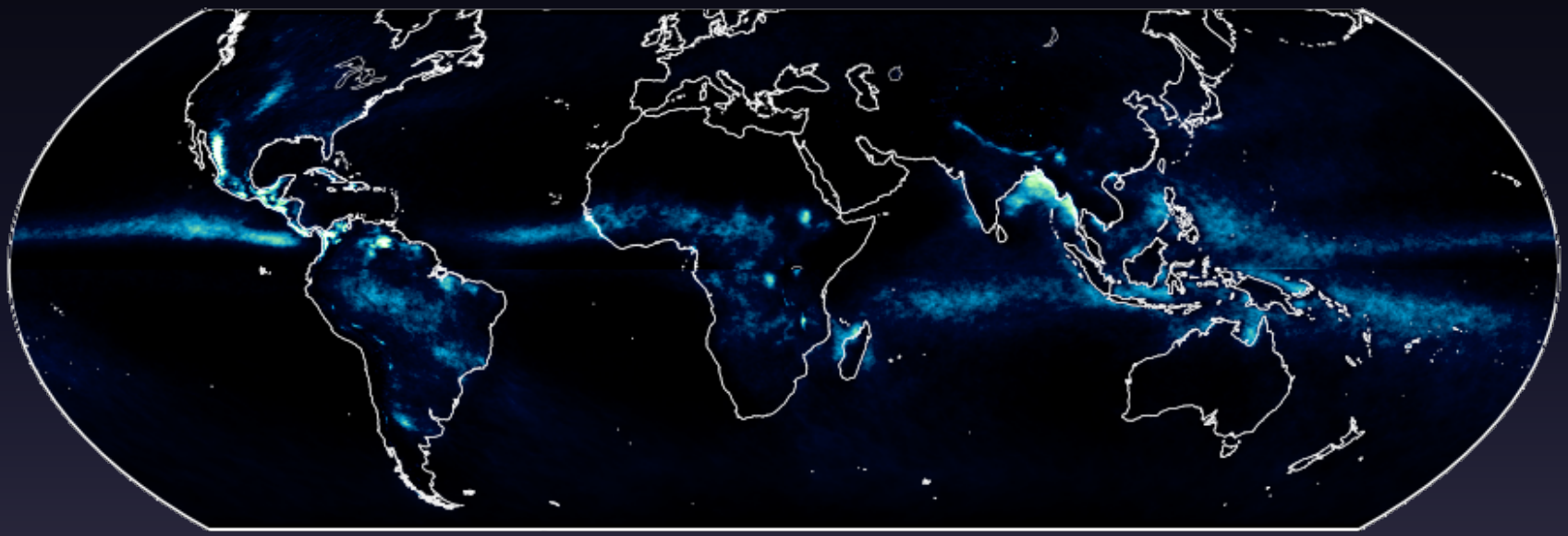
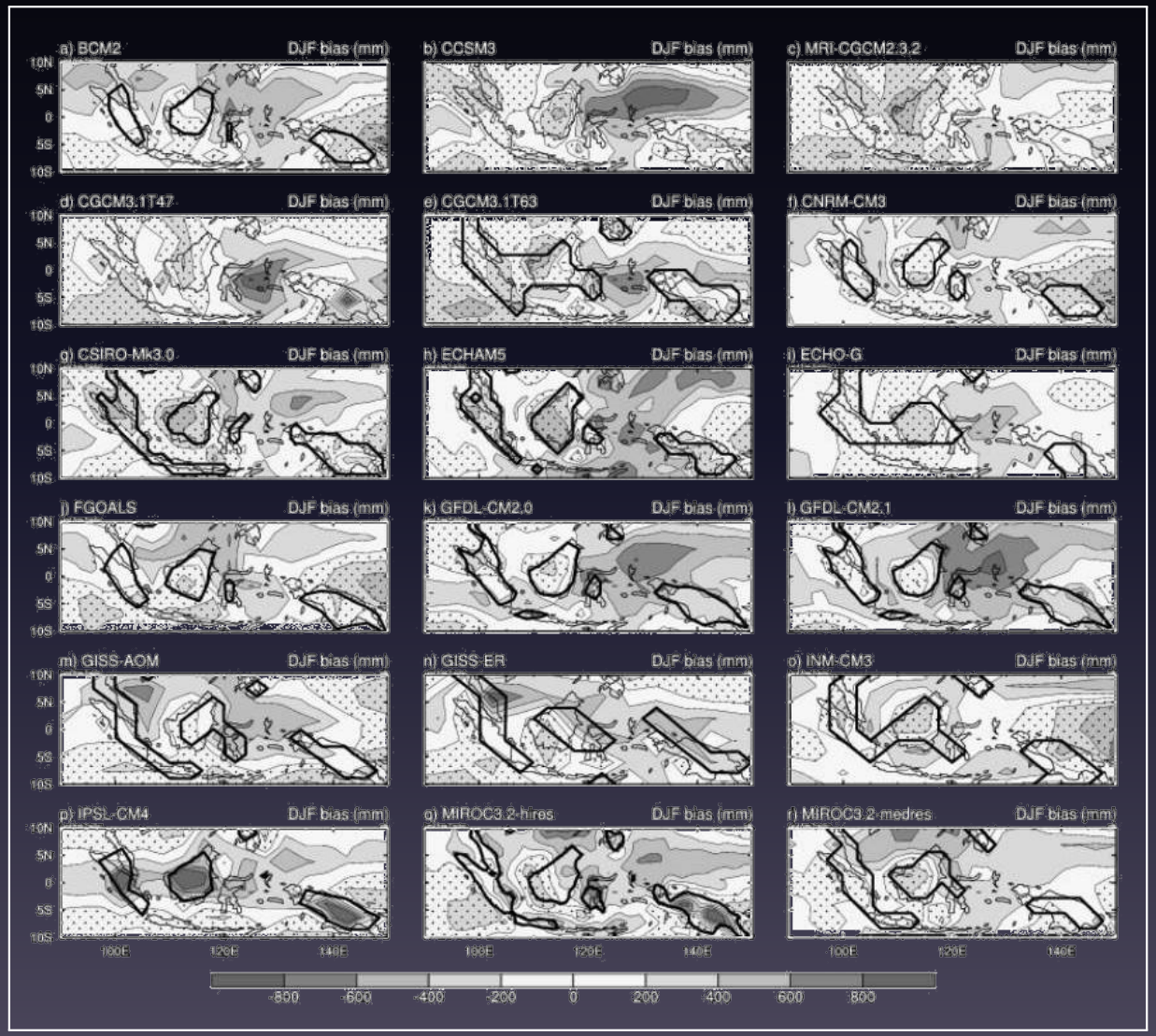
The role of coastal associated rainfall in the tropics



Martin Bergemann, Christian Jakob, Todd Lane

How is coastal rainfall represented in GCM's?



: Rainfall bias in 18 different climate models

Martin Bergemann (martin.bergemann@monash.edu)

Can rainfall due to land-sea interaction be characterized?

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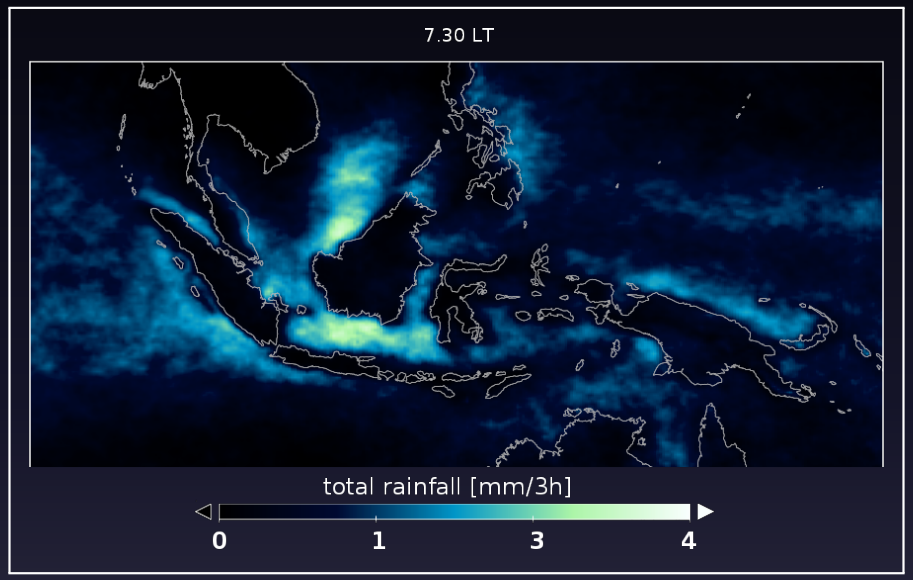

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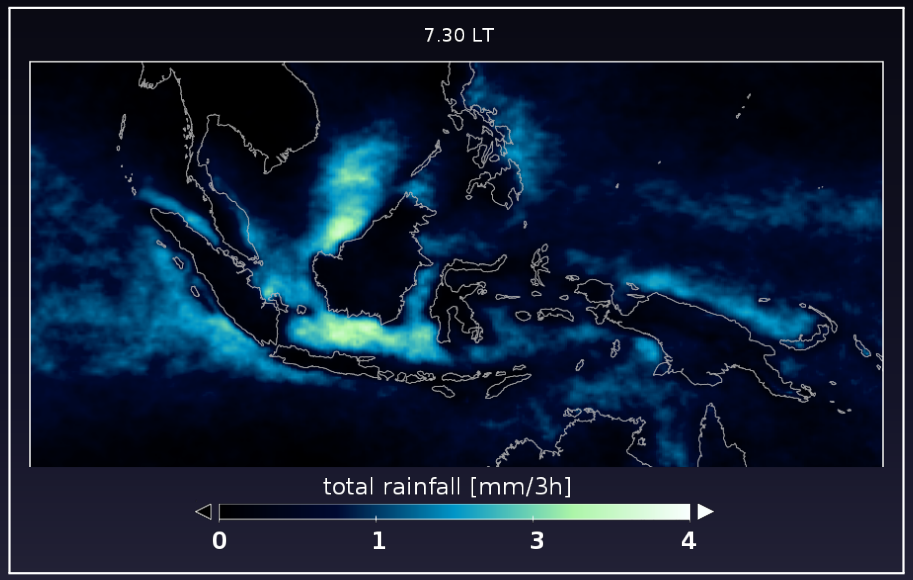

