This paper presents an evaluation of the simulated coupling between cloud base height (CBH) and surface fluxes. The data used for the study comprises 3-hourly surface observations from Cabauw, the Netherlands (51.97°N, 4.93°E), and simulations from five RCMs (CLM, GEMLAM, MRCC, RCA3 and RSM) for 3 years (2002 - 2004). The study validates the simulations with observations from the reference site and uses principal component analysis (PCA) and correlation coefficients to compare CBH coupling with surface variables in observed and model data.

The validation results show that in simulating seasonal and diurnal circles of CBH and surface variables over Cabauw, the European models (CLM and RCA3) demonstrate some home advantages over the North American models (GEMLAM, MRCC and RSM). CLM and RCA3 give credible simulations of most variables, however all models underestimate soil moisture.

Principal component analysis reveals three major processes that couple meteorological variables at Cabauw. A surface energy balance process couples CBH with surface fluxes; a thermodynamic process couples temperature with specific humidity; and a dynamic process couples surface pressure with wind speed. In agreement with observations, the RCMs (except GEMLAM) show a strong coupling between CBH and surface energy fluxes at Cabauw. The coupling is stronger in summer than in winter and stronger in daytime than nighttime. However, this study found that this coupling is not sensitive to changes in wind speed, possibly because the surface land cover is homogenous at the station and the synoptic forcing is not strong enough in summer to influence coupling significantly.