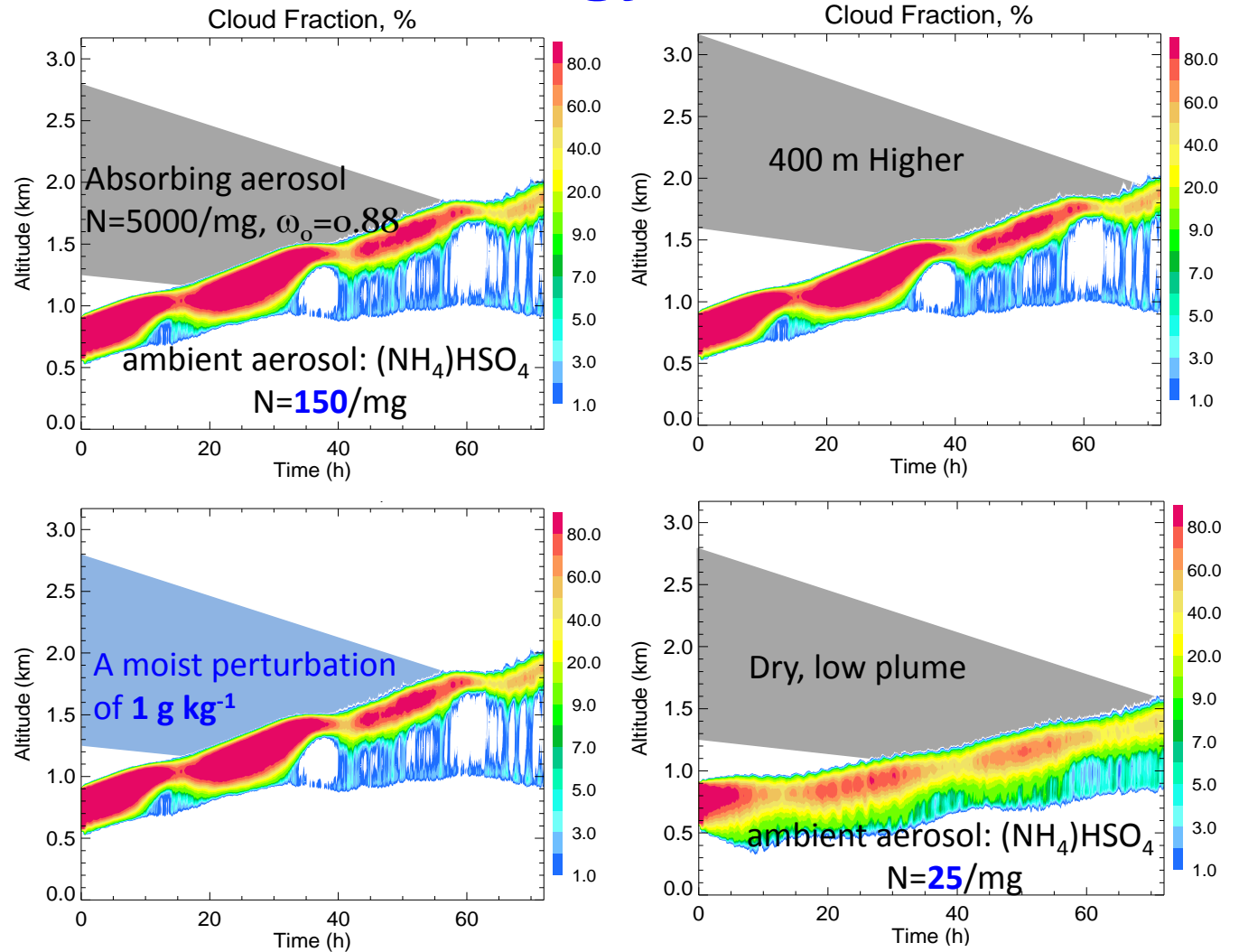


**LES proxy study of biomass burning plumes influencing
Namibian stratocumulus:
Guidance for analysis of ORACLES observations**

