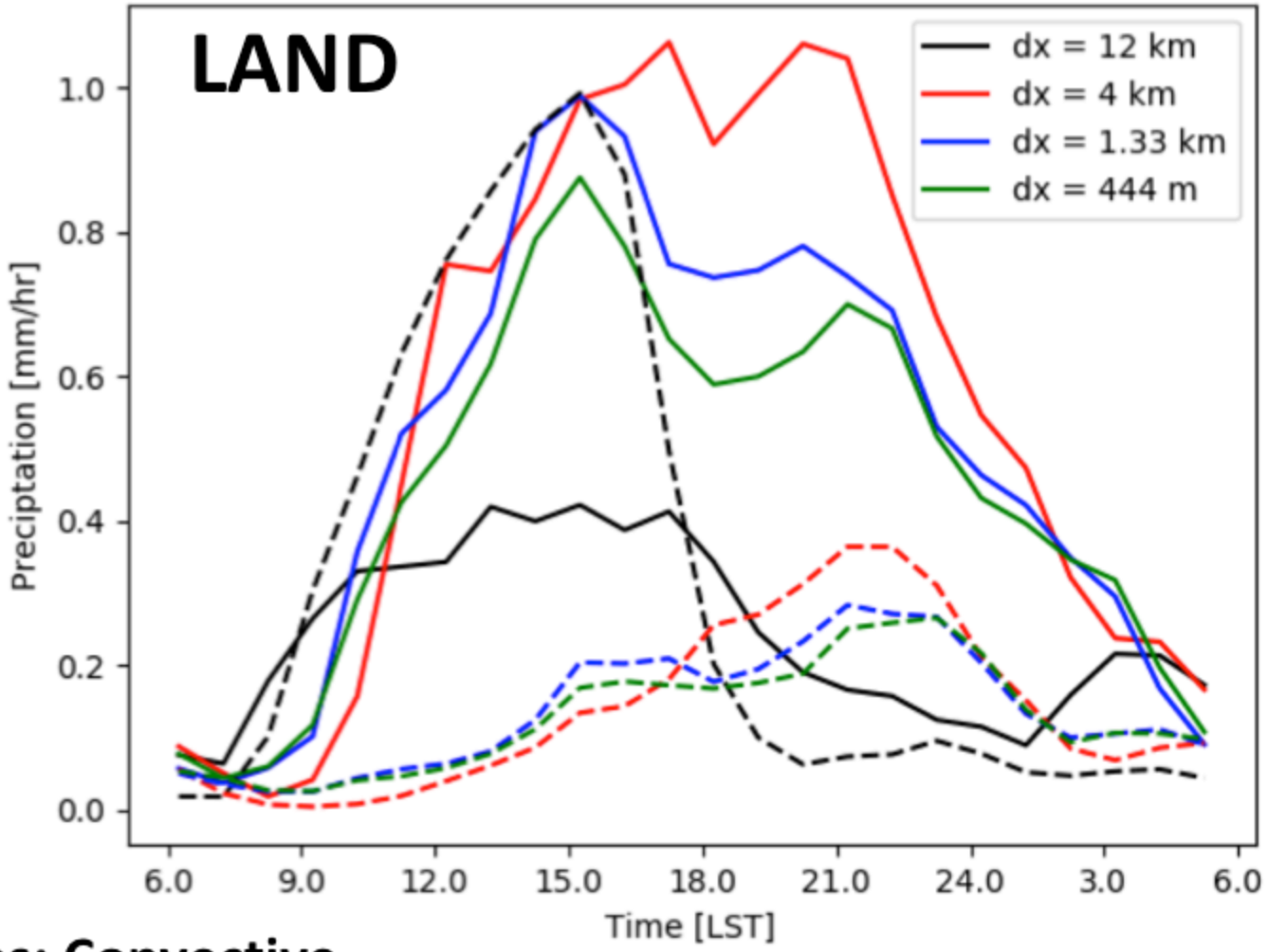
TRMM





Double peak in two finest resolutions