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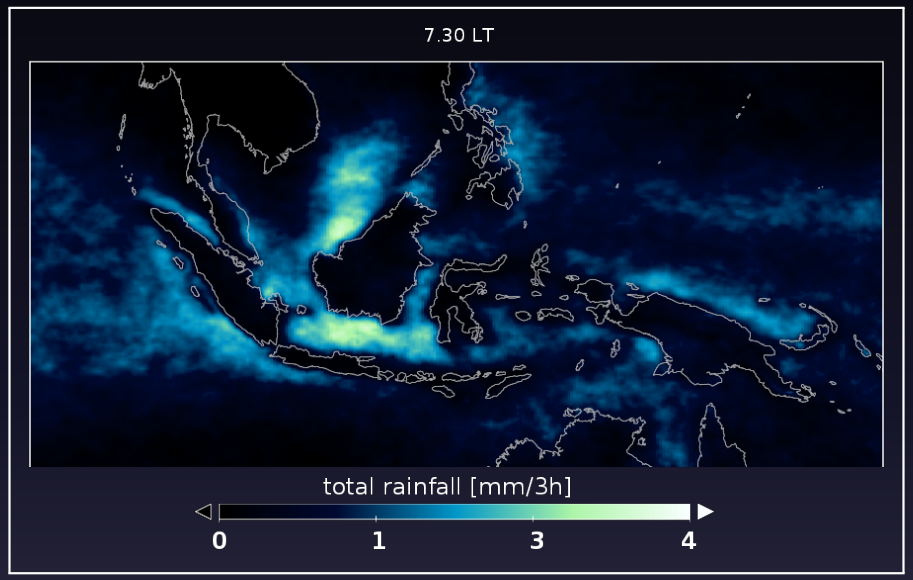

1. rainfall is of high intensity
2. the rainfall is meso-scale

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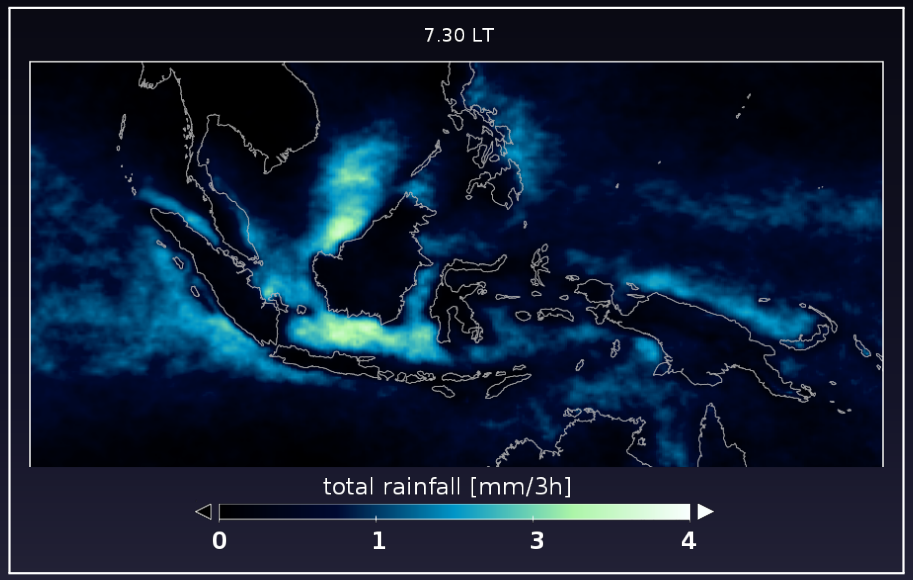

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3. occurs within coastal area (500 km from coast)

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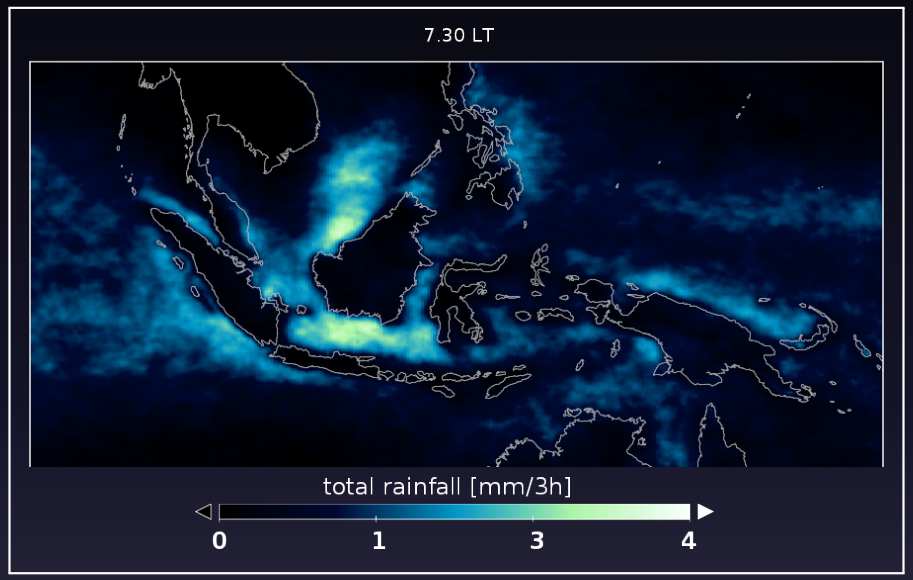

1. rainfall is of high intensity
2. the rainfall is meso-scale
3. occurs within coastal area (500 km from coast)
4. along the coastline $\rightarrow$ aligned with the coast

How to objectively identify coastline triggered rainfall?

Find high intensity rainfall domains, occurring within a coastal area and stretching along the coastline

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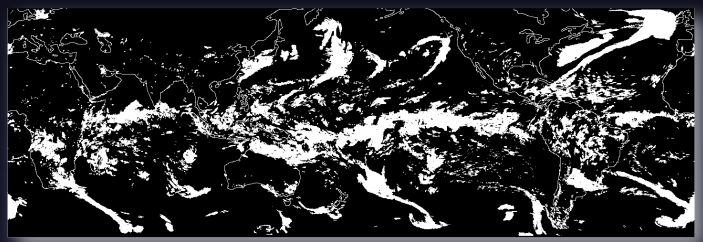

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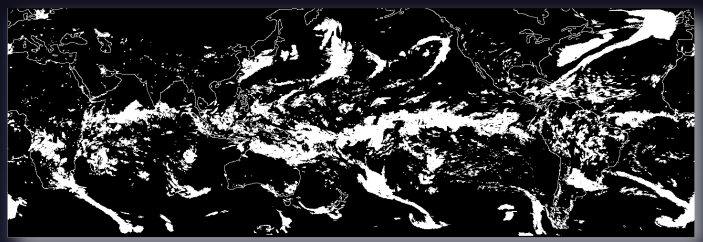

I) Apply precipitation threshold, blur data and close small holes

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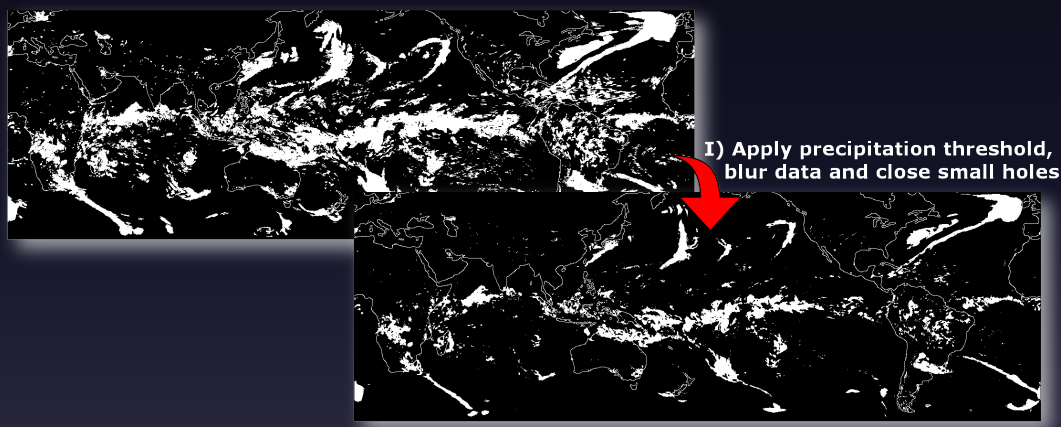

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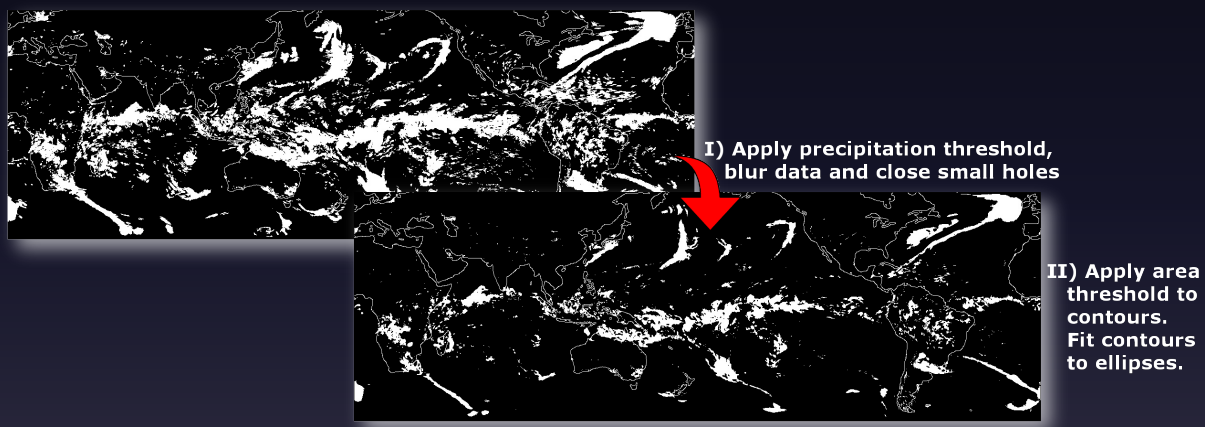

