

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

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Thermal plume model:

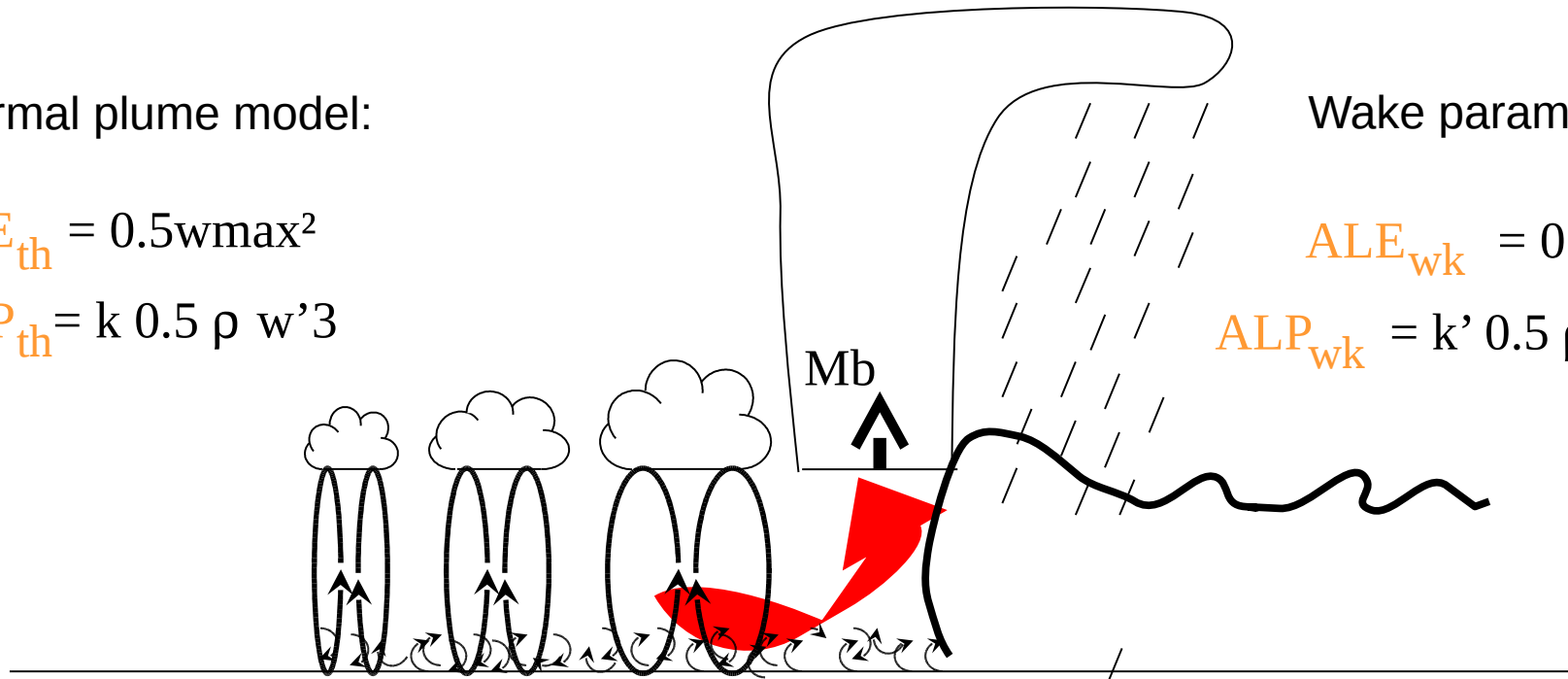
$$ALE_{th} = 0.5w_{max}^2$$

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

Wake parametrization:

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

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



Control of deep convection by thermals and wakes:

Triggering:

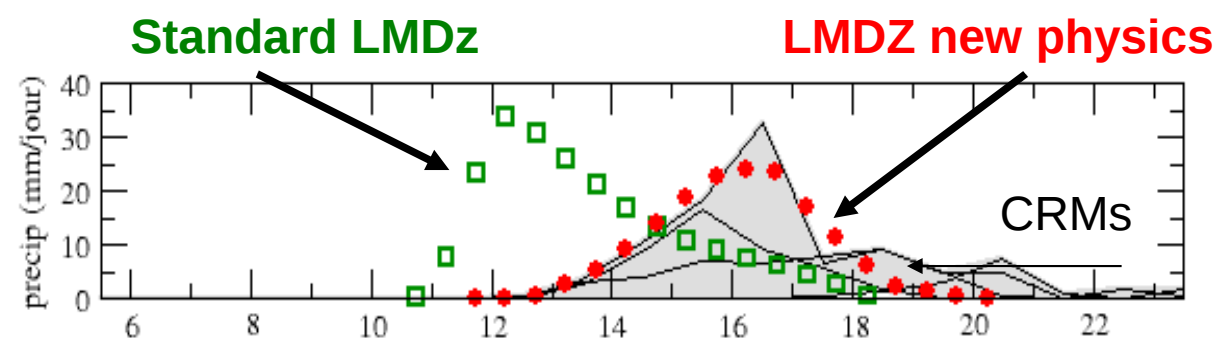
$$\text{MAX} ( ALE_{th}, ALE_{wk} ) > |CIN|$$