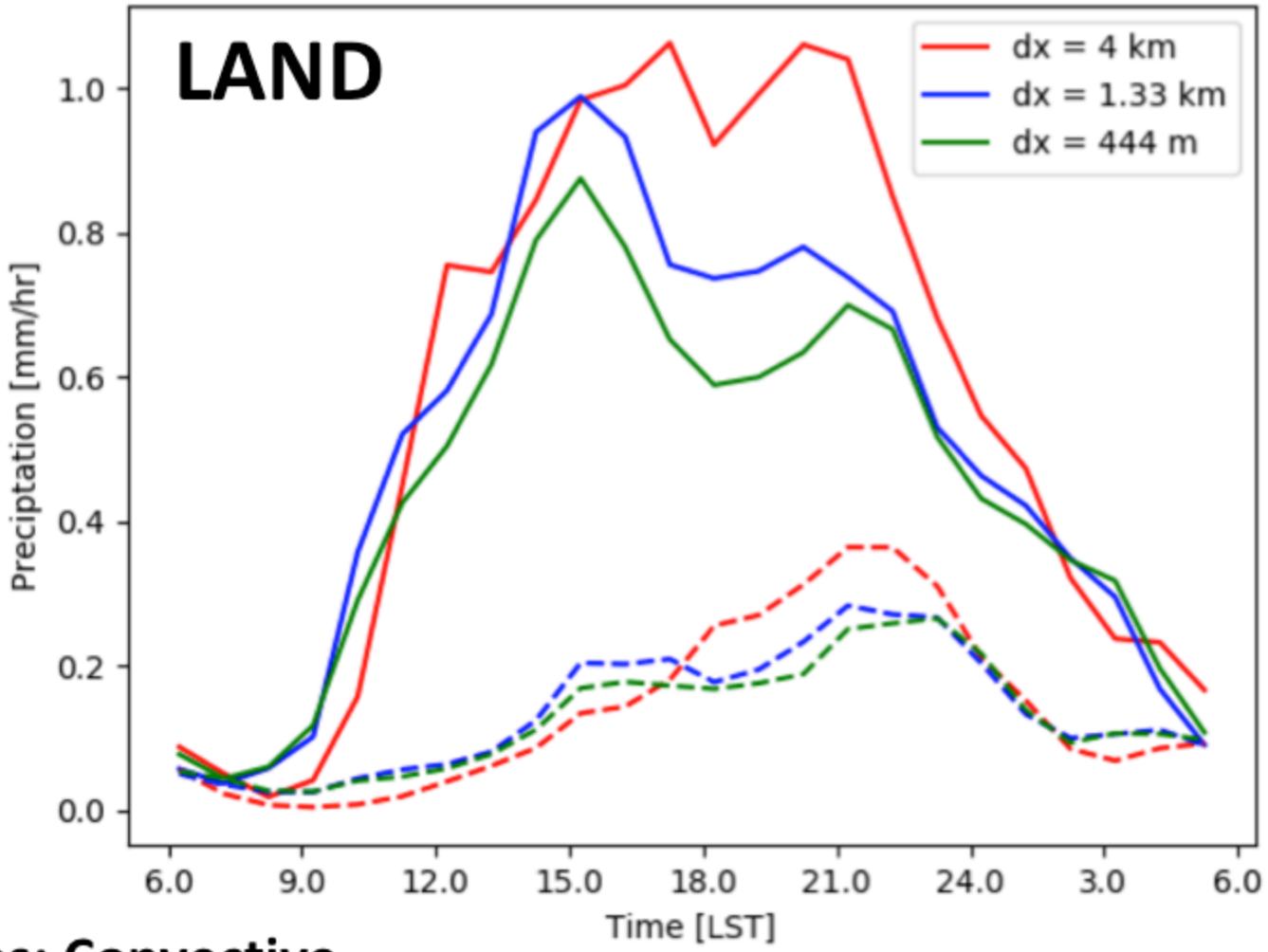
Convective and stratiform contributions to average precipitation cycle



