A Brief Introduction to the SimCloud Code (Version 1.0)

1 Introduction

The SimCloud is a simple cloud scheme that diagnoses cloud fraction based on relative humidity (RH) and specifies the in-cloud water mixing ratio and effective radius of the cloud condensate as function of temperature. It has been implemented and tested under Isca framework (Vallis et al., 2018) and can be ported to other climate models if needed.

2 Code Structure

The SimCloud codes are located at: `https://github.com/lqxyz/Isca/tree/simple_clouds`, which will be merged with the Isca master repository (`https://github.com/ExeClim/Isca`) in the future. Specifically, they are in `src/atmos_param/cloud_simple` directory and are called by the file `src/atmos_spectral/driver/solo/idealized_moist_phys.F90` (L992).

The major files in *src/atmos_param/cloud_simple* directory include:

- *cloud_simple.F90*

  The main module of the SimCloud scheme, which specifies the in-cloud water mixing ratio and effective radius of cloud condensate, and calls the following modules to diagnose cloud fraction.

- *large_scale_cloud.F90*

  The module that diagnoses large-scale clouds based on RH. In this module, several different schemes are provided, such as *linear* and *Sundqvist et al. (1989)* schemes, which can be set through *large_scale_cloud_nml* namelist by specifying the method name (*cf_diag_formula_name*).

- *marine_strat_cloud.F90*

  This module diagnoses the marine stratus clouds based on low-level cloud proxy *ELF* (estimated low-level cloud fraction) from Park and Shin (2019).

- *cloud_cover_diags.F90*

  This module diagnoses the 2D cloud cover based on different overlap assumptions, including *'maximum-random'*, *'maximum'* and *'random'*.

References

Park, S. and Shin, J.: Heuristic estimation of low-level cloud fraction over the globe based on a decoupling parameterization, Atmos. Chem. Phys., 19, 5635–5660, https://doi.org/10.5194/acp-19-5635-2019, 2019.

Sundqvist, H., Berge, E., and Kristjánsson, J. E.: Condensation and cloud parameterization studies with a mesoscale numerical weather prediction model,

Mon. Wea. Rev., 117, 1641–1657, https://doi.org/10.1175/1520-0493(1989)117<1641:cacpsw>2.0.co;2, 1989.

Vallis, G. K., Colyer, G., Geen, R., Gerber, E., Jucker, M., Maher, P., Paterson, A., Pietschnig, M., Penn, J., and Thomson, S. I.: Isca, v1.0: A framework for the global modelling of the atmospheres of Earth and other planets at varying levels of complexity, Geosci. Model Dev., 11, 843–859, https://doi.org/10.5194/gmd-11-843-2018, 2018.