

Exercises  
“Working with ICON”

Exercise 4

Problem 11

In this Problem, we introduce a new tracer `echam_ttr` into ICON. Since supplementary tracers are a non-standard case in ICON with echam physics, you have to activate some parts of the code. Go into `SRC/atm_phy_echam/mo_echam_phy_memory.f90`, activate the call of `add_echam_ttr_name` (this includes the activation of the `USE` statement!). Copy the new module `mo_echam_ttr.f90` containing `add_echam_ttr_name` into `SRC/atm_phy_echam/` from `mistral.dkrz.de:~m218036/icon_course_2018/mo_echam_ttr.f90`. Note that the name of the tracer `echam_ttr` as defined in the namelist `echam_ttr_nml` will be automatically supplemented by the prefix `q` and the suffix `_phy` (name for output!). In `SRC/run/exp.atm_amip_test`, increase `ntracer` to 4 and complete `transport_nml` (the new tracer has to be transported like water vapour, the first tracer). Configure, compile and run the program as a test.

Problem 12

Add a new physics process `<ttr>` to `SRC/configure_model/mo_echam_phy_config.f90`. Insert the `if`-clauses and the call of `omp_loop_cell_tc` into `SRC/atm_phy_echam/mo_echam_phy_main.f90`. The interface subroutine should be named `interface_echam_ttr`. Create a module `mo_interface_echam_ttr` containing the sole subroutine `interface_echam_ttr`, and call `add_emi_tracer` therein that calculates the tracer tendency from the emission flux in the lowest model level. The subroutine `add_emi_tracer` should be inserted into a new module `mo_echam_ttr.f90`. The tracer tendency is added to `tend%qtrc_phy(:, :, :, iqt)` if `is_in_sd_ed_interval = .TRUE.`. We cannot yet diagnose the tendency or calculate a purely diagnostic process.

You must introduce and define `add_emi_tracer` in `mo_echam_ttr.f90`. Use the template `mistral.dkrz.de:~m218036/icon_course_2018/mo_interface_echam_ttr.f90`.

**Hint:** Use the air mass field `mair` in  $\text{kg/m}^2$  to convert from a mass flux into a mass mixing ratio tendency. Perform a test simulation and look at your tracer.

Problem 13

Suggest, how a modification of the data structures `echam_phy_config` and `echam_phy_tc` could make the introduction of new physics processes potentially more user-friendly.