Solid lines: Convective

Dashed lines: Stratiform

Convective and stratiform contributions to average precipitation cycle



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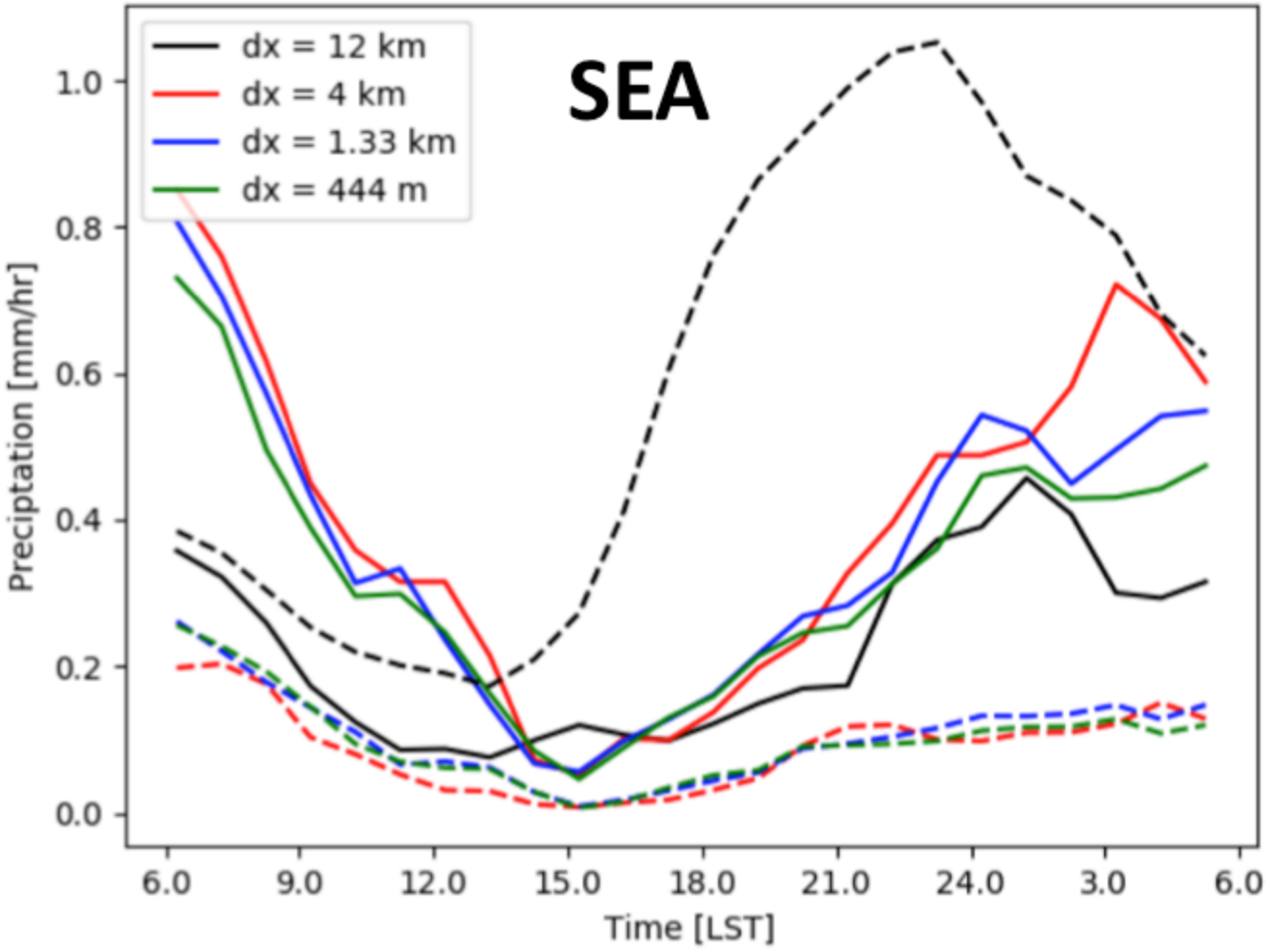