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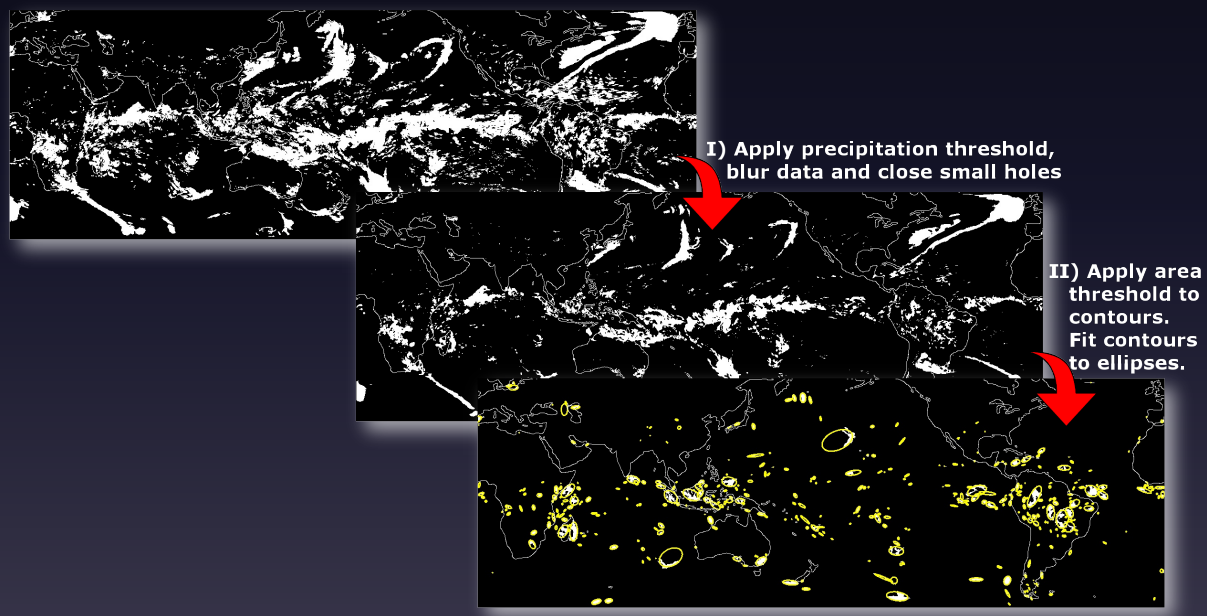

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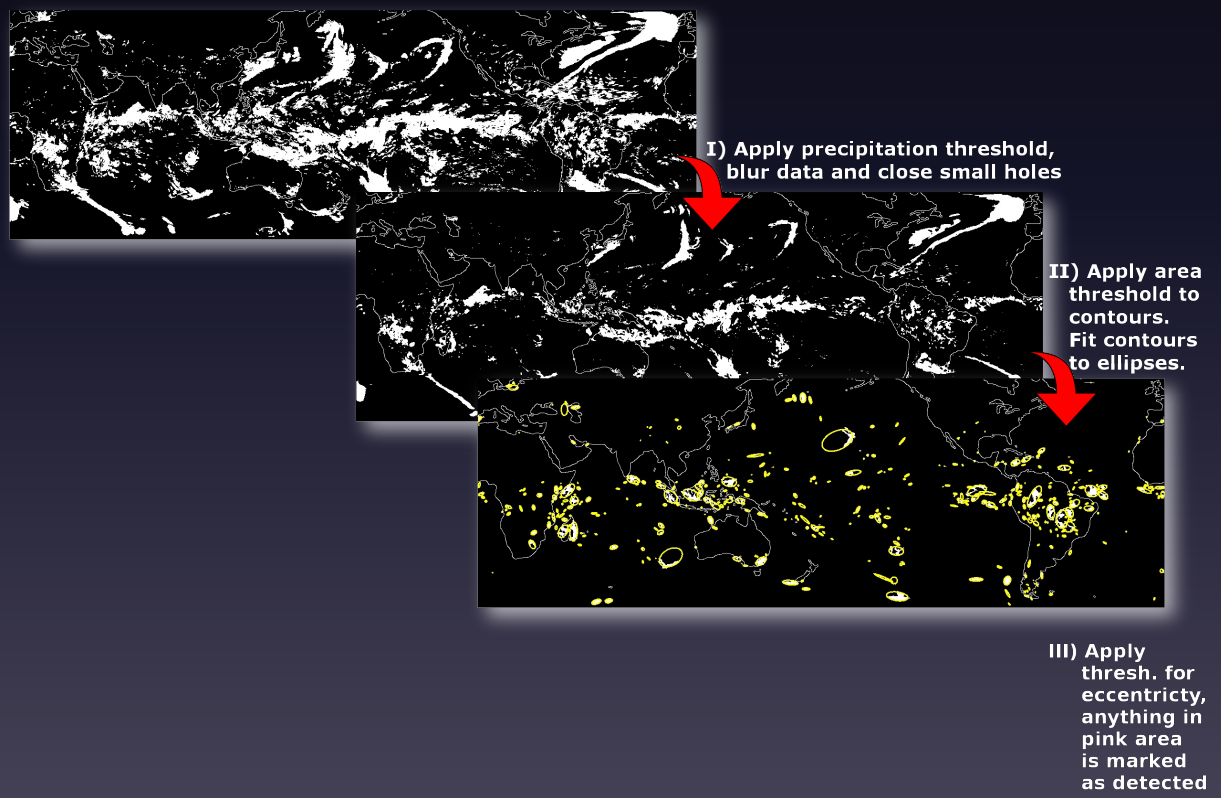

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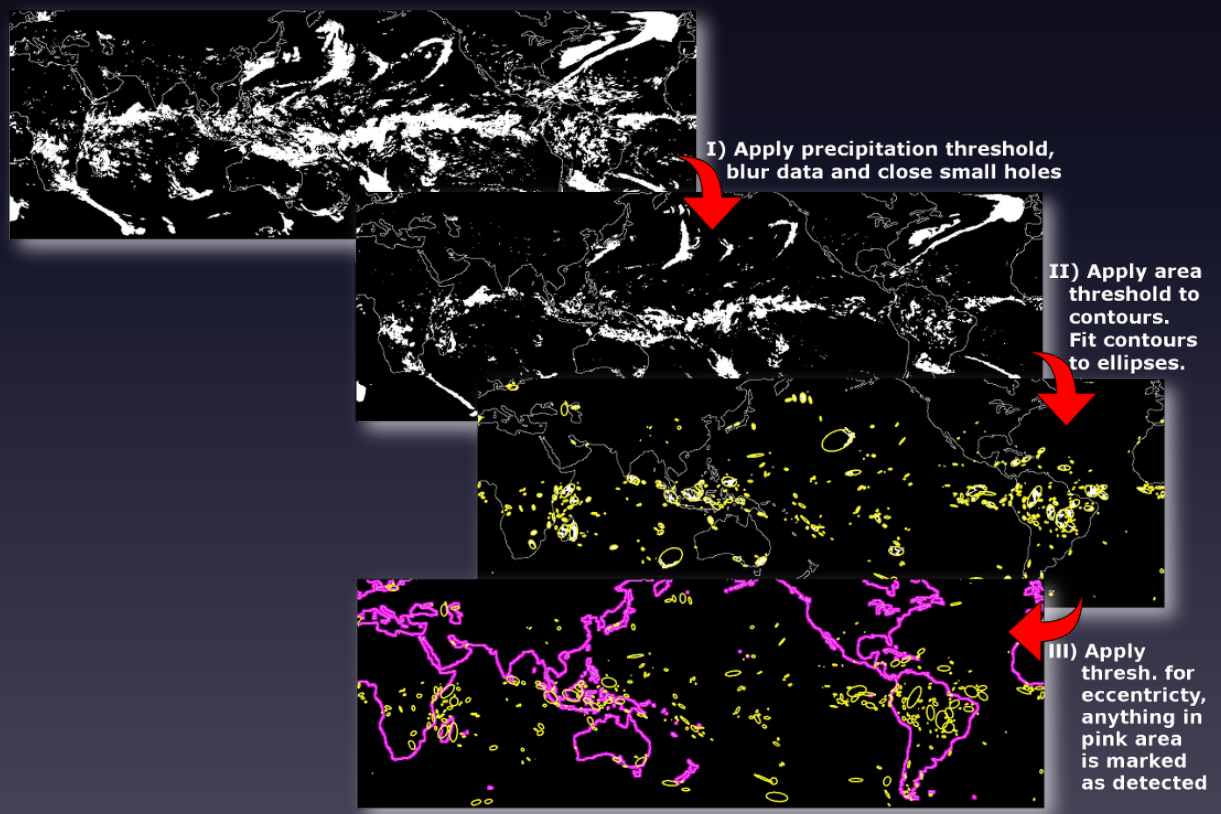

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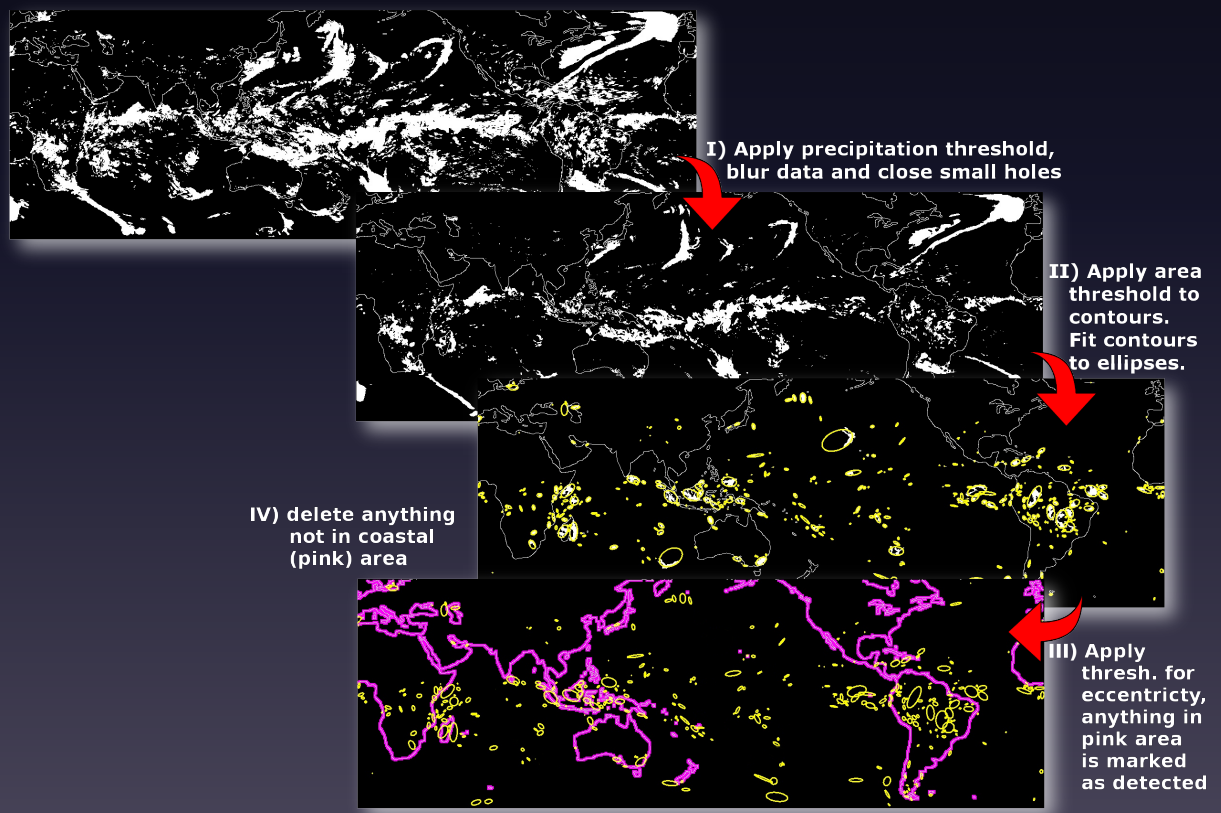

