Model Description

Scientist:

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Model Name and History:

- Long name: *Single column model (SCM) of the European Centre for Medium-range Weather Forecasts (ECMWF) - Cycle 30r1.*
- Acronym: *ECMWF_cy30r1*
- Short name: *ECMWF cy30r1*
- Generic predecessor or relative: -

Model Type: 1D

Numerical Domain:

- Domain size in x-direction: -
- Domain size in y-direction: -
- Domain size in z-direction: *from 1000 to .01 mbar*
- Number of grid points in x-direction: *1*
- Number of grid points in y-direction: *1*
- Number of grid points in z-direction: *91*
- Grid size in x-direction: -
- Grid size in y-direction: -
- Grid size in z-direction: *Varying with height (about 17 layers in lowest 2km)*
- Time step: *300s*

Numerical Technique:

- Numerical method (finite-difference, spectral, etc.):
- Advection scheme and its order of accuracy:
- Time scheme and its order of accuracy:
- Dynamical equations (elastic, anelastic, etc.):
- Numerical diffusion (type, order, magnitude of coefficient):
- Lateral boundary conditions:
- Upper boundary condition (Sponge layer, specification, ...):
- Translation velocity of the reference frame:

Physical Parameterizations:

- Surface flux parameterization for heat, moisture, momentum:
- Longwave radiation parameterization:
- Shortwave radiation parameterization:
- How were radiative fluxes above the computational domain handled?

- Cloud/convective (1D model) parameterization:

  Cloud fraction and total condensate: *These prognostic variables are modeled using the cloud scheme of Tiedtke (1993), in which many processes affecting these quantities are represented by separate sources and sinks. Within the PBL a statistical cloud scheme is used. The potentially skewed PDF is described using a beta-function structure, as defined by two independent shape parameters (Tompkins, 2002). In addition, the total specific humidity variance budget is parameterized, featuring flux-gradient production and dissipation.*

  Mixed phase fraction: *Only one prognostic variable for condensate water species is used. The distinction between the water and ice phase is a diagnostic function of temperature within a specified range.*

  Precipitation: *AsGP: For pure ice-clouds, two separate classes of ice-particles are modelled (smaller and larger than 100μm). Small ice particle content is modelled using the parameterization of McFarquhar and Heymsfield (1997), using a small terminal fall speed of 0.15 m/s. For the (variable) large ice particle fall speed the parameterization of Heymsfield and Donner (1990) is used. For precipitation in mixed-phase and pure water clouds, the Sundqvist (1978) scheme is used. Evaporation of precipitation follows the parameterization of Kessler (1969), below a threshold relative humidity.*

- Turbulence closure scheme:

  Turbulent transport: *Modeled using the Eddy Diffusivity Mass flux (EDMF) framework (Siebesma et al., submitted to JAS, 2006). In this scheme K-diffusion and advective mass flux transport are applied simultaneously.*

  Variables predicted and diagnosed by the turbulence closure: *turbulent fluxes of thermodynamics and momentum, the associated tendencies, profiles of multiple updrafts, turbulent variances, eddy-diffusivity coefficients.*

  Closure for eddy diffusivity coefficients: *A bulk profile method is used, featuring multiple independent modes with predefined vertical structures and depth ranges.*

  Closure for mixing across interfaces: *At mixed layer top the vertical mixing is explicitly modeled using entrainment-efficiency formulation, dependent on bulk Richardson number of the associated layer and inversion.*

Documentation:

IFS Documentation Cycle 28r1, Part IV: Physical processes. Available at *http://www.ecmwf.int/research/ifsdocs/*

Remarks on the supplied data:

The vertical profile data of quantities 7 and 8 (the rain and snow mixing ratios) is not available in our 1D model, because any precipitation is removed from the column immediately. Instead, these quantities are given as precipitation fluxes [mm/day].

I assumed the radiative fluxes in time-series group 2 (quantities 2-8) are by convention positive in the direction asked for.