Closure:

$$Mb = f( ALP_{th} + ALP_{wk}, wb, CIN )$$

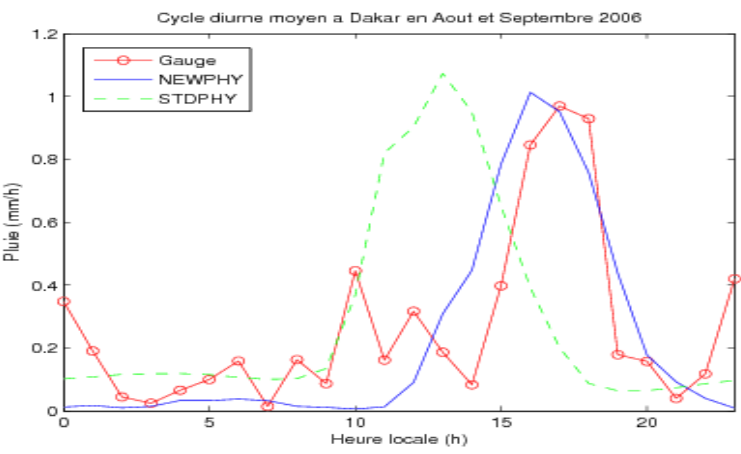
# 1D results

Diurnal cycle of precipitating convection over land

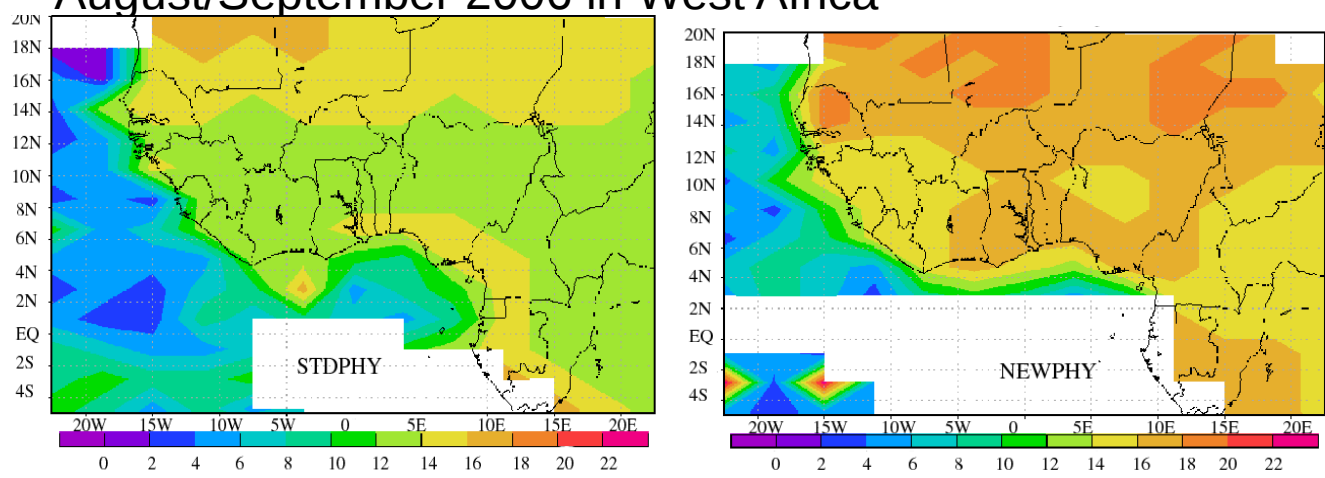


# 3D results

Diurnal cycle of precipitation in August/September 2006 in Dakar

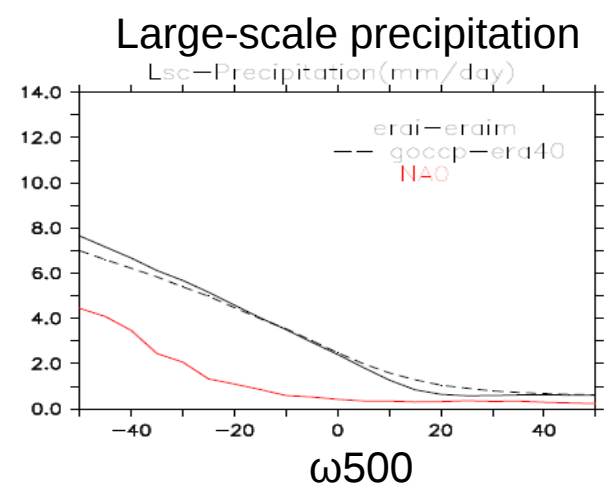
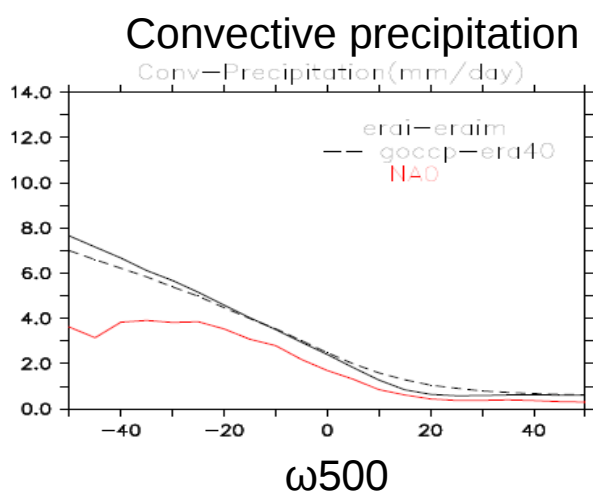
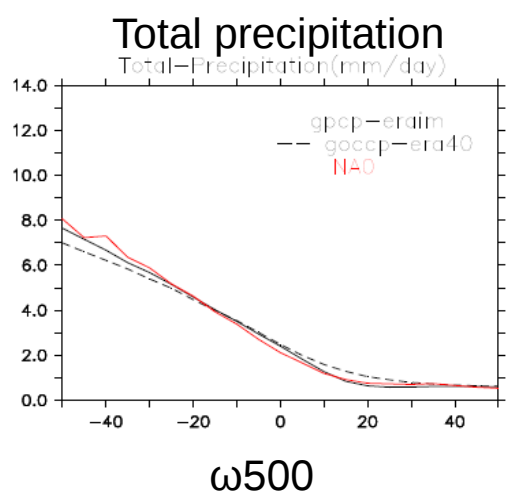


Local hour of the maximum of precipitation in August/September 2006 in West Africa



