What controls the vertical distribution of dust over the Western Africa region?

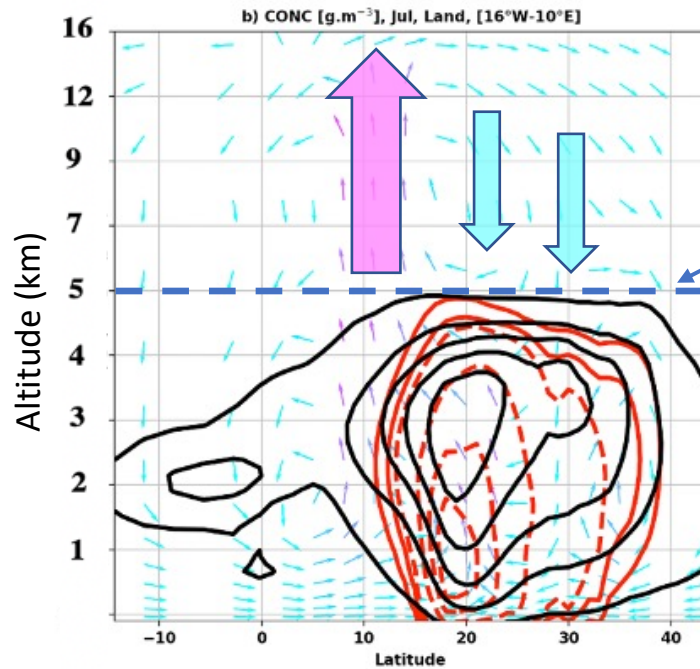Habib Senghor, Romain Pilon

B. Diallo, J. Escribano, F. Hourdin, J.-Y. Grandpeix, O. Boucher, M. Gueye, A. T. Gaye, and E. Machu

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Motivation

Are other processes involved in the dust distribution?

Model simulation

- ITCZ (dry & moist convection)

- The Hadley cell limits the top dust layer.

—— FINE $(< 1\ \mu m)$ dust concentration

—— SCDU $(6 - 30\ \mu m)$ dust concentration

Models & Methods

LMDz v6
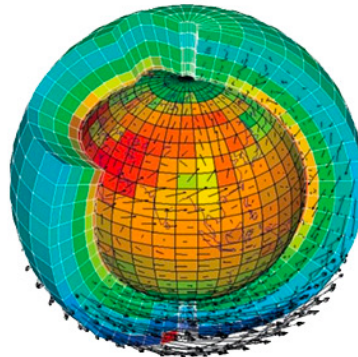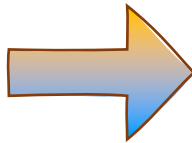climate model
Hourdin et al. (2020)

SPLA (simplified aerosol model)
Huneeus et al. (2009)
Escribano et al. (2016)

Tracer transport and scavenging
Pilon et al. (2015)

↳ **tracers follow convective processes**

Mineral dust production, emissions & dust bins
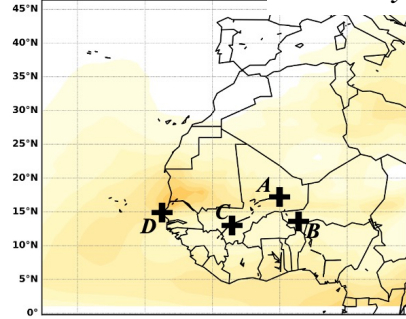

