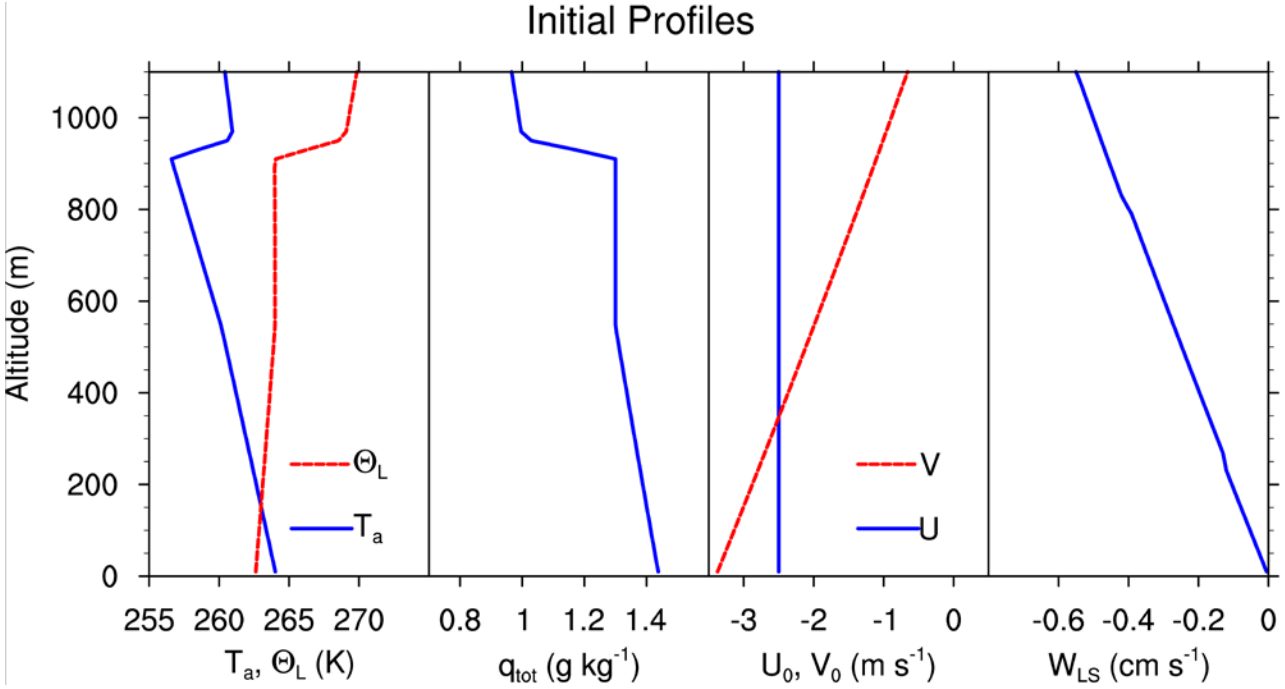
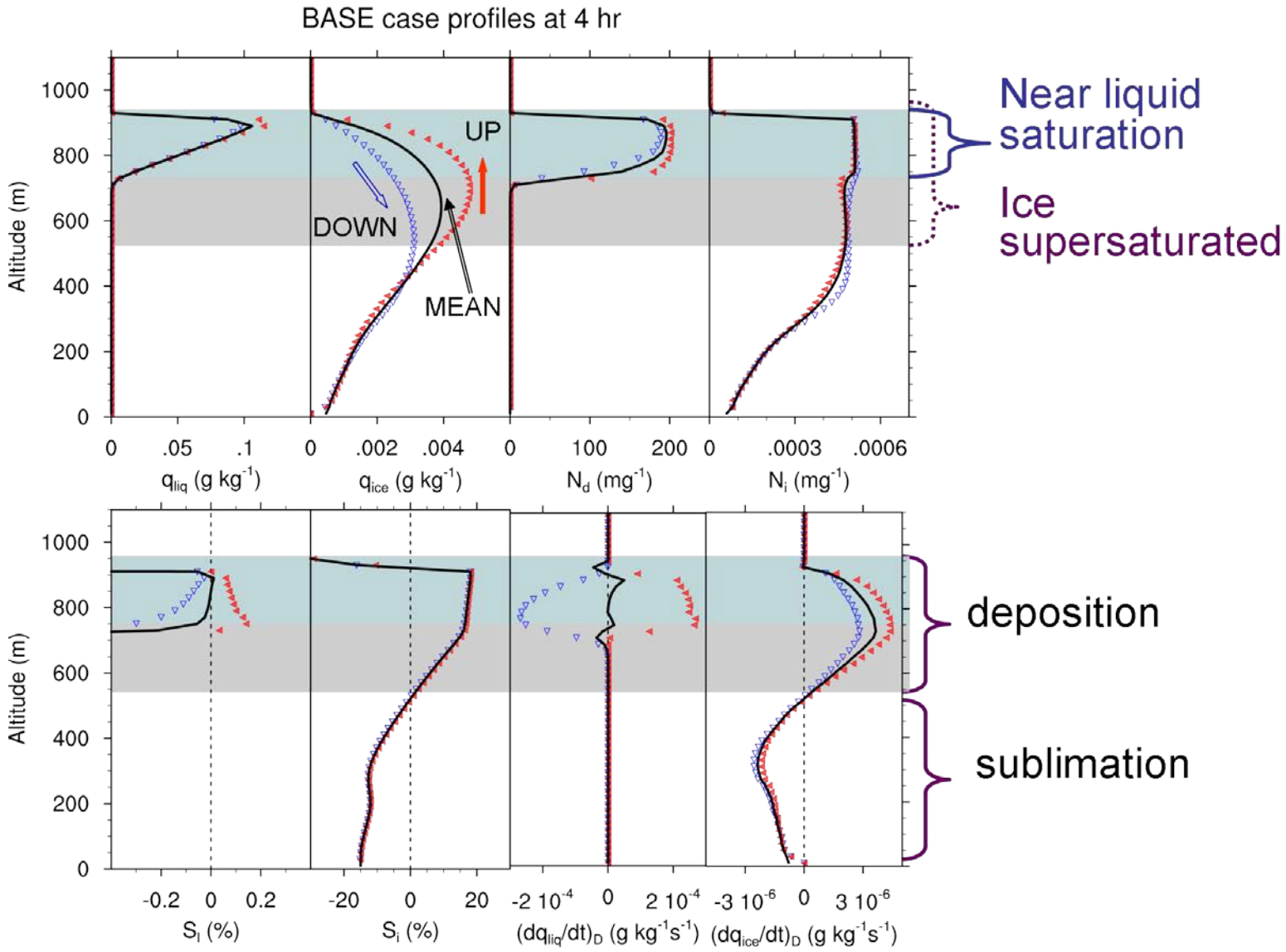
Ice effects on the cloud dynamics (Ovchinnikov, Korolev, Fan)