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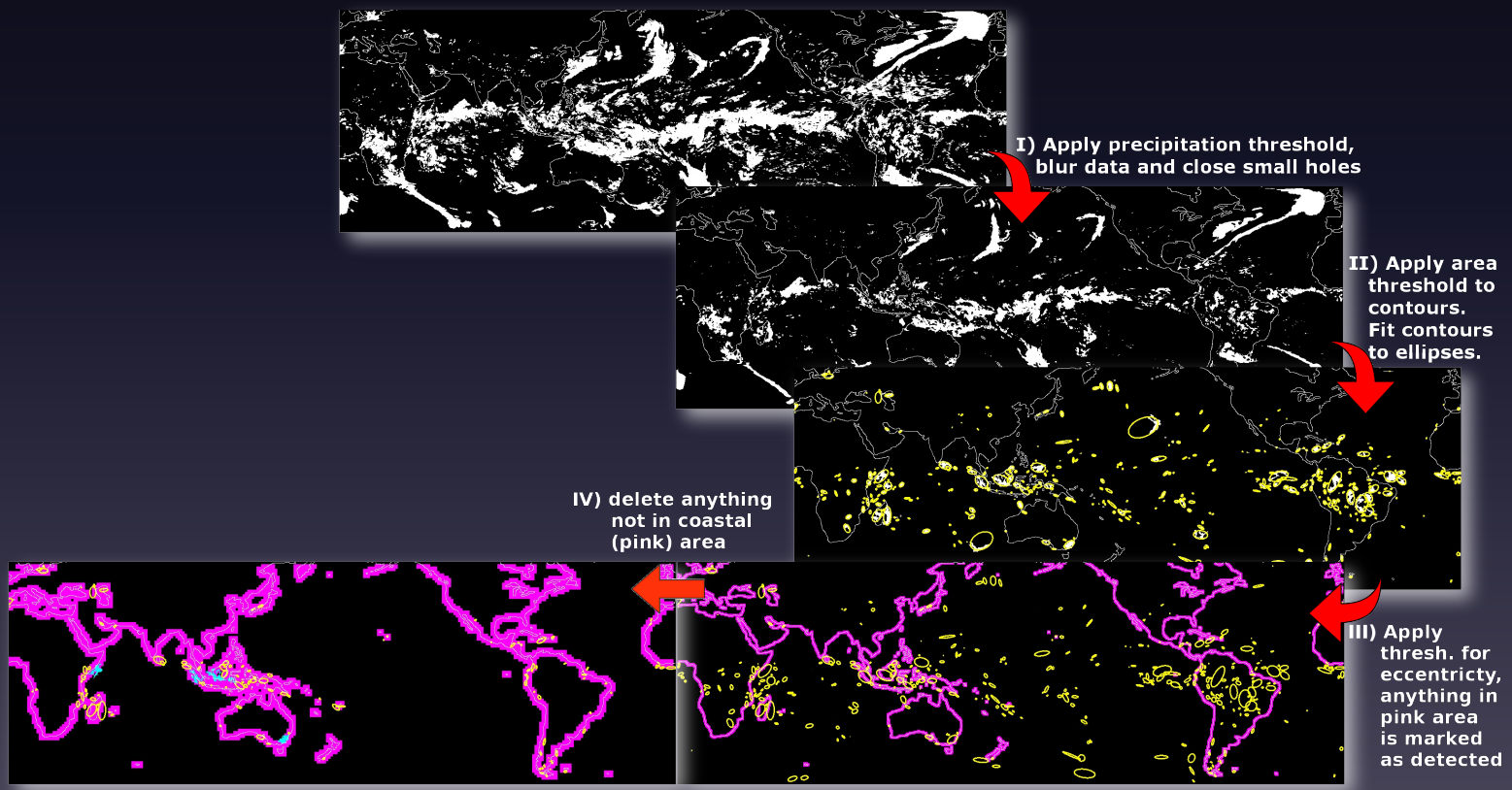

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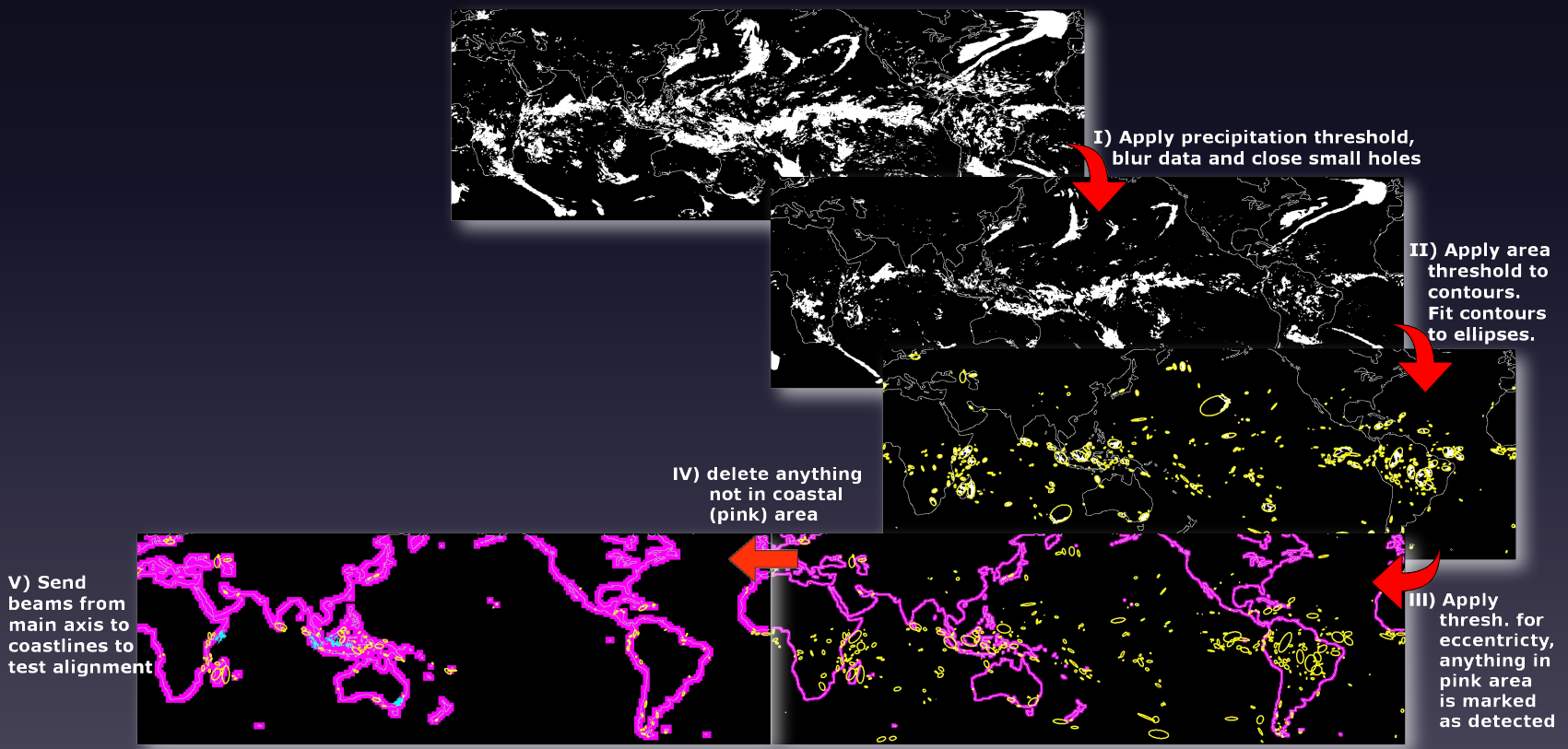

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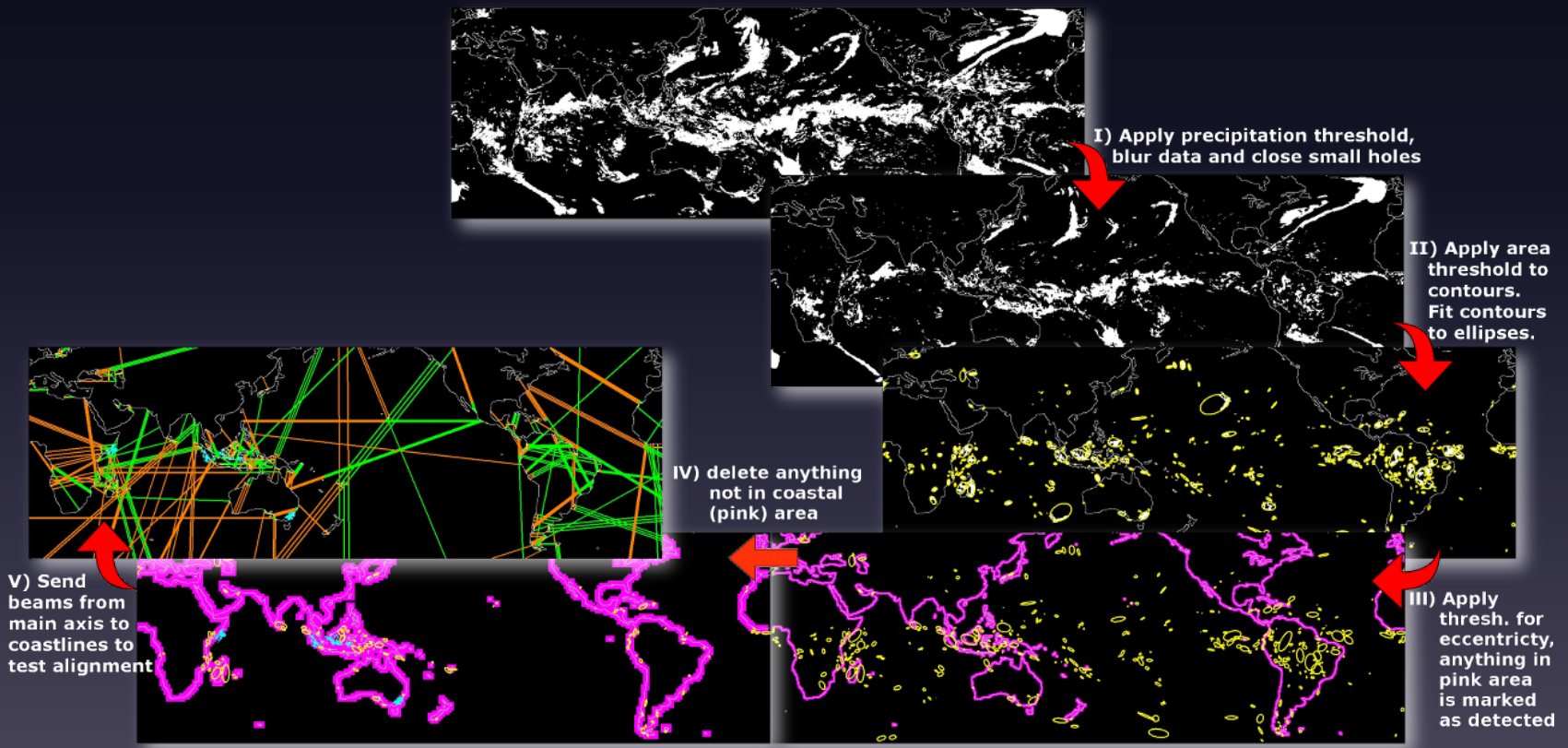

