Control of deep convection by sub-cloud processes in the new physics of the LMDZ model

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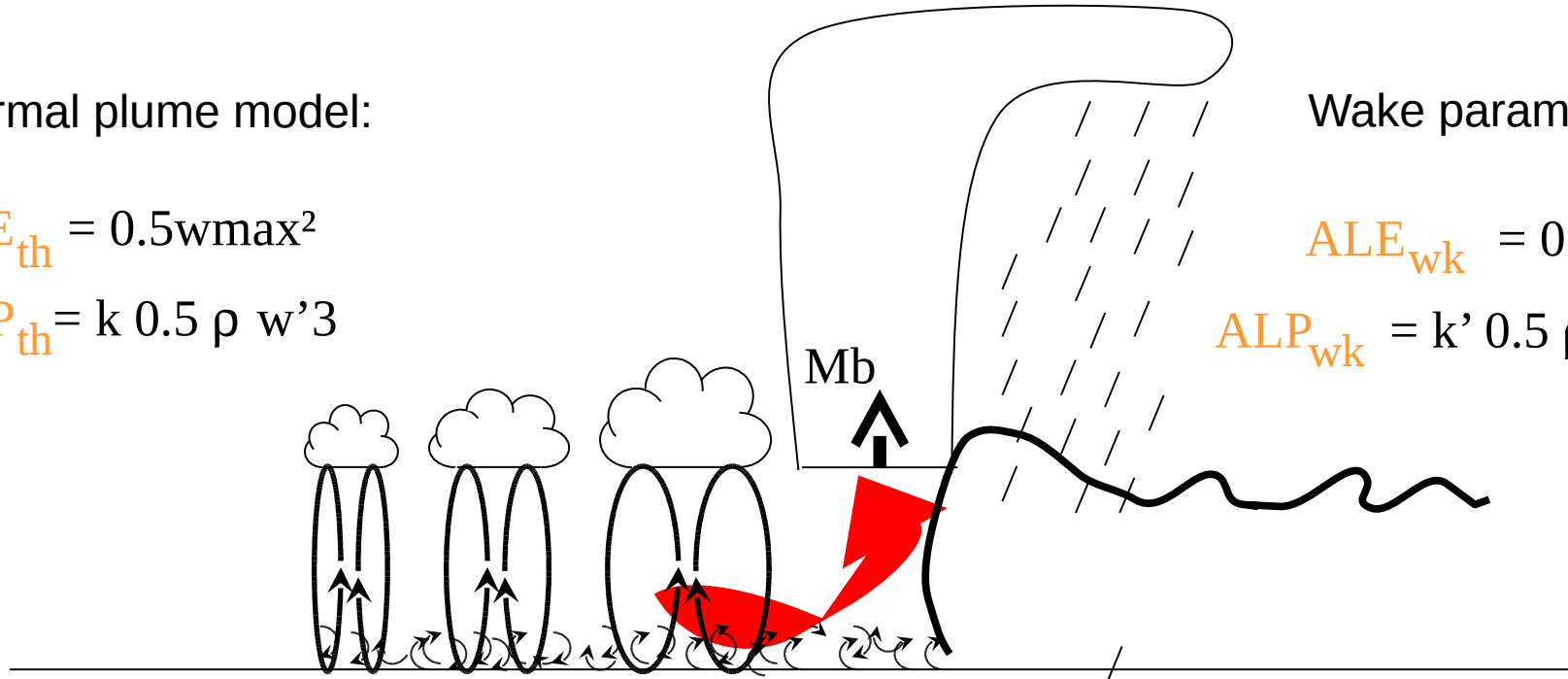
Thermal plume model:

$$ALE_{th} = 0.5 wmax^2$$

$$ALP_{th} = k\,0.5\,\rho\,w'3$$

Wake parametrization:

$$ALE_{wk} = 0.5 c*^2$$

$$ALP_{wk} = k'\,0.5\,\rho\,c*3\,Hw\,Lg$$

Mb

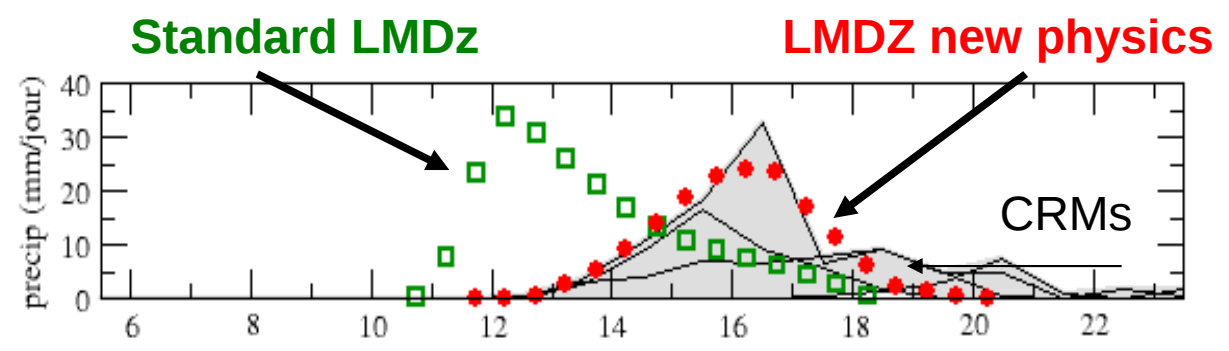Control of deep convection by thermals and wakes:

Triggering: $$MAX(\,ALE_{th},\ ALE_{wk}) > |CIN|$$
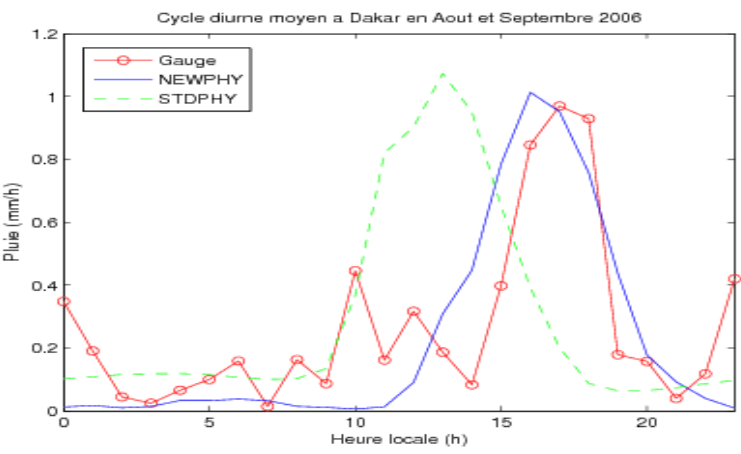
Closure: $$Mb = f(\,ALP_{th} + ALP_{wk},\ wb,\ CIN)$$

1D results
Diurnal cycle of precipitating convection over land
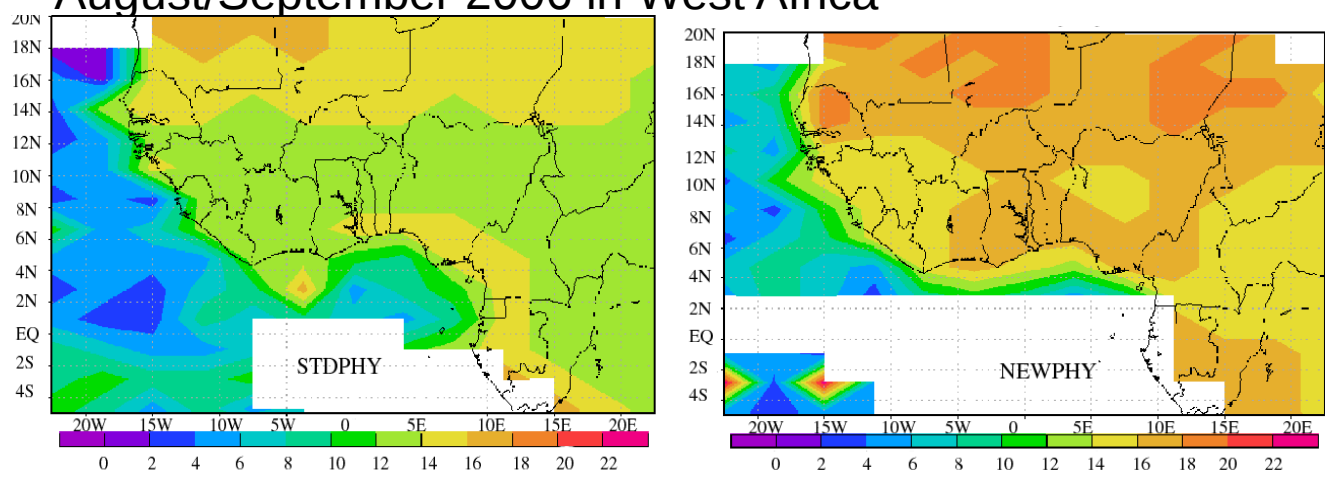
Standard LMDz   **LMDZ new physics**