ISDAC FLT31: Initial profiles and model's setup



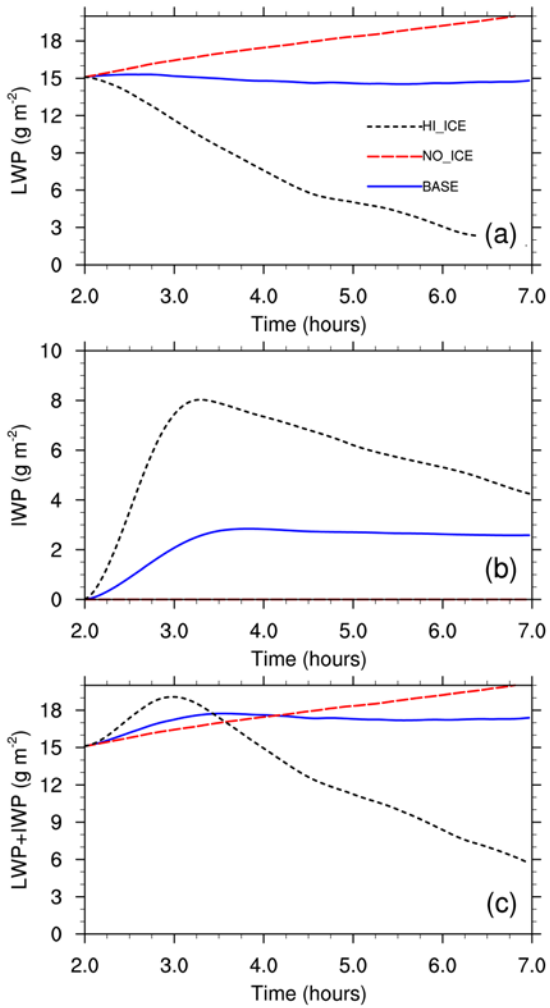
LES, 50 m horizontal and 20 m vertical grid size, 256x128x120 domain, Δt=2 s
Bin microphysics for liquid and ice
Liquid-only dynamics spin-up for 2 hrs
Elevated mixed-layer with temperature inversion at the top and slightly stable and moister layer below