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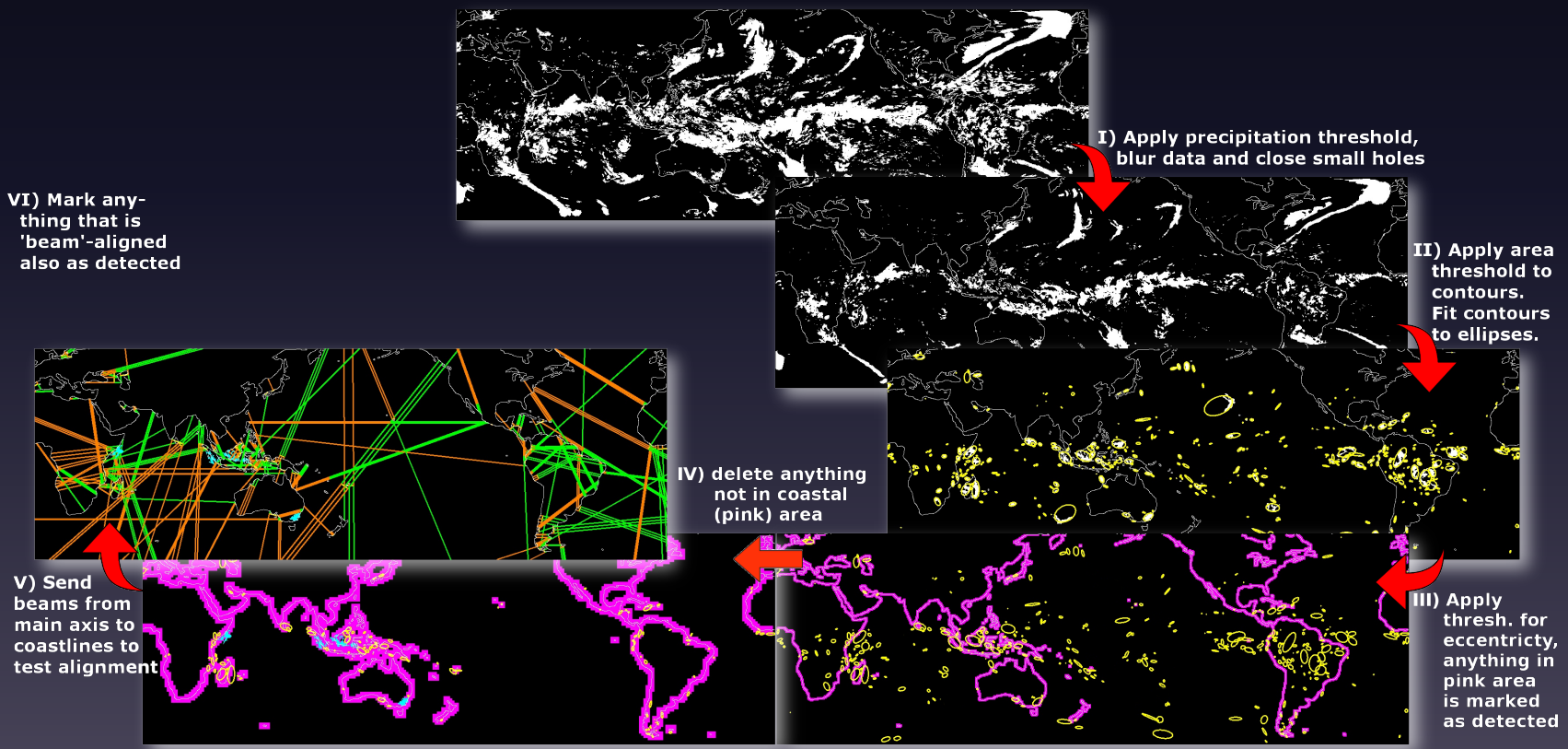

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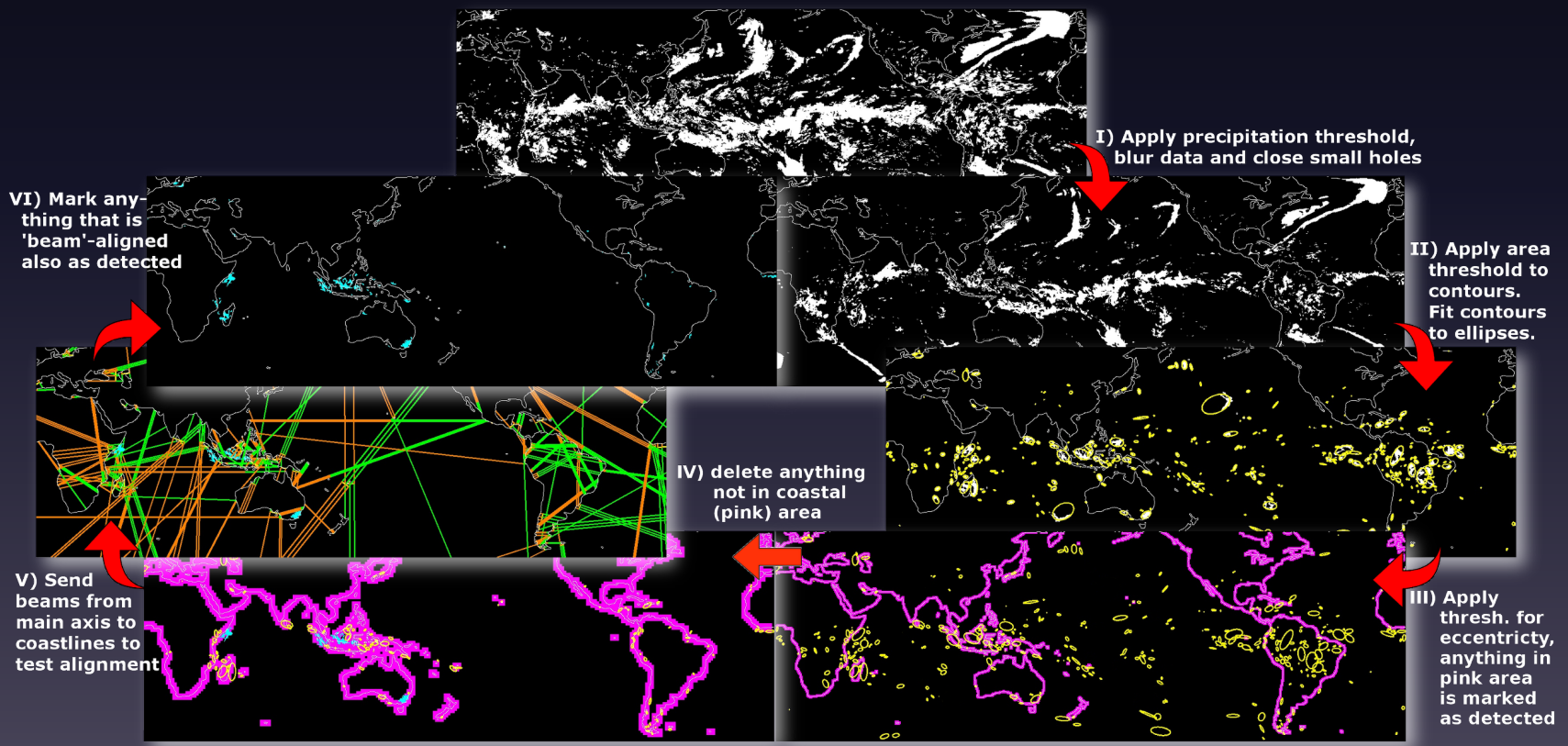

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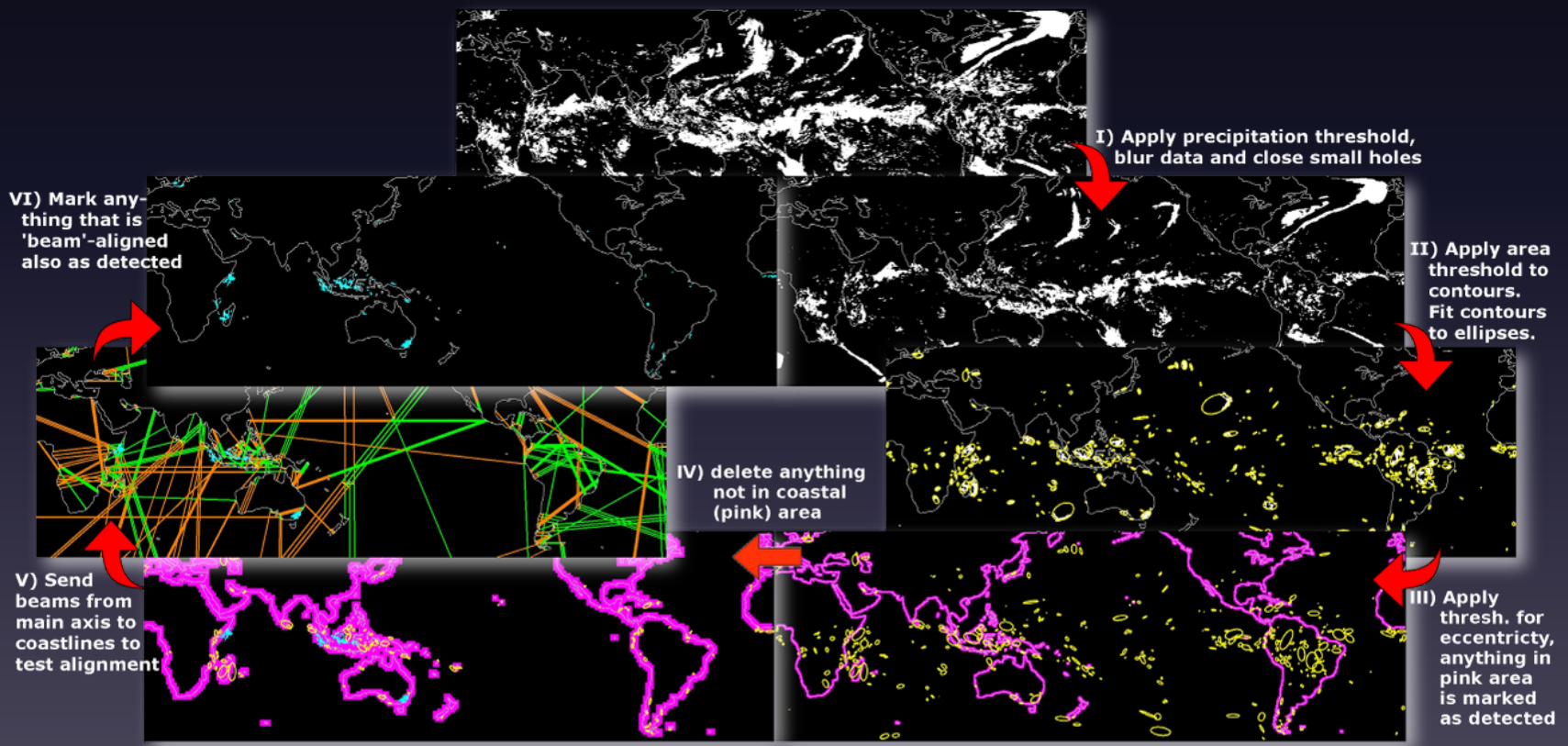
How to choose the optimal threshold combination?