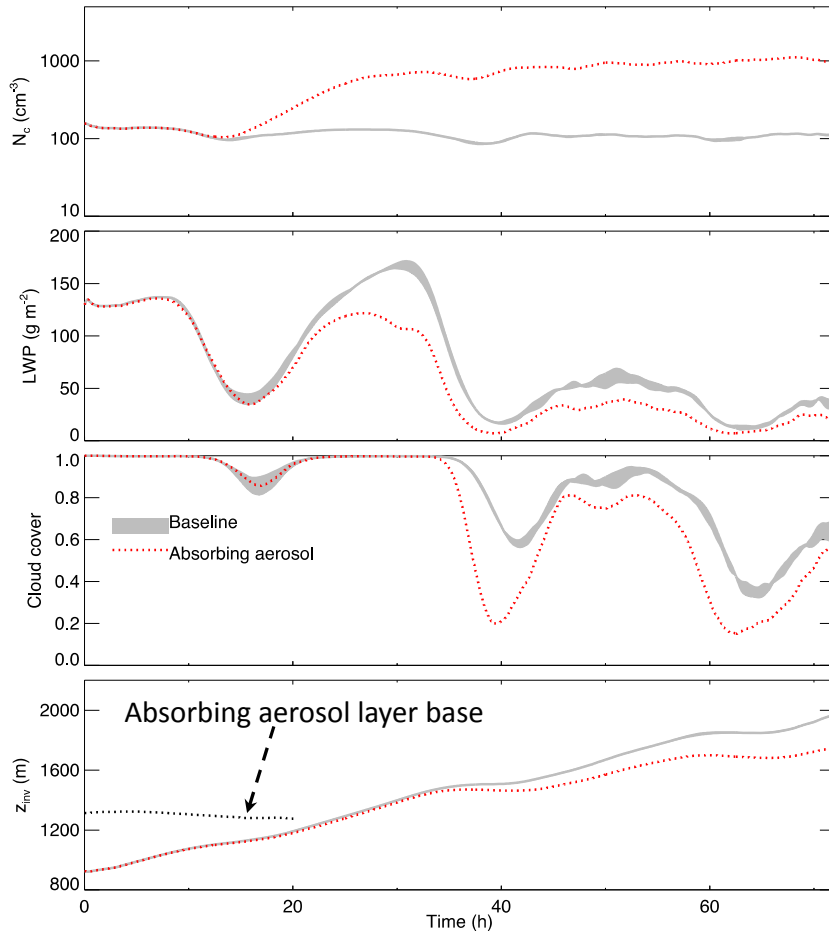
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Simulation strategy

- 10.8 x 10.8 x 3.2 km grid
- 2-moment microphysics
- meteorology: base case used in de Roode et al. (2016) LES intercomparison (from NE Pacific trajectories)
- ambient aerosol: $k=0.55$, $r_g=0.05 \mu\text{m}$, $\sigma_g=1.2$
- absorbing layer: $k=0.2$, $r_g=0.12 \mu\text{m}$, $\sigma_g=1.3$



Indirect plus semi-direct forcings



- Transition hastened and strengthened (Yamaguchi et al., 2015: transition delayed instead)
- Net **negative** radiative forcing (but positive ΔCRF , opposite of Y15)
 - SW: Twomey overcomes reduction in CF and LWP
 - LW: shallower PBL, reduced CF both increase upwelling LW

	RF @ TOA (W m^{-2})		
	SW	LW	TOTAL
Day 2	-0.5	-2.6	-3.1
Day 3	-1.2	-6.0	-7.2

(aerosol forcings computed following Ghan 2013)

Key conclusions

- Stratocumulus to trade cumulus transition **hastened**
- TOA indirect and semi-direct radiative forcings consistently **-ive** (greater than or comparable to +ive direct forcing)
- LW forcings not to be ignored (at TOA, even for shallow clouds!)

	Direct forcing			Indirect, semi-direct forcings			All forcings
	SW	LW	SW+LW	SW	LW	SW+LW	SW+LW
3-day mean	1.5	-0.2	1.3	-1.1	-2.9	-4.0	-2.7

- Higher aerosol layer **enhances**
 - The presence of additional moisture **reduces**
 - The presence of drizzle **enhances**
- } total aerosol radiative forcings

Guidance for analysis of ORACLES observations

- Background conditions are very important to assessing BBA effects
 - what are BL aerosol and cloud properties prior to direct BBA plume contact?
 - use near-coast in situ measurements
- Different LES models give different results re BBA effects on the SCT, especially CF
 - what is evolution of CF along BL trajectories?
 - use airborne imagery
- Aerosol indirect and semi-direct effects on SW and LW fluxes individually substantial, but also commonly offsetting
 - expect complex interplay of radiative effects from ΔN_c , CF, BL depth, drizzle
 - diurnal cycle a further complication
 - ORACLES observations will be foundation for next round of modeling...