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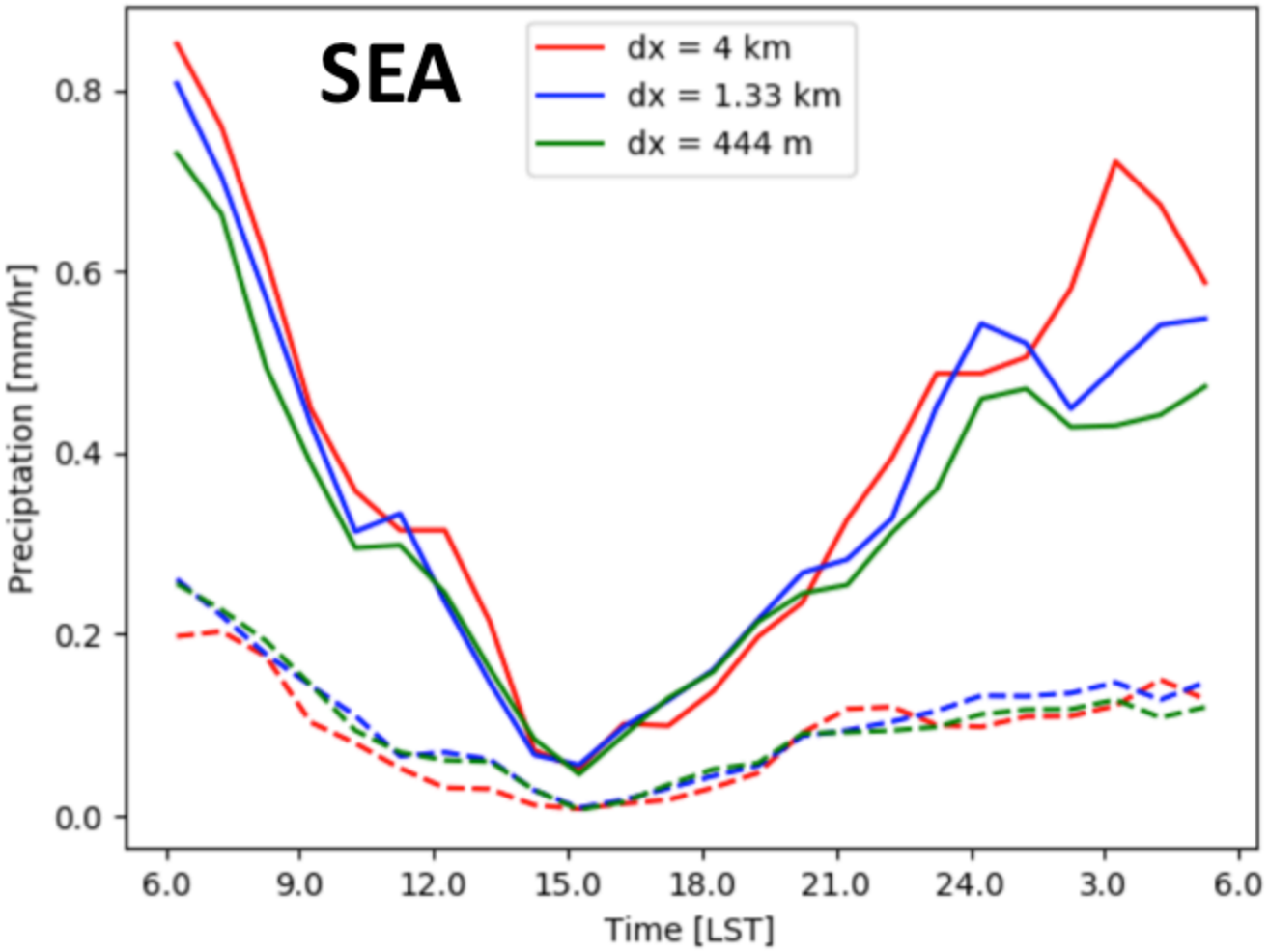

