Impact of 3D Radiation on Clouds
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The two radiation parametrizations TenStream & NCA, introduced in a companion poster, were implemented into UCLA LES.

A simple example – Heat Bubble
In order to study the effects of solar and thermal radiation on clouds, a heat bubble experiment is performed; the model is initially forced by a 0.96 K temperature perturbation and driven by no radiation, 1D radiation and 3D radiation. Solar and thermal effects are studied independently and combined. The spatial resolution is 50 m with a domain size of 64x64 grid boxes in the horizontal.

First test studies have been simulated with the TenStream solver and are shown in the following.

Complex Cloud Field
This simulation has a spatial resolution of 50 m with a domain size of 512x512 grid boxes. The simulation is started with 1D radiation. After a spin up time of 4h, the radiation scheme is switched from 1D ICA TwoStream to 3D TenStream.

Time series of liquid water and vertical velocity for the heat bubble simulation. Thermal radiation decreases the upward velocity as well as the liquid water mixing ratio. Solar radiation increases the upward velocity and the liquid water mixing ratio. The effects are much more dominant in the 3D radiation simulations compared to the 1D simulations. The combined solar and thermal 3D simulation partially cancels the individual 3D effects of the solar and thermal simulation.

References

http://www.meteo.lmu.de