application of 3 arbitrary thresholds
$\rightarrow$ create an ensemble of $3^3 = 27$ threshold setups



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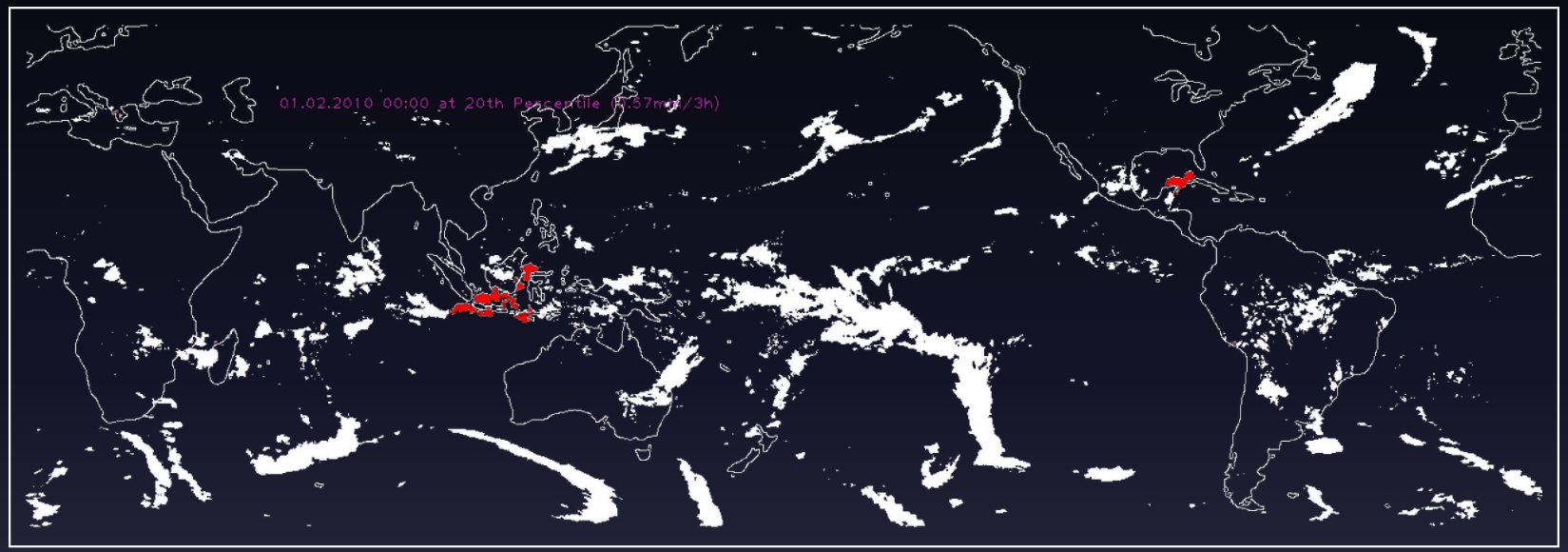
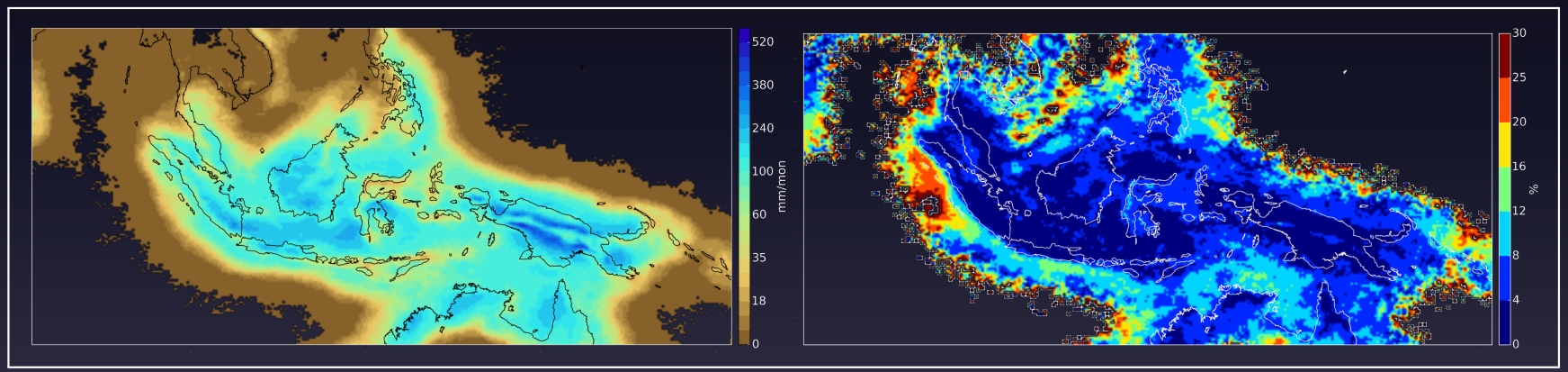
How is the algorithm applied?



- applied on 3 hly satellite based rainfall estimates (CMORPH)
- 27 different data sets are created $\rightarrow$ ensemble
- climatology and diurnal cycle investigation $\rightarrow$ evaluation

How much rainfall is detected?

ensemble mean and standard deviation of detected precipitation

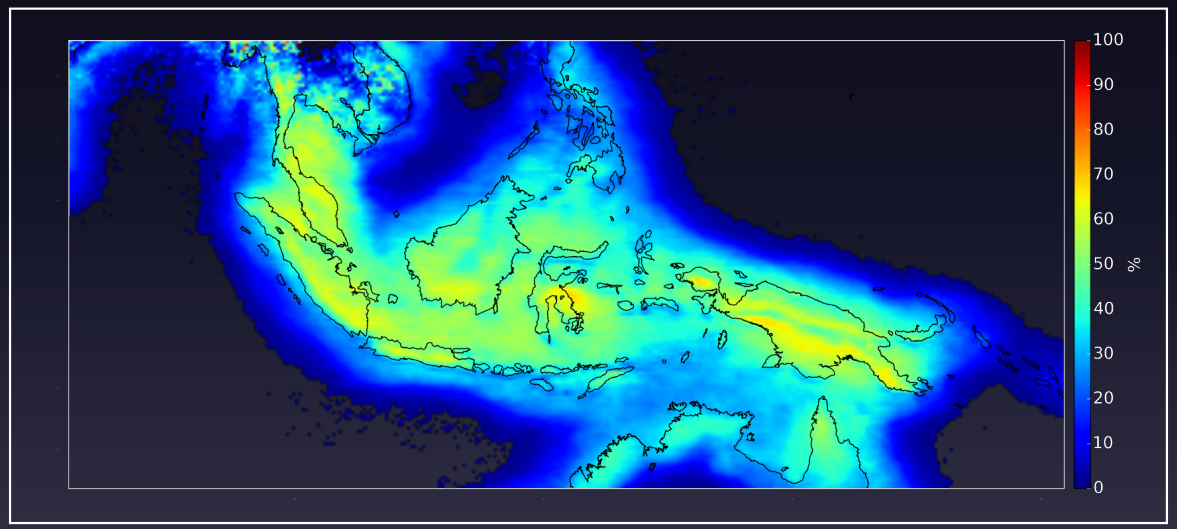


- seasonal variability is captured by the algorithm
- MC $\rightarrow$ high amounts of rainfall throughout the entire year
- better agreement over land [1]

[1] http://arxiv.org/abs/1501.06265

How important is the detected rainfall?

fraction of total yearly rainfall coming from detected rainfall



- fraction: detected rain / total rain
- reveals regions where land-sea interaction is important [1]

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How is the diurnal cycle represented?