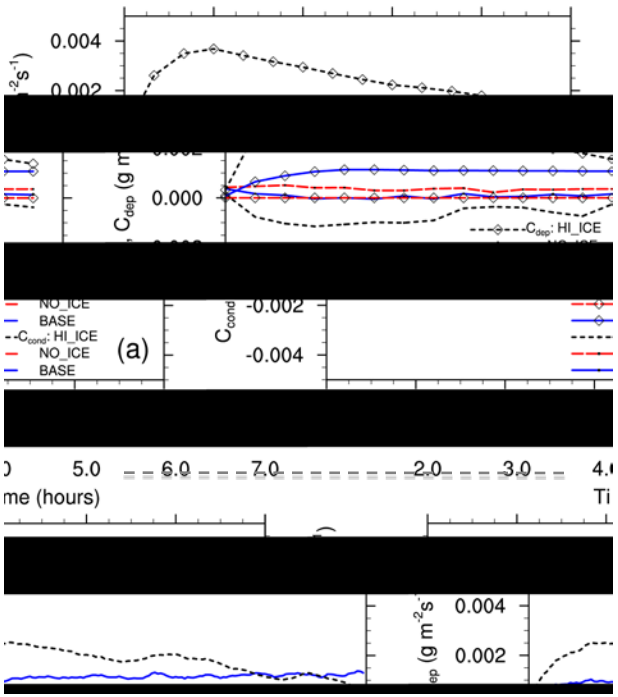
ISDAC FLT31: Base case cloud properties (N_i=0.5 L^{-1})



