

Solar radiative transfer in a 3D CSRSM simulation of a mock-Walker circulation

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Does using 3D, rather than ICA, solar radiative transfer affect a long simulation over tropical ocean?

1. Numerical Experiments

The model

Dynamical: SAM v6.5

Radiative transfer: solar - Monte Carlo
infrared - 2-stream

The configuration

Domain: 4096x128x28 km, $\Delta x = \Delta y = 1$ km

Lower BC: Sinusoidal SST

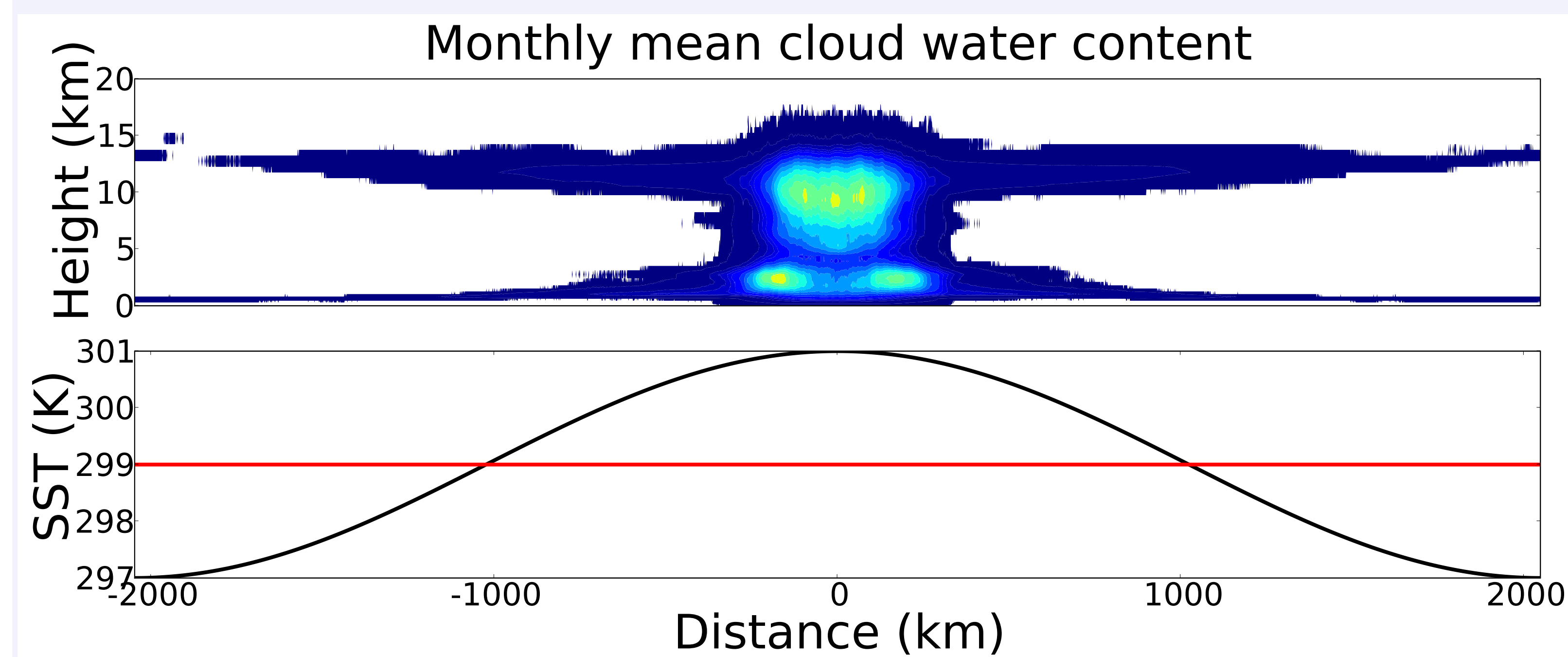
Integration: 60 days (last 30 days for analysis)
Started from spunup 2D run