CRMs

3D results
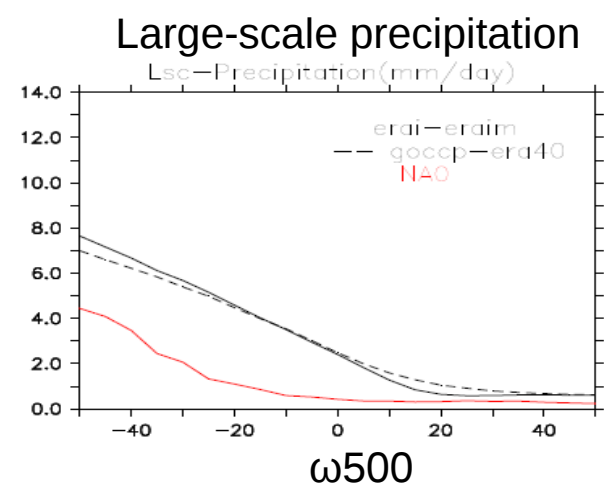Diurnal cycle of precipitation in August/September 2006 in Dakar
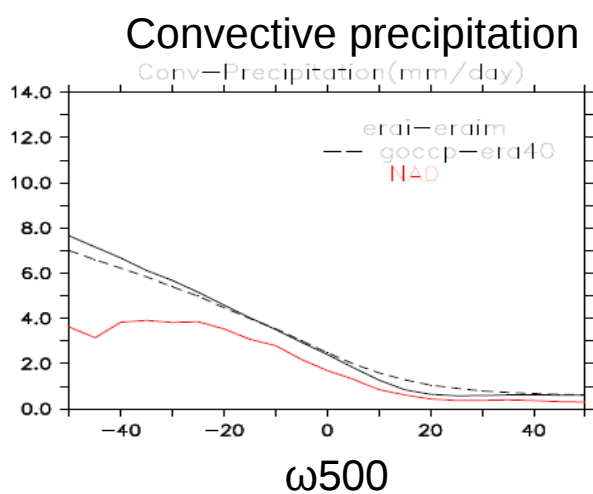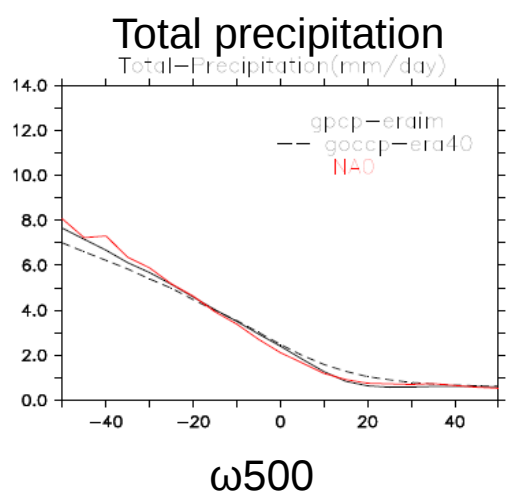
Local hour of the maximum of precipitation in August/September 2006 in West Africa