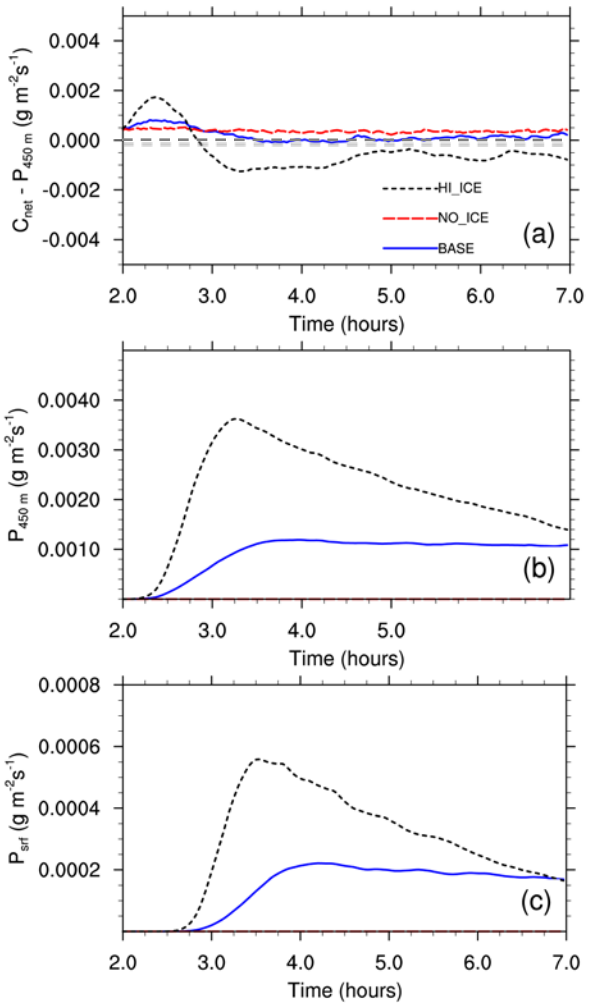
Sensitivity to N_i

Stable LWP for the BASE, increasing for NO_ICE, decreasing for HI_ICE

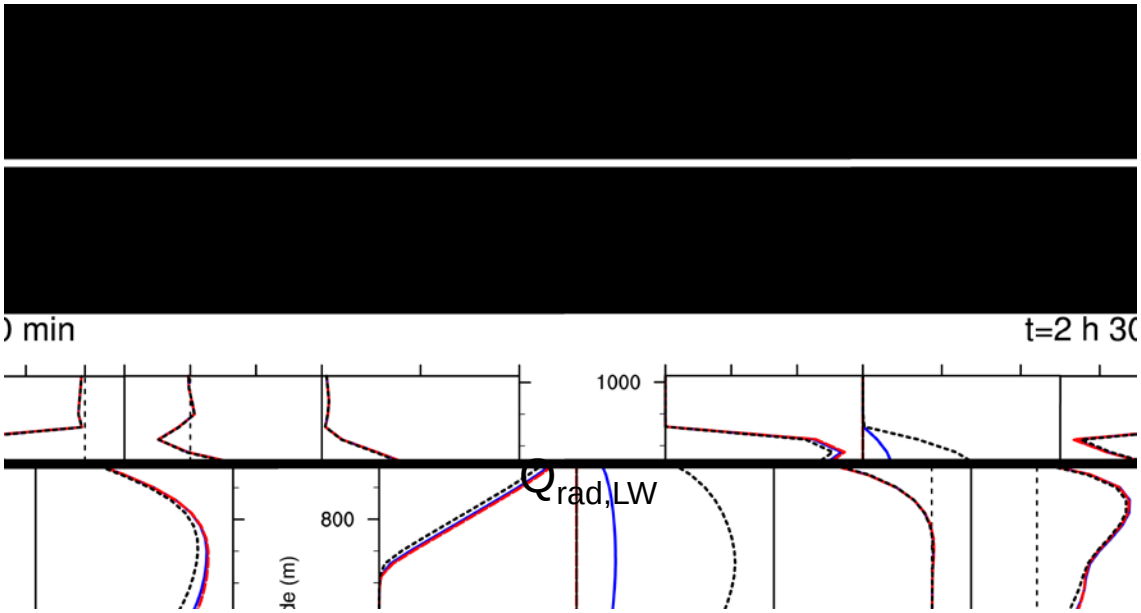




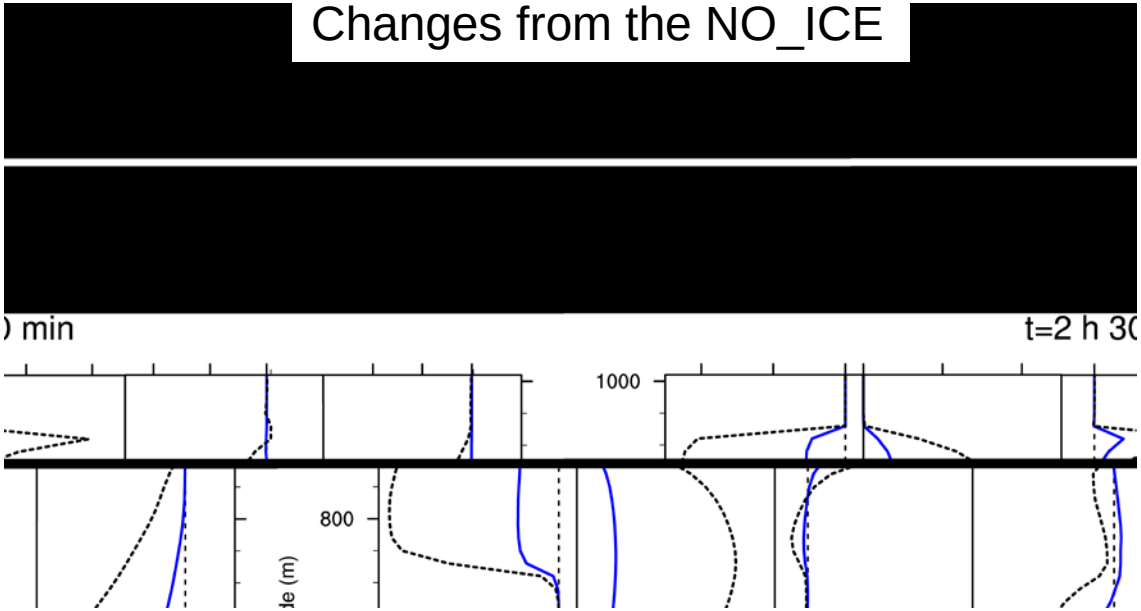
BASE: $N_i = 0.5\ L^{-1}$
NO_ICE: $N_i = 0\ L^{-1}$
HI_ICE: $N_i = 2\ L^{-1}$