Radiative transfer: Called every 5 minutes

The experiments

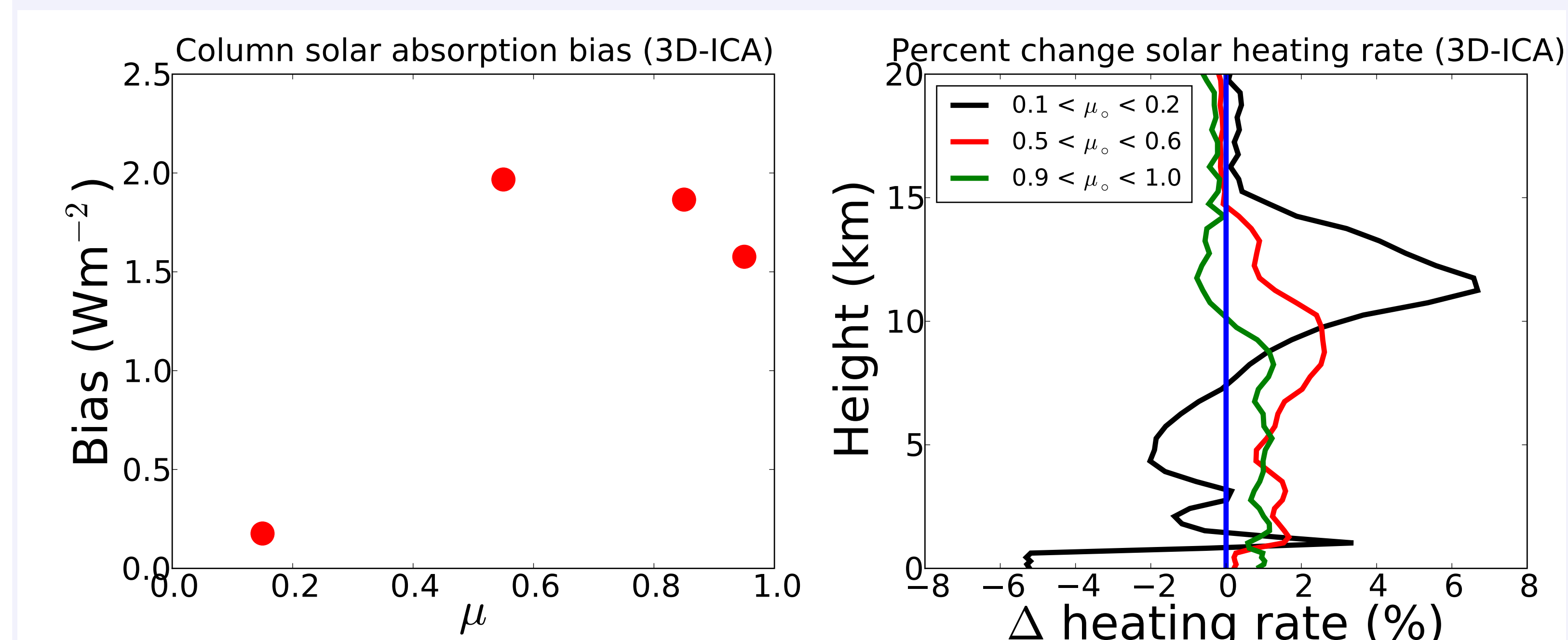
Control - ICA solar radiative transfer

Experiment - 3D solar radiative transfer



2. Offline solar flux biases

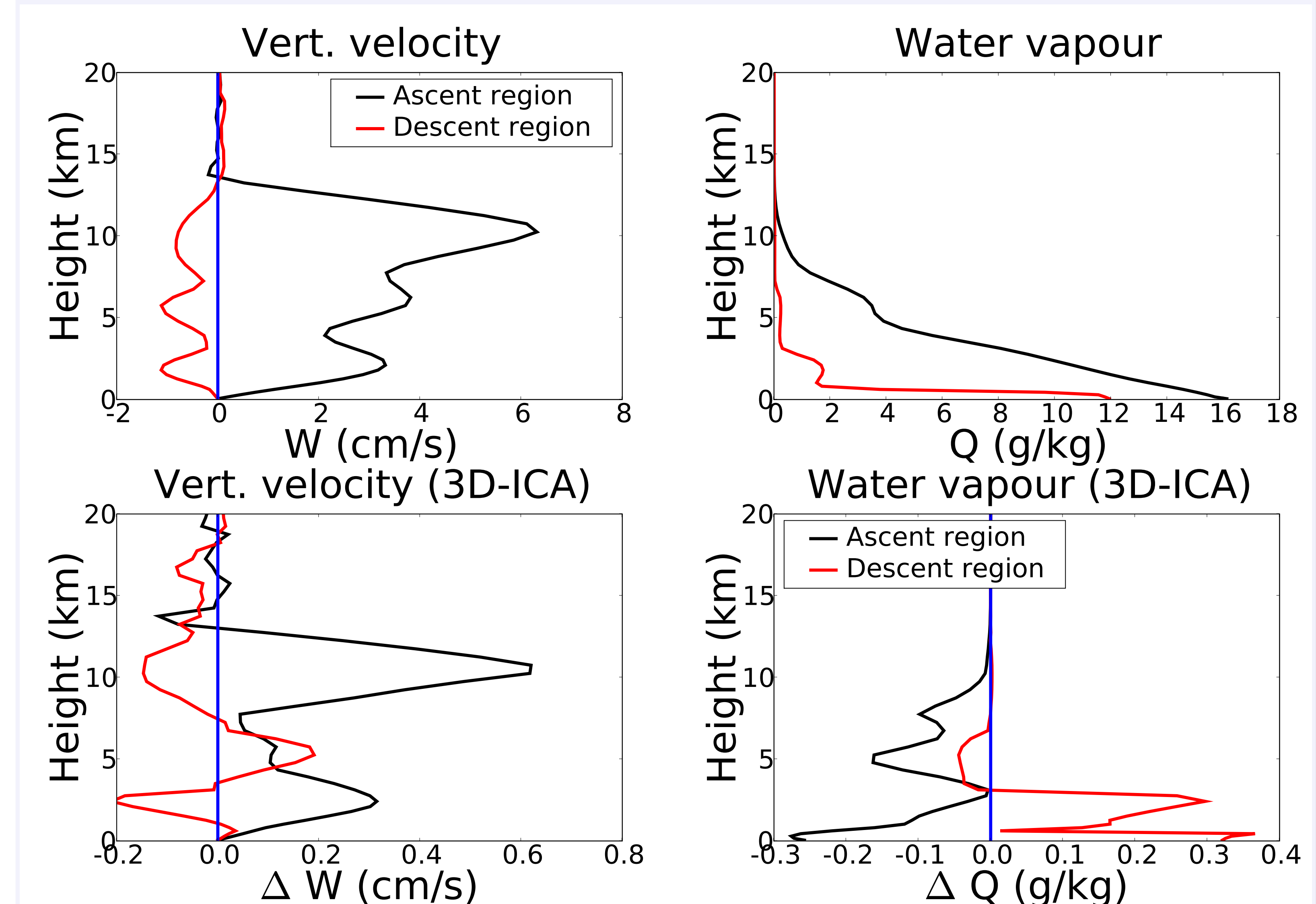
In the convective region more solar radiation is absorbed when using 3D solar radiative transfer.