BUT: weak convective precipitation in ascending regions

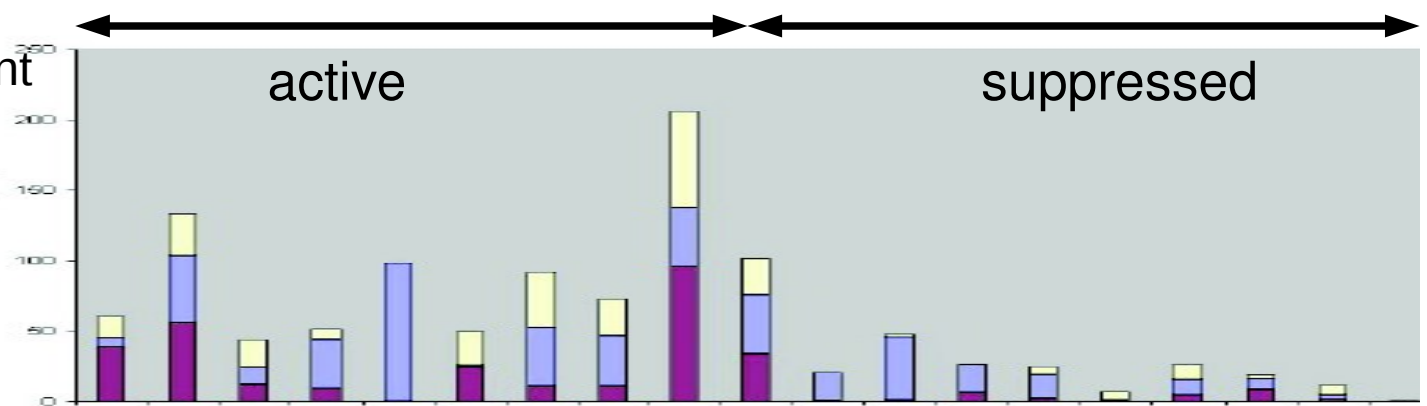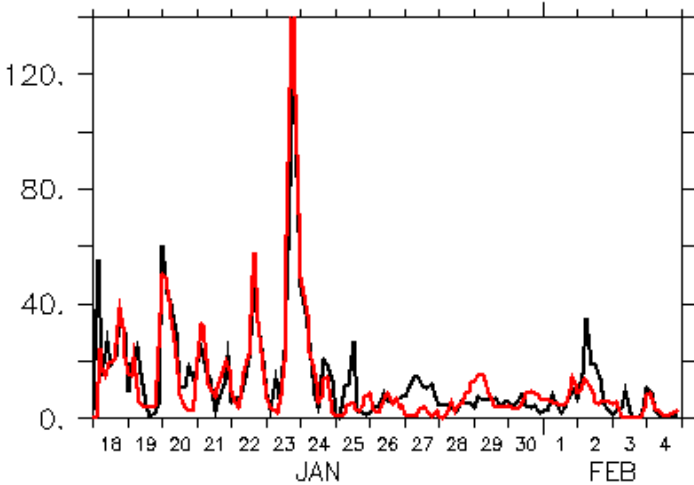*Sane et al.*

Total precipitation

Convective precipitation

Large-scale precipitation

$\omega 500$ $\omega 500$ $\omega 500$

The Tropical Warm Pool-
International Cloud Experiment
TWP-ICE

1D case-study

— LMDZ standard
— LMDZ new physics
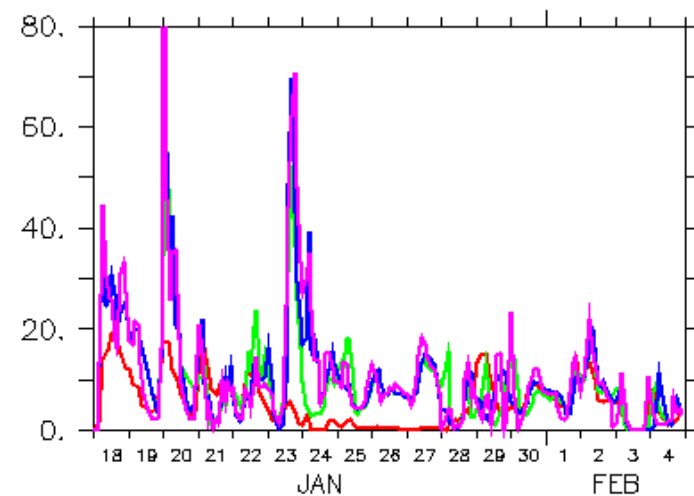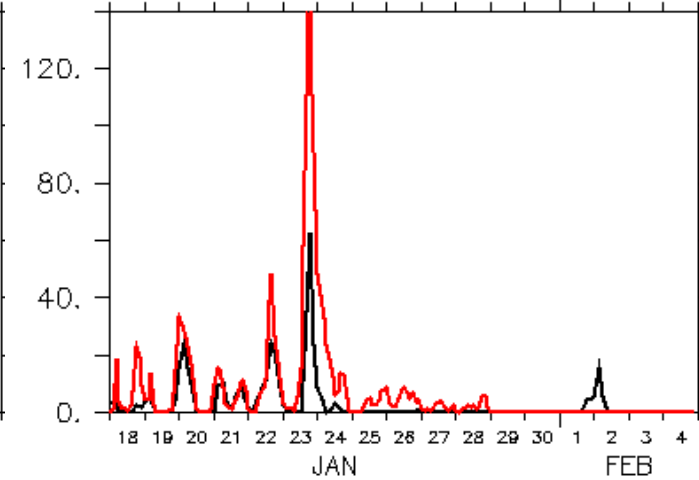
active   suppressed