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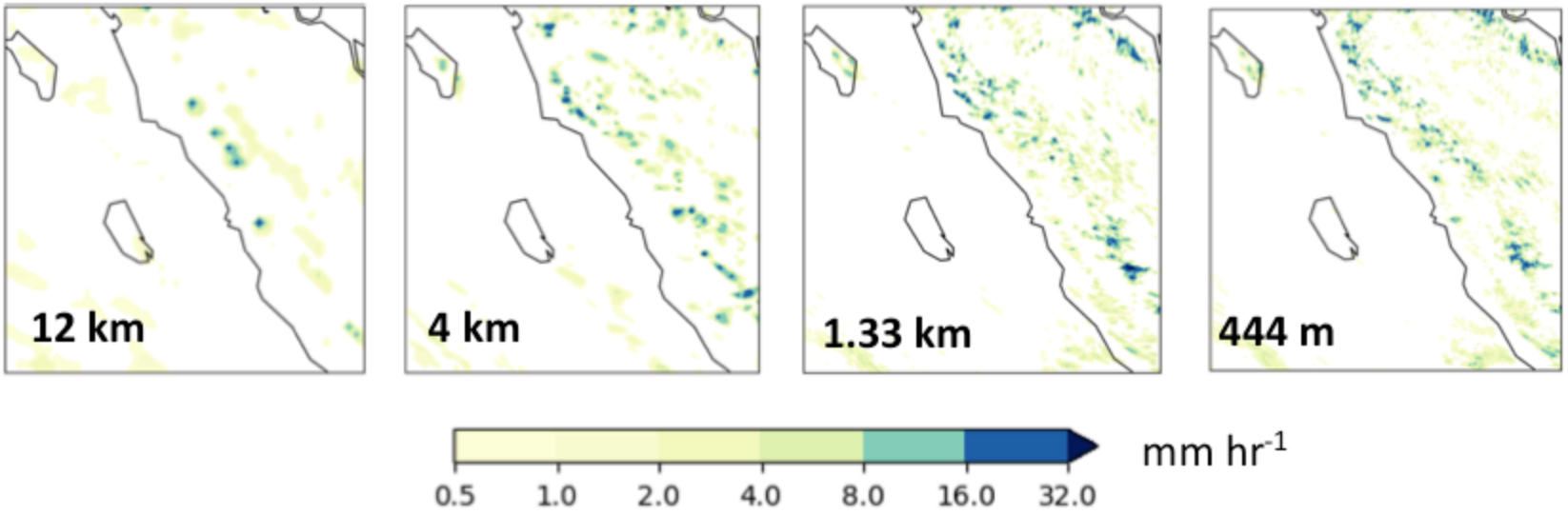
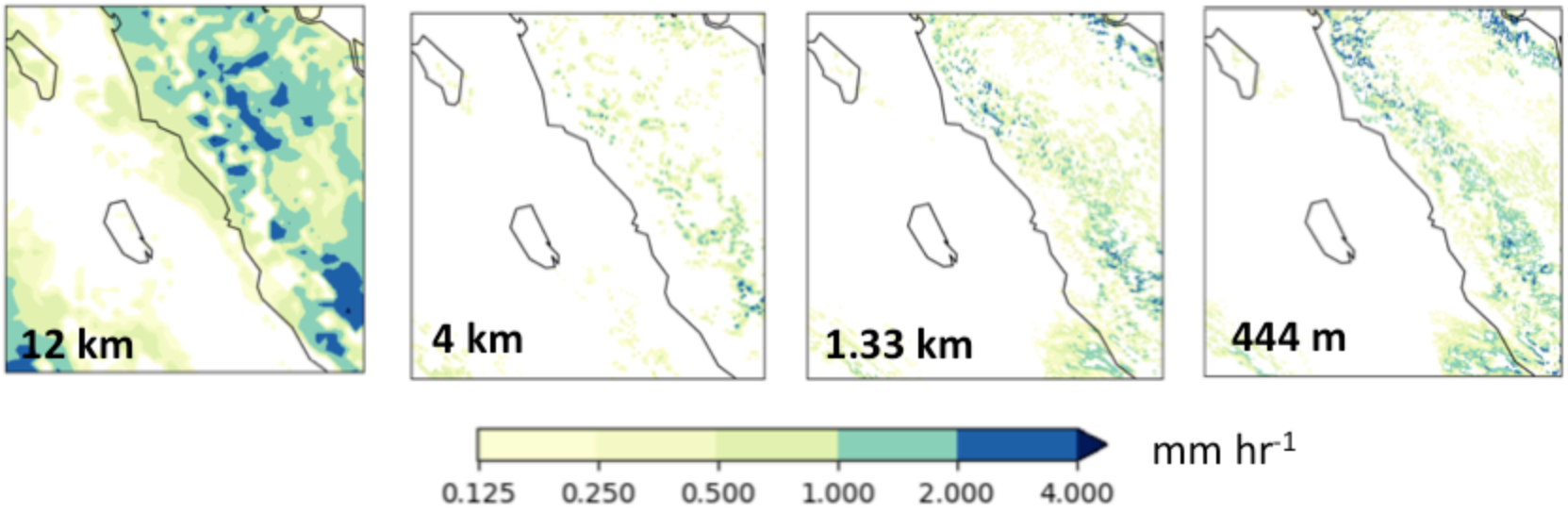
AFTERNOON: 1500 LST