Simulation 2006–2010

Scavenging ON vs OFF

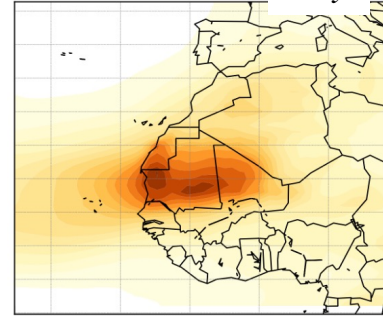# Aerosol Optical Depth

Monthly averaged 2006–2010

model

With scavenging

data

MODIS/TERRA

model
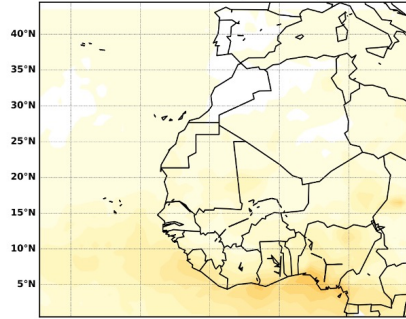
No scavenging

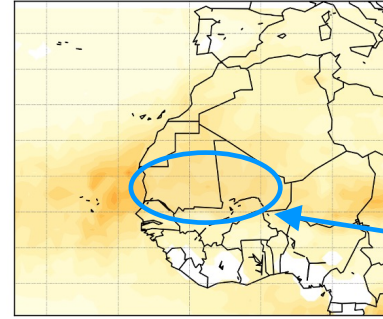Sources missed by satellite

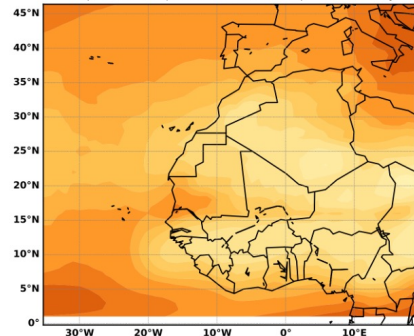a) LMDz (model-scav)   *January*

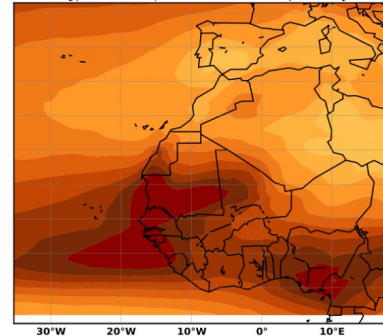b) LMDz (model-scav)   *July*

c) Modis/Terra (obs) - January

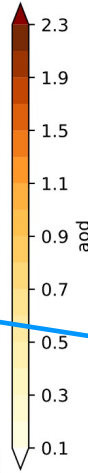d) Modis/Terra (obs) - July

e) LMDz (model - noscav) - January

f) LMDz (model - noscav) - July

January

July

Improvement of dust seasonal cycle
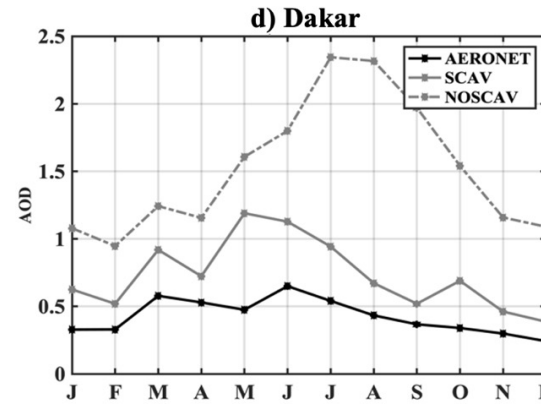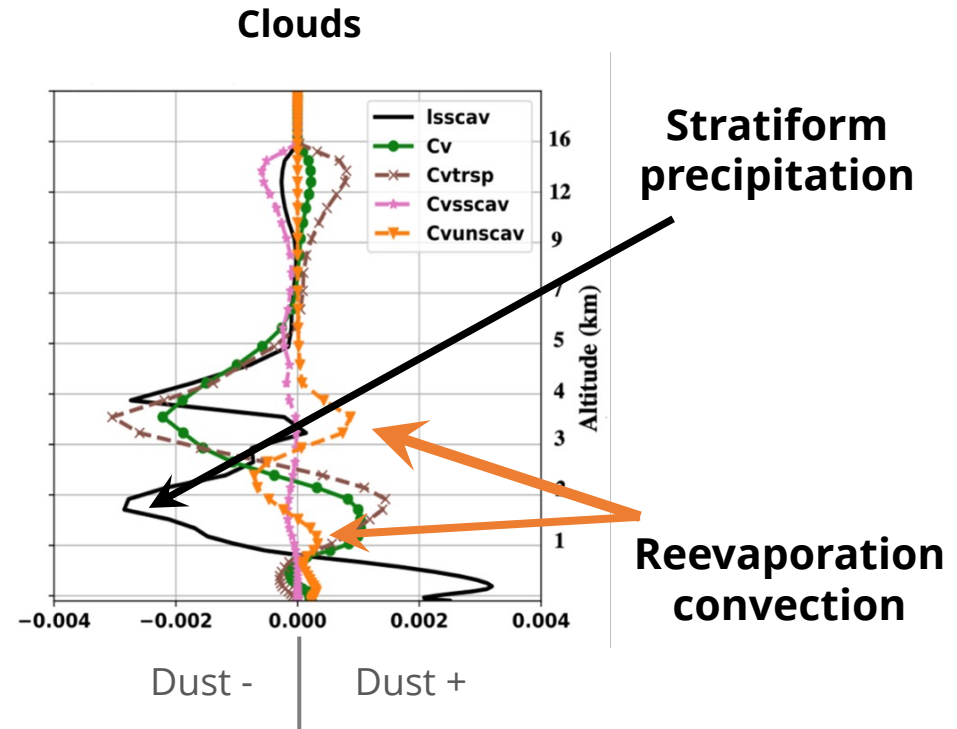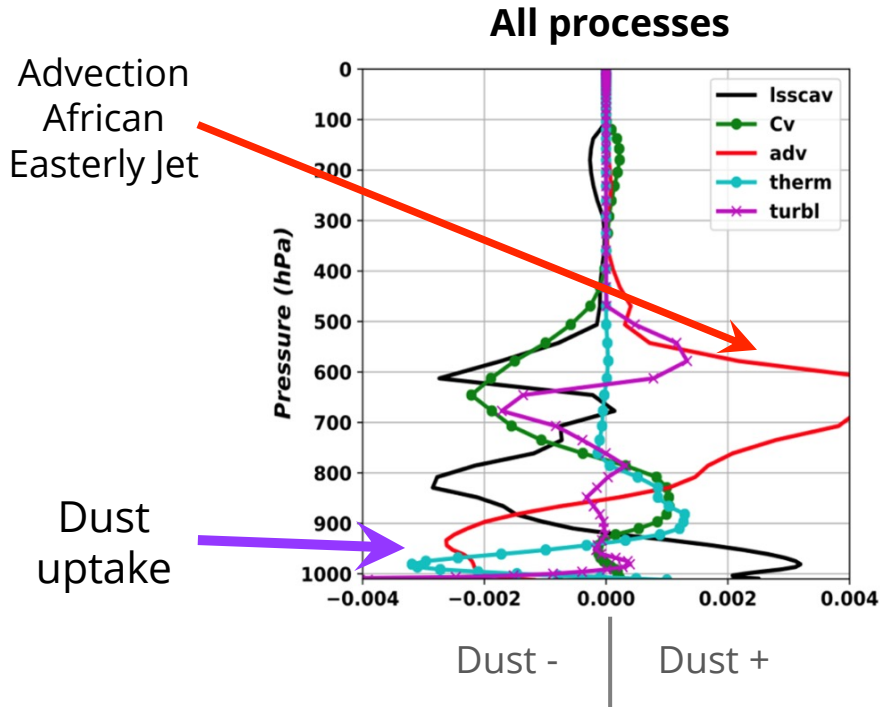
Aerosol Optical Depth

