Coastal winds blowing in the UM?

A Sea-breeze diagnostic for GCM's

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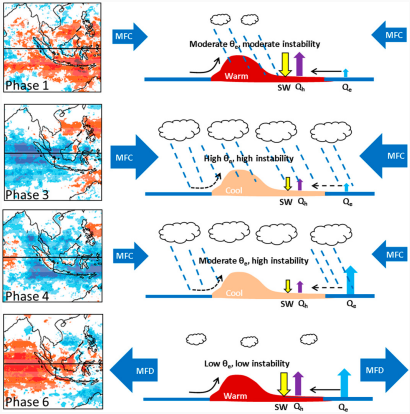
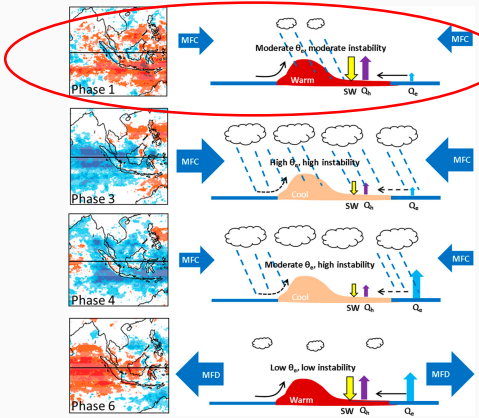
MJO ↔ MC rainfall



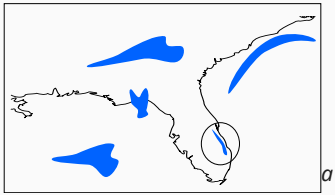
Birch et al. (J Clim 2016)

MJO ↔ MC rainfall



Birch et al. (J Clim 2016)

Rainfall ⟷ Humidity

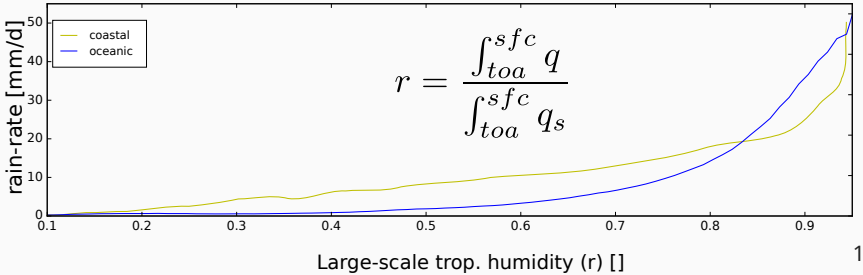


[a]

[a]Bergemann et al. 2015, JClim

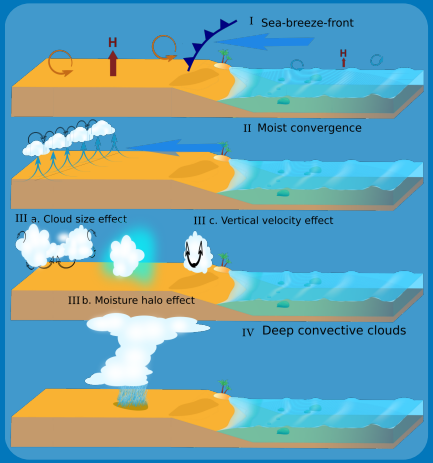
Detect rainfall patterns:

- occur in coastal areas
- are not synop scale
- are aligned with the coastline

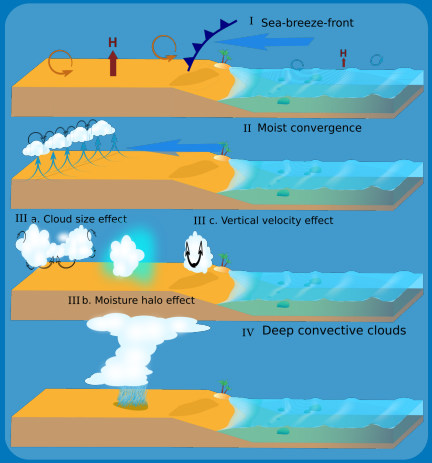


$$r = \frac{\int_{toa}^{sfc} q}{\int_{toa}^{sfc} q_s}$$

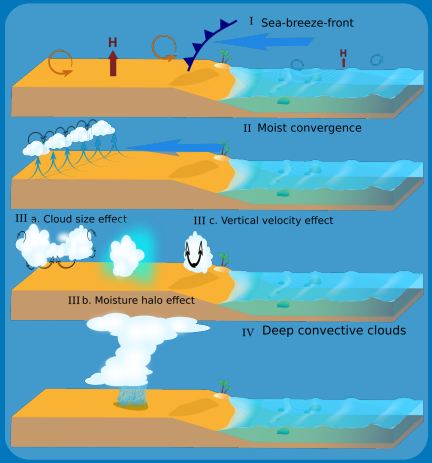
1


I Sea-breeze-front
H
H
II Moist convergence
III a. Cloud size effect
III c. Vertical velocity effect
III b. Moisture halo effect
IV Deep convective clouds

When are coastal effects present?