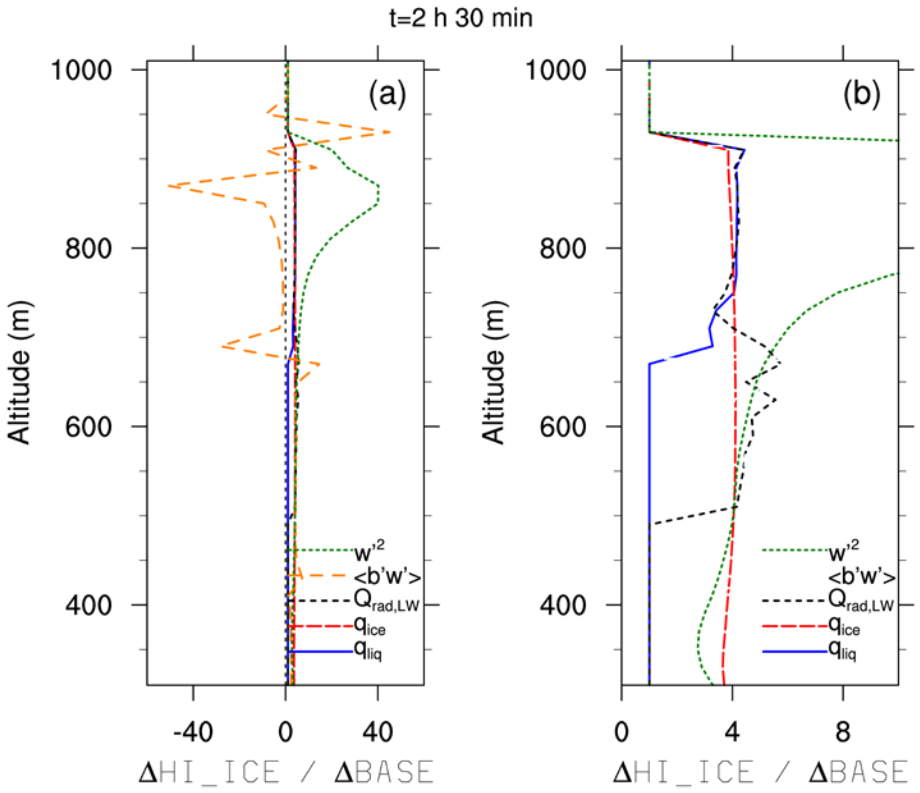
Changes in profiles 30 min after the appearance of first ice



Changes from the NO_ICE



Linear versus non-linear responses to changes in N_i



- Initial changes in LWC and Qrad are proportional to Ni
- Changes in buoyancy flux and vertical velocity variance are non-linear