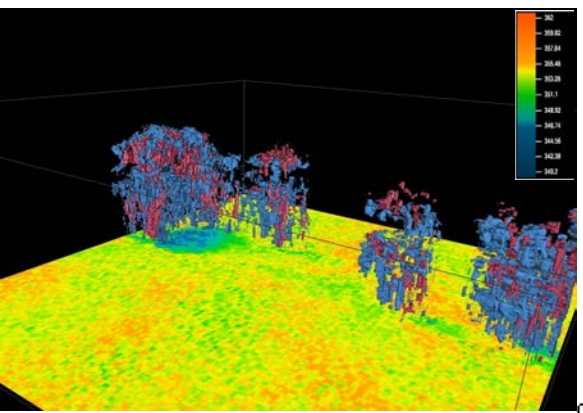Total precipitation   Convective precipitation   Large-scale precipitation

Sensitivity tests to:
- vertical velocity at cloud base wb
- wakes driven by both convective and large-scale precipitation
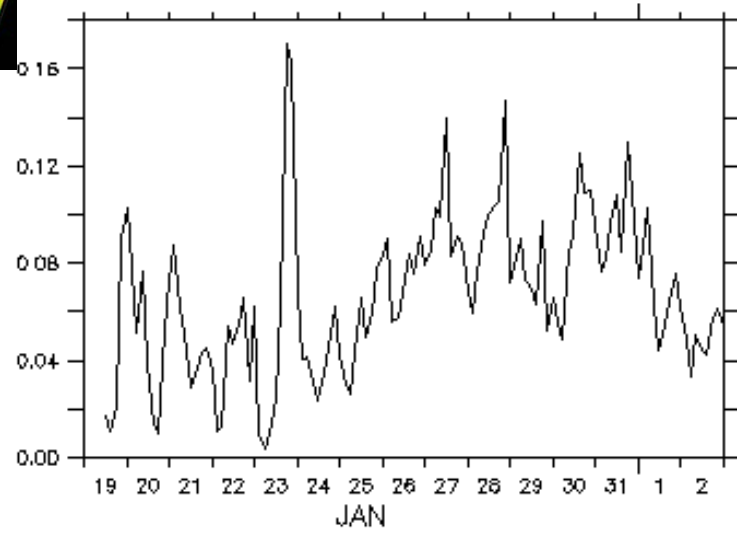- lifting efficiency

Use of Cloud Resolving Model simulations to evaluate the formulations of ALE and ALP and the new triggering and closure assumptions.
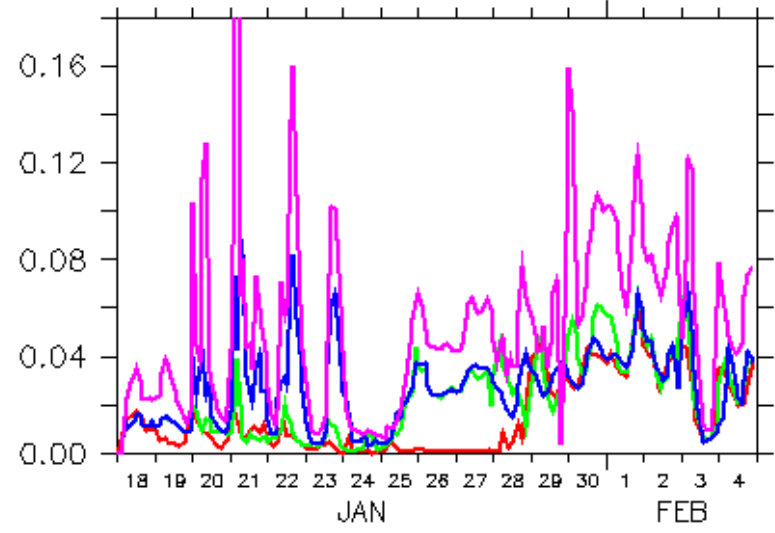

- Identification of updrafts and wakes
- Estimation of ALP, ALE, CBMF ...

DHARMA

LMDZ

W'3 vs ALP

Cloud base
mass-flux (kg/m2/s)