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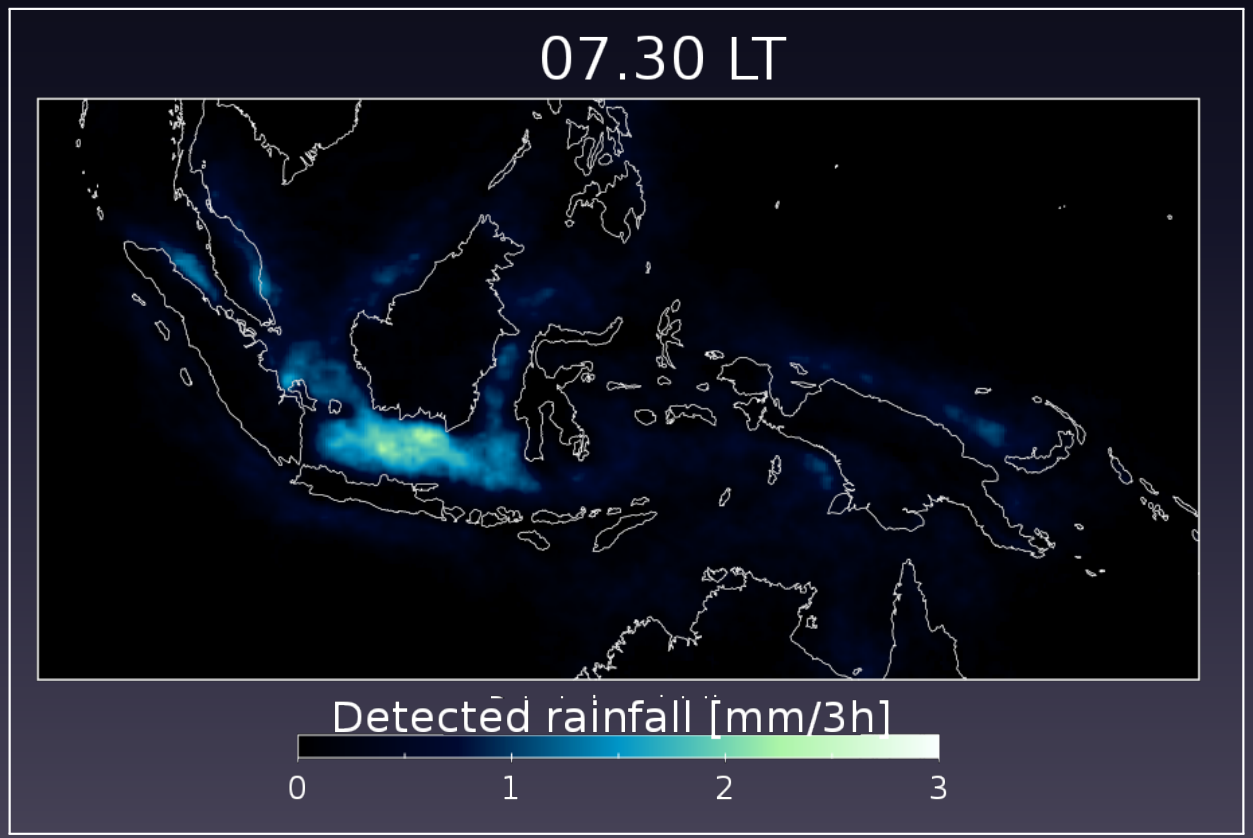
diurnal cycle of detected rainfall



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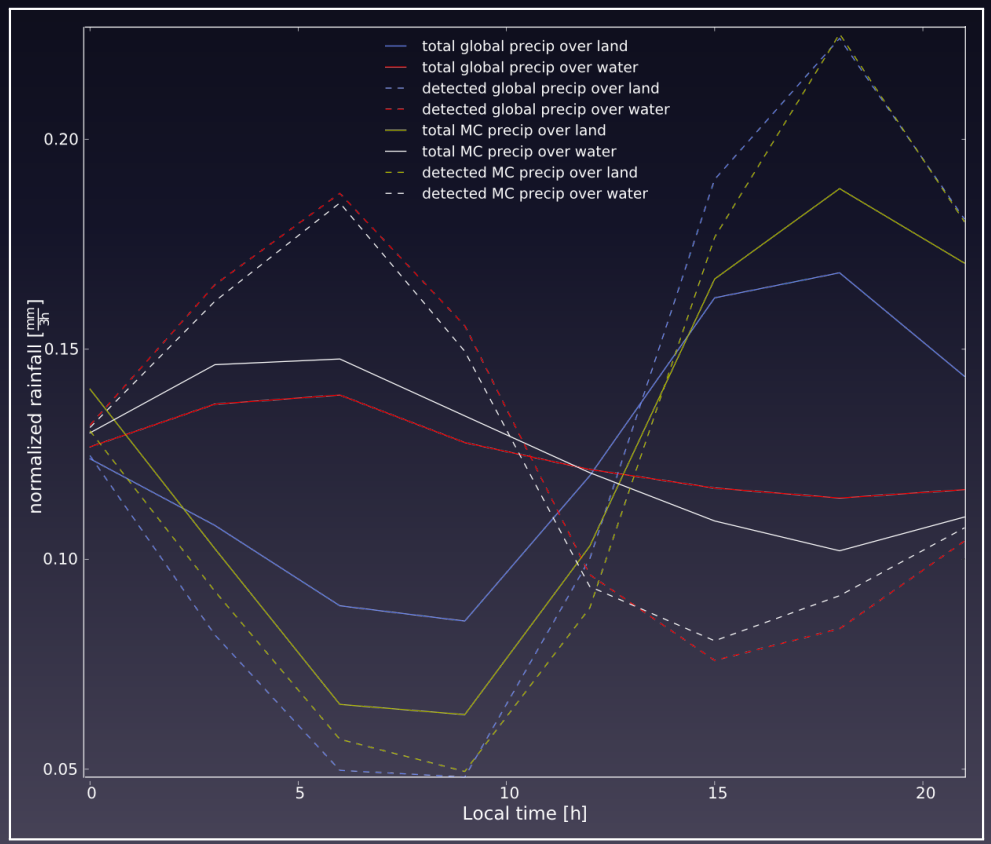
How is the diurnal cycle represented?

timing of the rainfall rainfall



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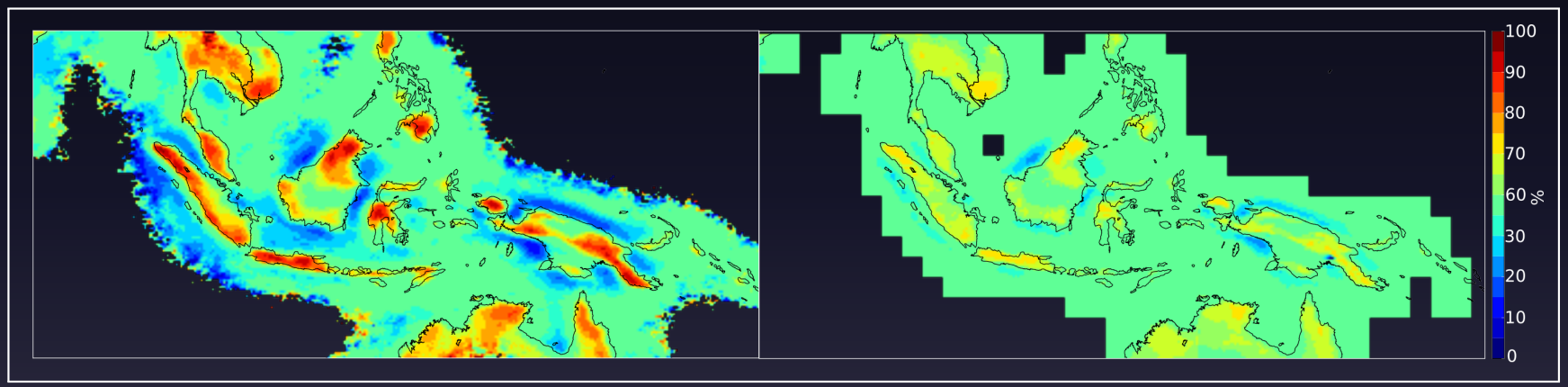
How is the diurnal cycle represented?

day time (1030LT - 2130LT) / night time (2130LT - 1030LT) rainfall



- strong diurnal variation over MC
- residual rainfall: total precip. - detected precip.
  weak diurnal variability $\rightarrow$ good [1]

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How do large-scale modes of variability affect coastal rainfall?

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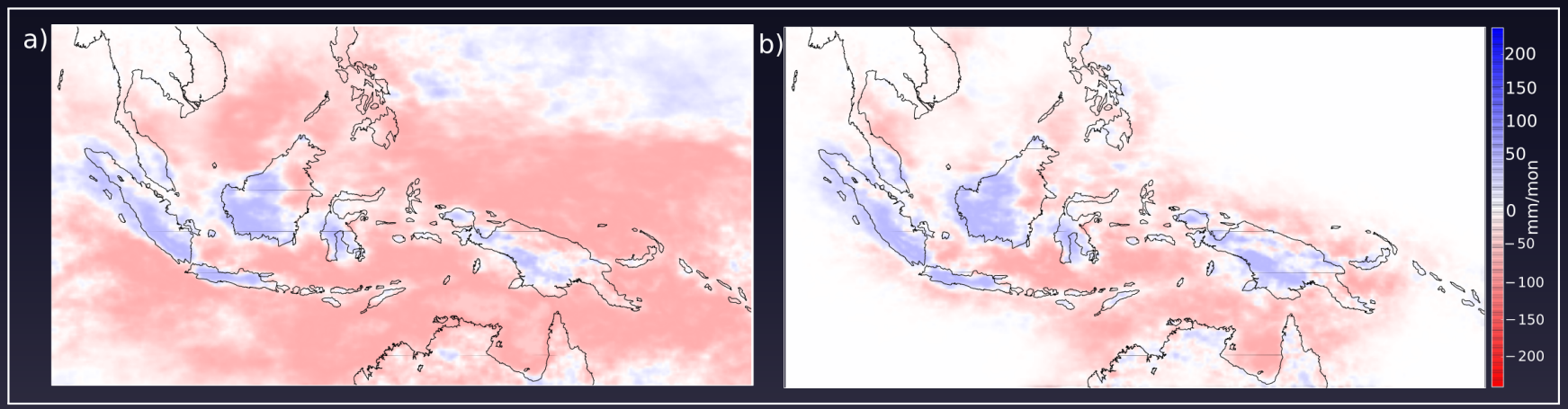
suppressed - active MJO Phase for
a) total rainfall b) detected rainfall during DJF

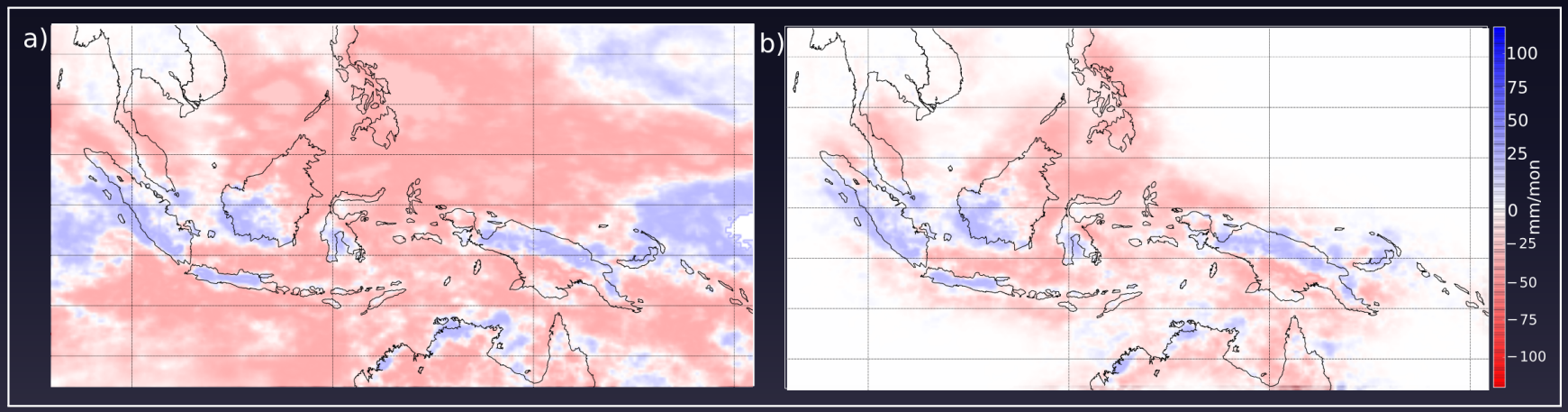


- differences stronger for suppressed phase
- more rainfall over land during suppressed phase [1]

[1] http://arxiv.org/abs/1501.06265

How do large-scale modes of variability affect coastal rainfall?