at 550 nm
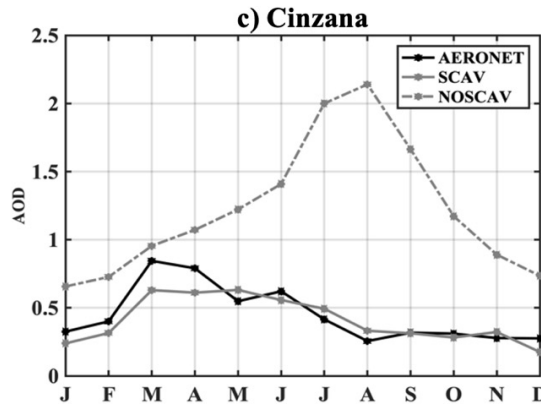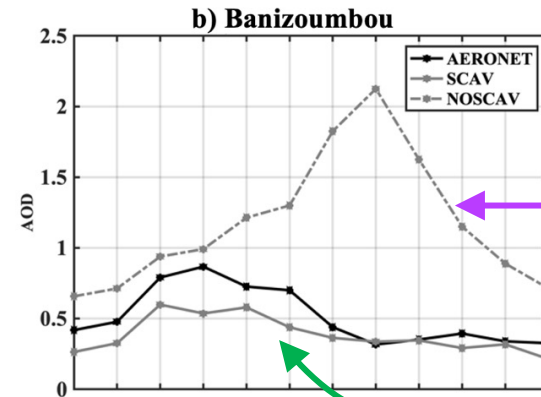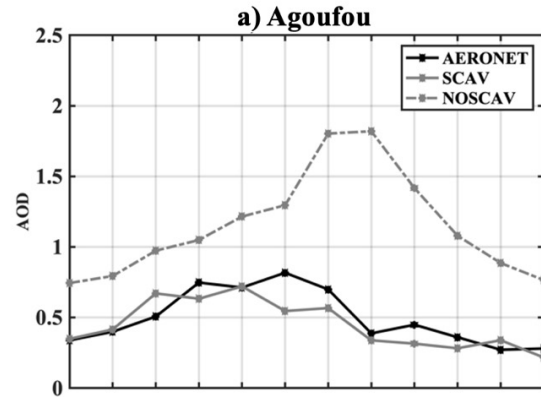
AERONET stations in the Sahel region 2006–2010