3. Results

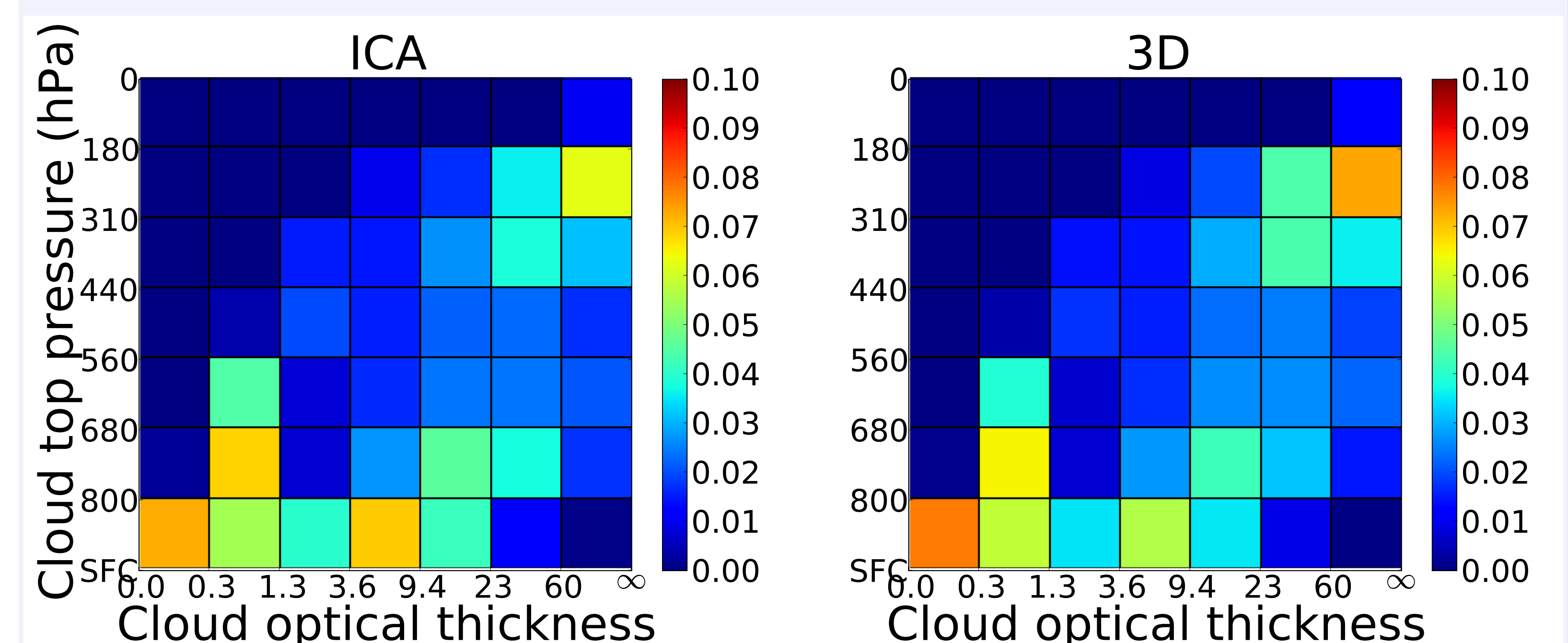
Mean vertical velocity and water vapour

Vertical velocity increases by $\sim 10\%$ when using 3D solar radiative transfer.



Cloud occurrence

Distribution of cloud tops and optical thickness similar between the two experiments.



4. Discussion

Using 3D instead of ICA solar radiative transfer has a relatively small impact (over the ocean).

Non-interactive surface may be mitigating effect; potentially larger effects over land.