El Niño - weak ENSO Phase for
a) total rainfall b) detected rainfall during DJF



- land rainfall patterns similar
- land-sea interaction allows rainfall in supp. conditions [1]

[1] http://arxiv.org/abs/1501.06265

How is coastal rainfall linked to the large-scale state?

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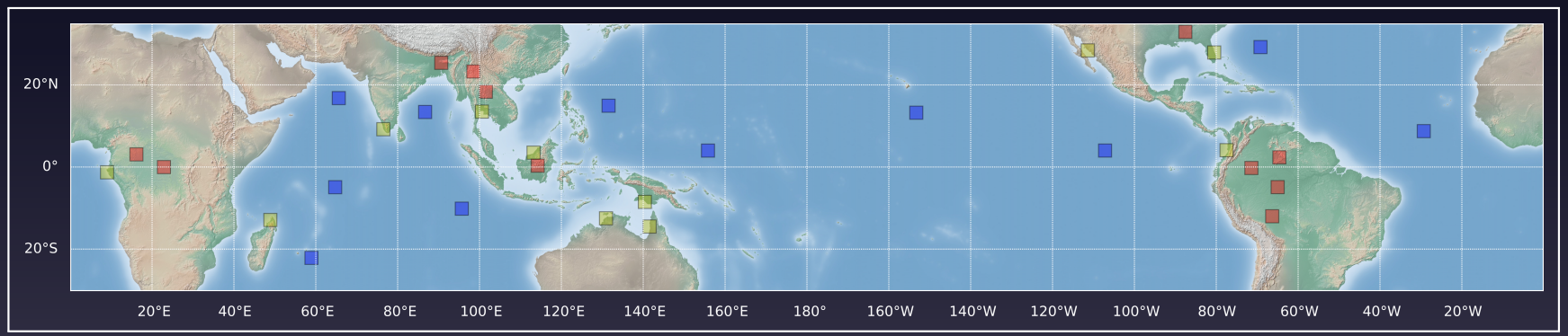
Choose 33 different boxes (300×300 km) in ocean, land and coastal regions



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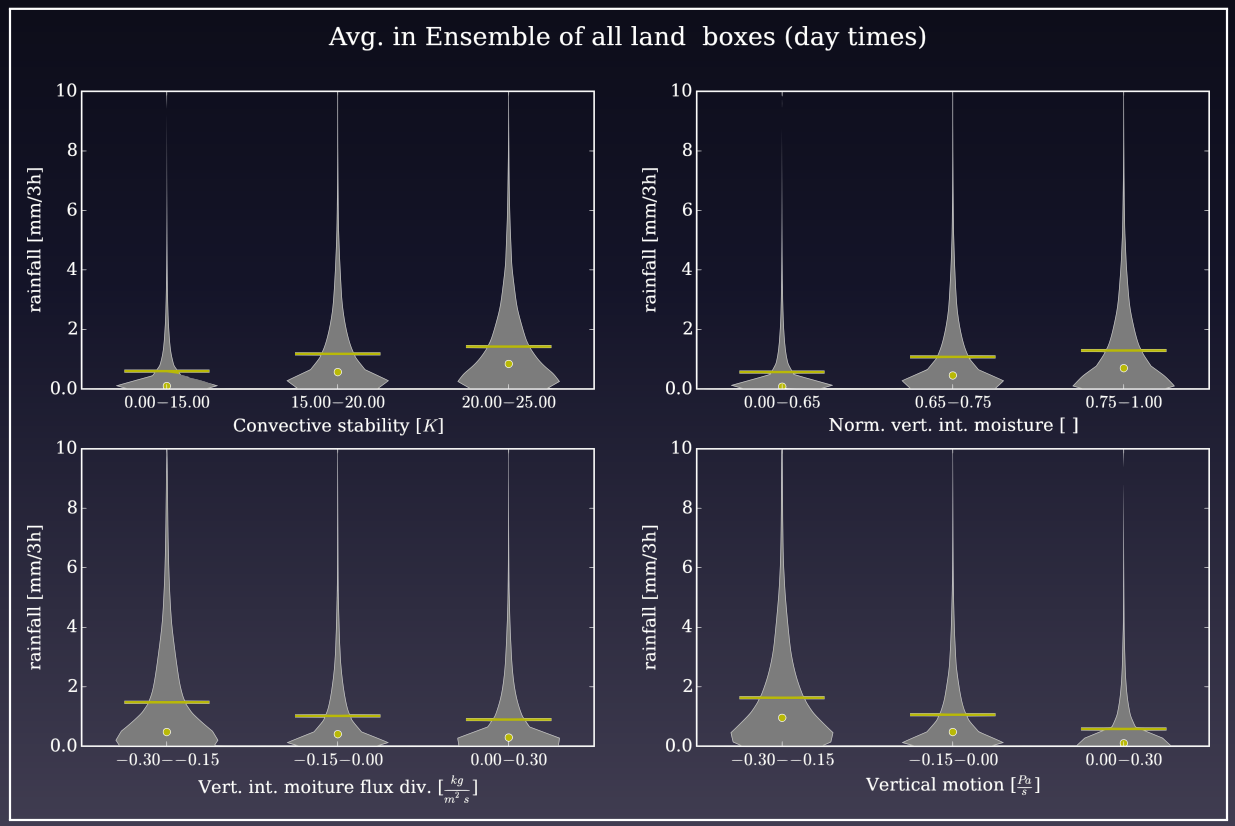
Which large-scale variables are important?



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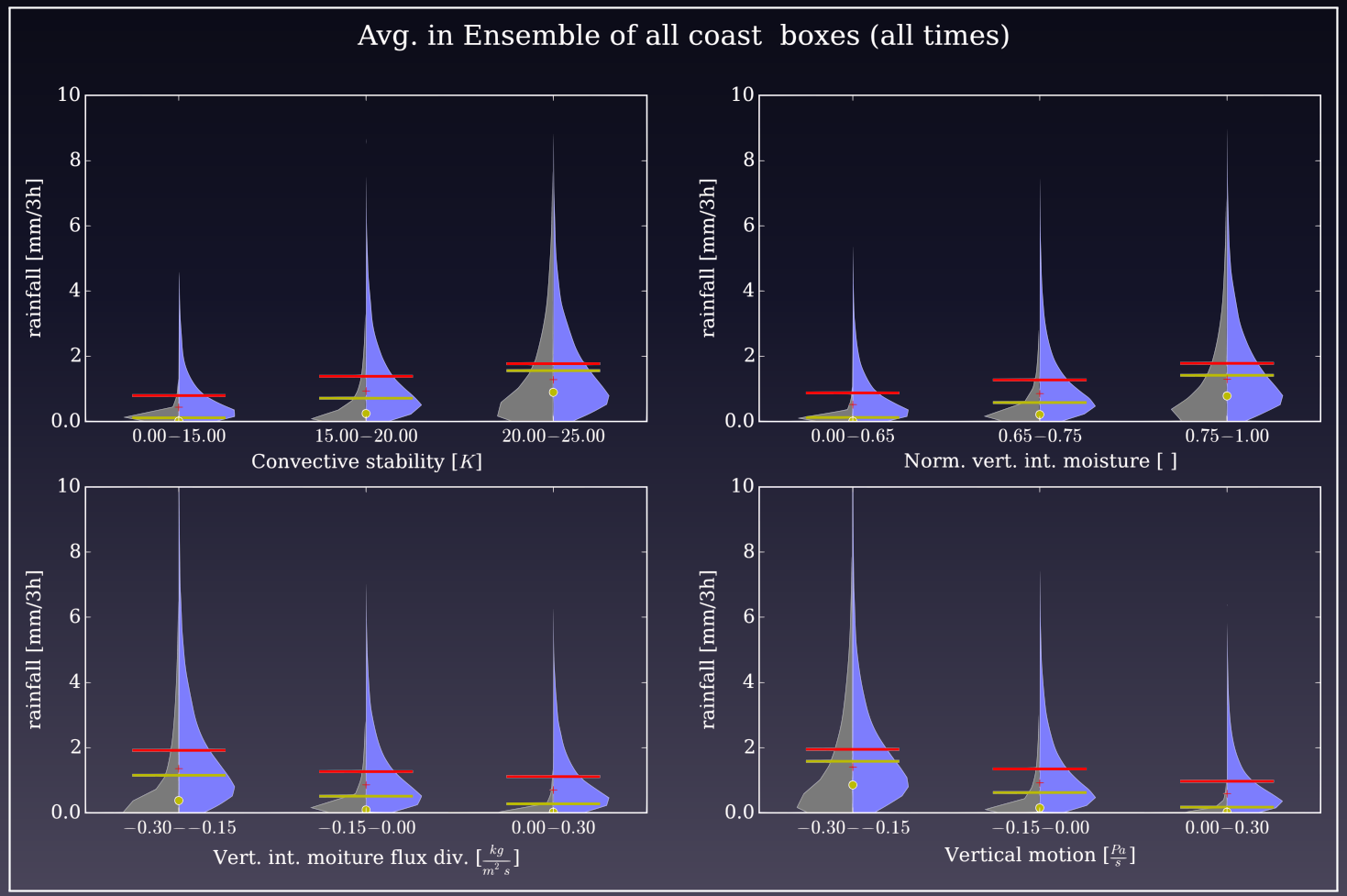
How different is coastal associated from non-coastal rainfall?

non-detected (black) and detected rainfall (blue)



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What are the main conclusions so far[1] [2]?

[1] http://arxiv.org/abs/1501.06265
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- major portions of precip. in coastal areas can be related to land-sea interaction

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- coastal processes seem to modulate precipitation in suppressed large-scale conditions

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What are the main conclusions so far[1] [2]?

- major portions of precip. in coastal areas can be related to land-sea interaction
- coastal processes seem to modulate precipitation in suppressed large-scale conditions
- response to large-scale forcing seems to be different for coastal associated precip.

[1] http://arxiv.org/abs/1501.06265
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