Convective

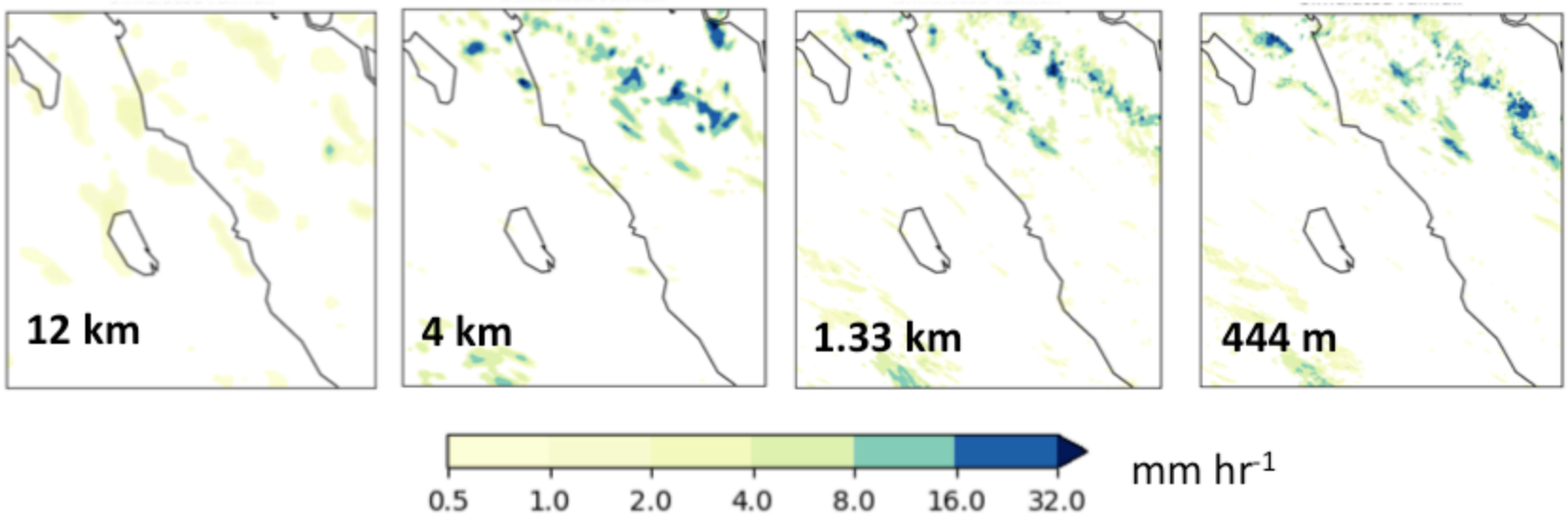


Stratiform

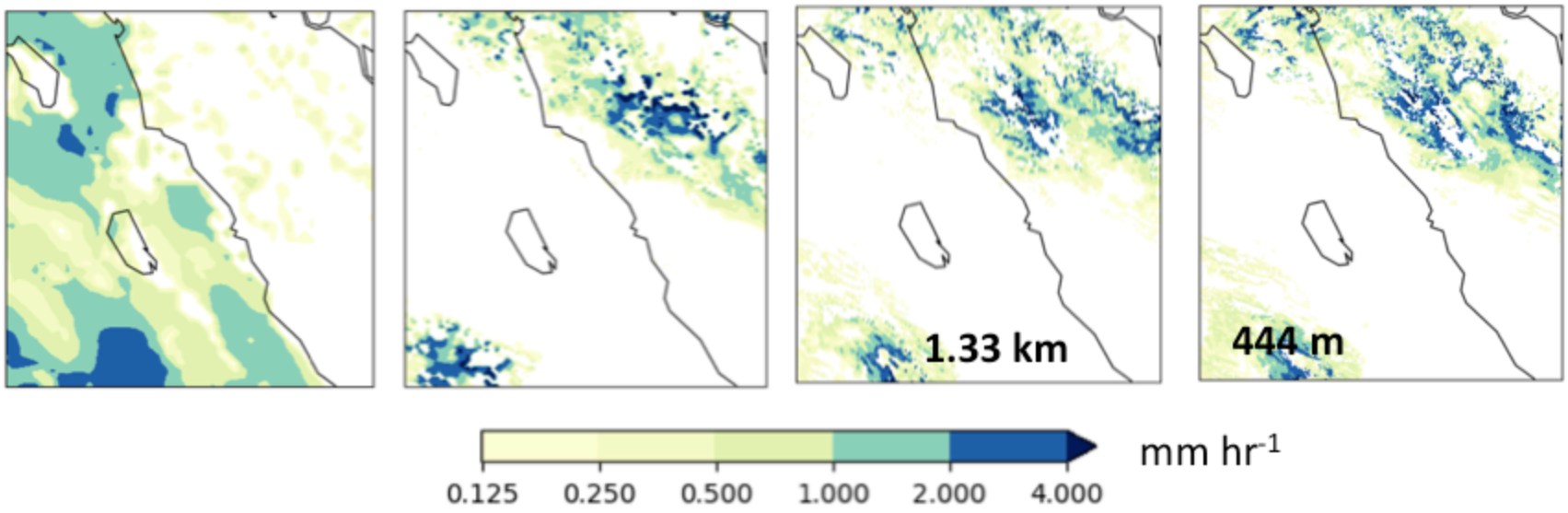


NIGHT: 2200 LST

Convective



Stratiform



Unanswered questions:

1. What controls the convective / stratiform partitioning, other than resolution?

2. Resolution dependence of the partitioning diagnosis? How else could this have been done?

3. How to prevent early initiation of convection?

Conclusions

1. Diurnal peaks in precipitation due to both convective and stratiform processes

2. Decreasing grid length -> increasing role of secondary stratiform precipitation peak

3. Results consistent with observed model errors at dx = 4 km, but validation is ongoing

4. Improved representation of stratiform rain may be critical for improving the diurnal precipitation cycle