BUT: weak convective precipitation in ascending regions

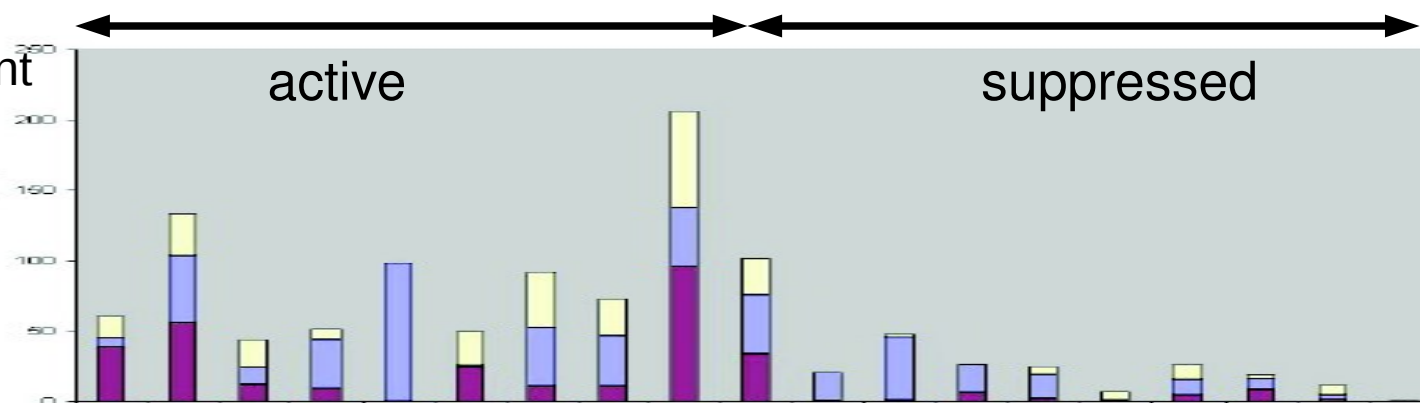
*Sane et al.*



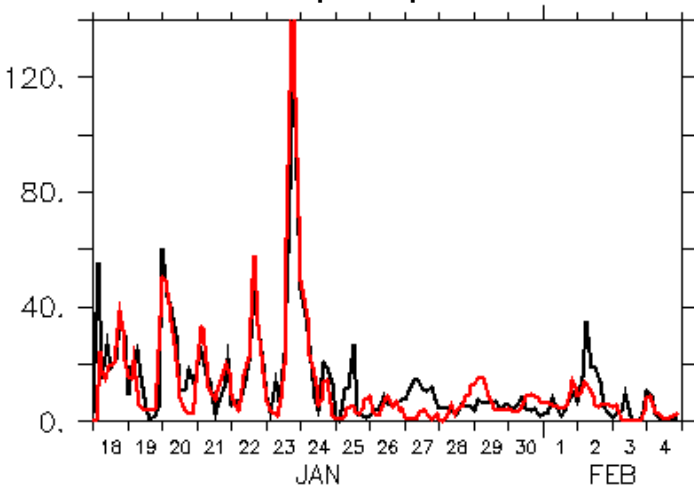
# The Tropical Warm Pool- International Cloud Experiment