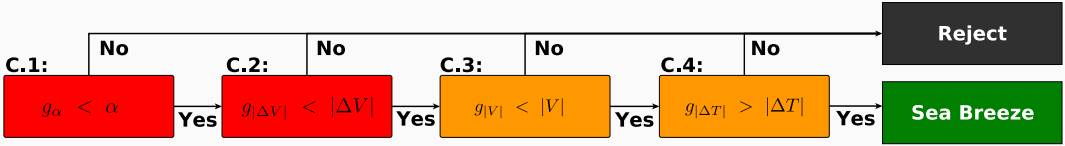


When are coastal effects present?



How to change the cu. param.?

Identification of sea-breeze conditions



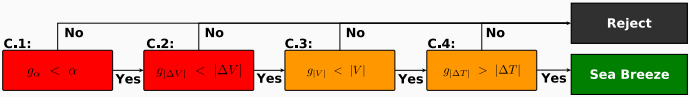
large-scale conditions only (Borne et al. 1998, Int J Clim)

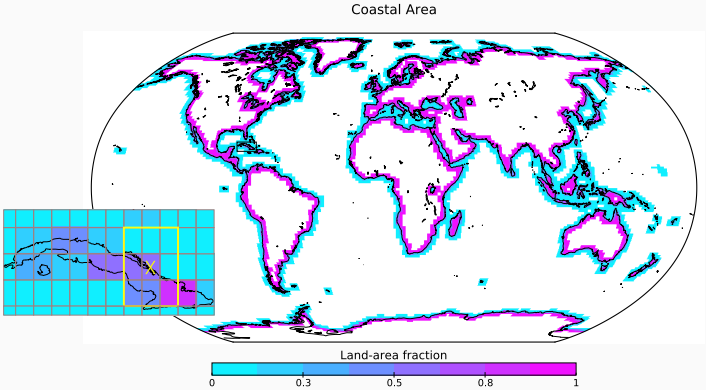
Binary (yes/no):

Scale the output by $|V|$ and $|\Delta T|$

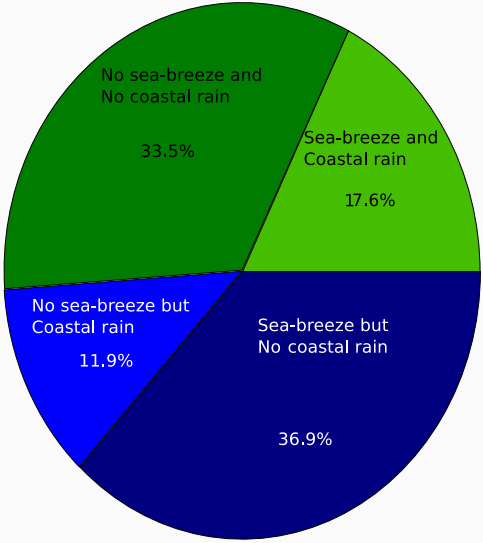
$$f(t) = \begin{cases} 0 & \text{if } f(t) = 0 \\ \underbrace{\frac{|g_{\Delta T}(t)|}{\Delta T}}_{>0} \cdot \underbrace{\frac{|\vec{V}| - g_{|\vec{V}|}(t)}{|\vec{V}|}}_{>0} & \text{if } f_B(t) = 1 \end{cases}$$

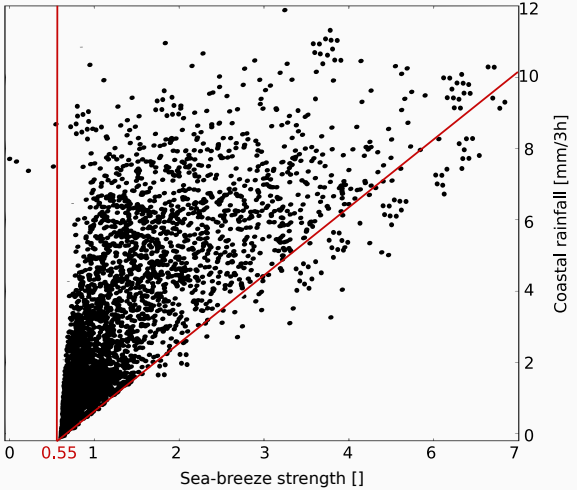
Implementation





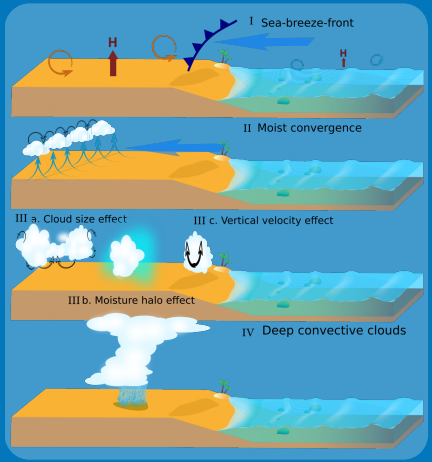
Performance test with ERA-I and coastal rainfall





$$\Delta \mathrm{T} = 1.75\ \mathrm{K}\ |\vec{V}| = 11\ \tfrac{\mathrm{m}}{\mathrm{s}}\ \Delta|\vec{V}| = 6\ \tfrac{\mathrm{m}}{\mathrm{s}}\ \Delta\alpha = 90^{\circ}$$

When are coastal effects present?



How to change the cu. param.?