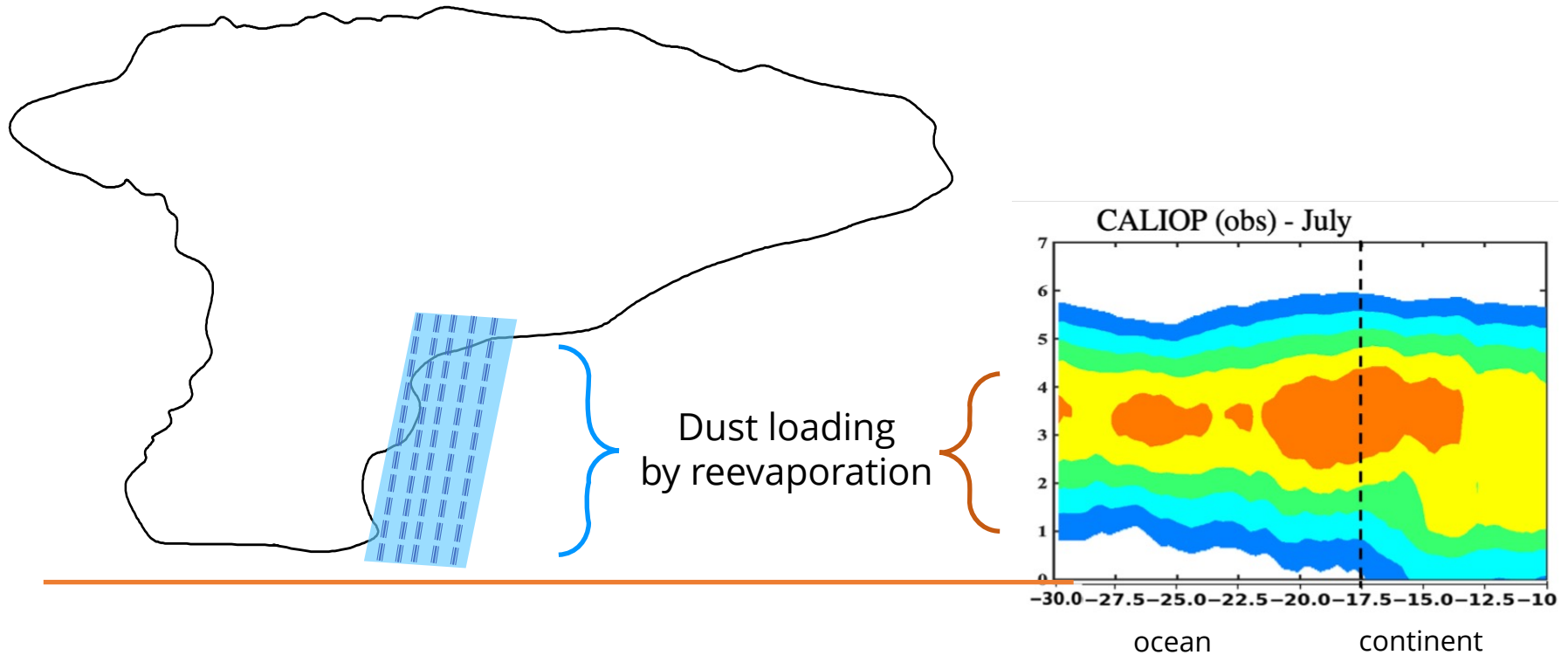# Which physical process prevails on the vertical distribution?

Removal and release of coarse dust
between 16°W–10°W / 0–10°N

Vertical redistribution

Common knowledge: scavenging processes ≈ sink for aerosols

Here, **convection** (**re-evaporation** in downdrafts) ⟹ ↗↗ dust concentration

Dust loading
by reevaporation

CALIOP (obs) - July

ocean   continent

Take-home message

Scavenging in deep convection

& **subsequent re-evaporation of dusty rainfall**

➡️ Key role for maintaining a well-defined dust layer with sharp transition at the top of the SAL

➡️ Dust seasonal cycle

More in a paper in review:

"Control of the Dust Vertical Distribution in the Saharan Air

Layer by Convection and Scavenging"

We also talk about the dust layer over the Atlantic.