TWP-ICE

## 1D case-study

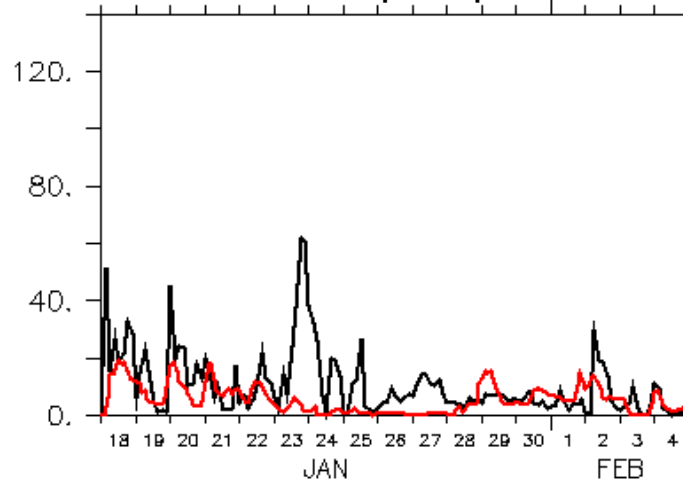
- LMDZ standard
- LMDZ new physics



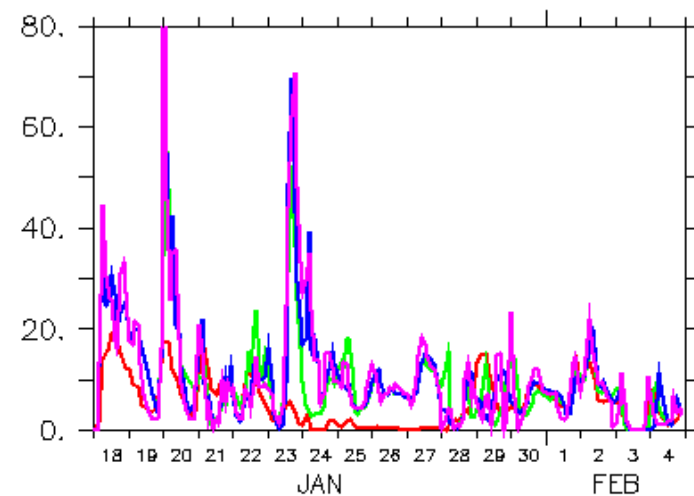
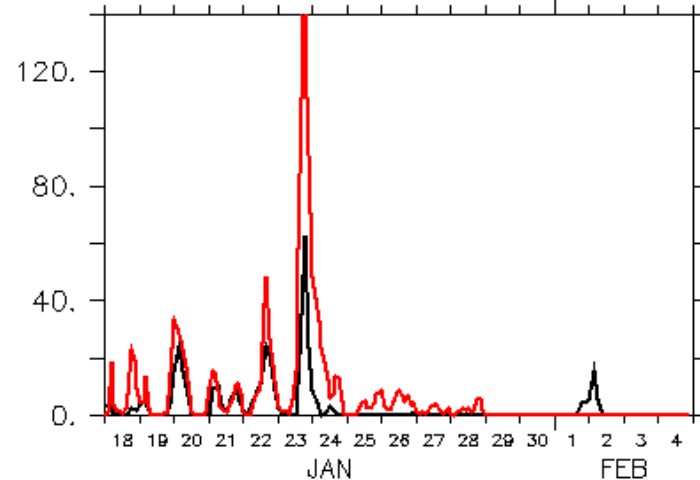
Total precipitation



Convective precipitation



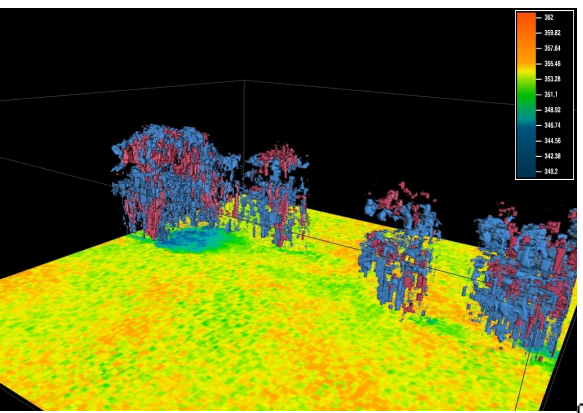
Large-scale precipitation



### Sensitivity tests to:

- vertical velocity at cloud base  $w_b$
- wakes driven by both convective and large-scale precipitation
- lifting efficiency

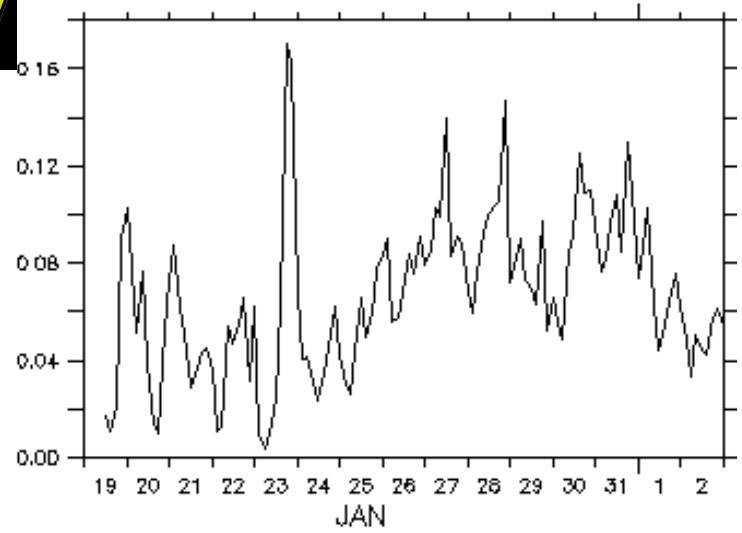
# Use of Cloud Resolving Model simulations to evaluate the formulations of ALE and ALP and the new triggering and closure assumptions.



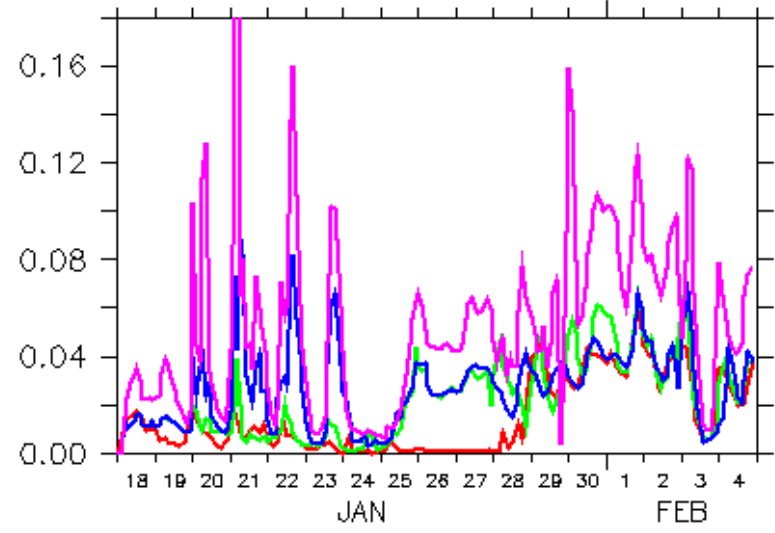
- Identification of updrafts and wakes
- Estimation of ALP, ALE, CBMF ...

W'3 vs ALP

### DHARMA



### LMDZ



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

