DDH for AROME

Tomislav Kovacic

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1 Introduction

The goal was to anable usage of DDH in AROME and particulary for fluxes from parameterizations of physical processes. This is a continuation of the work done a year earlier when a usage of MesoMH budget analysis was introduced in AROME. In AROME physical parameterizations from MesoNH are used. The greatest difference compared to parameterizations used in ALADIN, in respect of number and nature of fluxes and tendencies, appears in microphysics. In AROME subroutine CPTEND is not used and there is no need to bring physical fluxes out of APL_AROME through its arguments list. A new module YOMAPFT is introduced to bring physical fluxes calculated in APL_AROME in DDH subroutines. The module containes array APFT in which physical fluxes are saved in subroutine APL_AROME. The APFT is used in new subroutine ARO_CPPHDDH to put values of physical fluxes in DDH array PDHCV.

NOTE: There is a draft version of manual available.

2 Physical fluxes in AROME

In this section fluxes from physical parameterizations in AROME are listed sorted by equations in which they appear. In the list, for each flux it's DDH name and symbol in equation is given. Superscript in symbolic name of flux describes a physical process to which it belongs. Superscript starting with tur means turbulence, neg stays for correction of negative values, conv is for convection parameterization and ray is for radiation. The meaning of other superscripts can be found in table given in draft version of manual. In subscript is given a symbol of prognostic variables whichi ic changed by flux.

2.1 Momentum equations

FUUTUR	F_u^{tur}
FVVTUR	F_v^{tur}
FVWTUR	F_w^{tur}

2.2 Turbulence kinetic energy

FTETURB	F_{tke}^{tur}
FTEDYPRO	$F_{tke}^{tur-prod-dyn}$
FTETERMPRO	$F_{tke}^{tur-prod-term}$
FTEDISS	$F_{tke}^{tur-diss}$

2.3 Enthalpy

FCTNEGC1	F_h^{negc1}
FCTCDEPI	F_h^{cdepi}
FCTVCONV	F_h^{conv}
FCTVTURB	F_h^{tur}
FCTDISSTUR	$F_h^{tur-diss}$
FCTNEGC	F_h^{negc}
FCTHENUI	F_h^{henuv}
FCTHON	F_h^{honl}
FCTSFR	F_h^{sfr}
FCTDEPS	F_h^{deps}
FCTDEPG	F_h^{depg}
FCTREVA	F_h^{reva}
FCTRIM	F_h^{rim}
FCTACCS	F_h^{accs}
FCTCFRZ	F_h^{cfrz}
FCTWETG	F_h^{wetg}
FCTDRYG	F_h^{dryg}
FCTMLTG	F_h^{mltg}
FCTMLTI	F_h^{mlti}
FCTBERFI	F_h^{berfi}
FCTRAYSOL1	$F_h^{raysol1}$
FCTRAYTER1	$F_h^{rayter1}$

2.4 Water vapor

FQVNEGC1	$F_{q_v}^{negc1}$
FQVDEPI	$F_{q_v}^{depi}$
FQVVCONV	$F_{q_v}^{conv}$
FQVVTURB	$F_{q_v}^{tur}$
FQVNEGC	$F_{q_v}^{negc}$
FQVHENUI	$F_{q_v}^{henu}$
FQVDEPS	$F_{q_v}^{deps}$
FQVDEPG	$F_{q_v}^{depg}$
FQVREVA	$F_{q_v}^{reva}$

2.5 Cloud water

FQLNEGC1	$F_{q_l}^{negc1}$
FQLCDEPI	$F_{q_l}^{cdepi}$
FQLVCONV	$F_{q_l}^{conv}$
FQLVTURB	$F_{q_l}^{tur}$
FQLNEGC	$F_{q_l}^{negc}$
FQLHON	$F_{q_l}^{hon}$
FQLAUTO	$F_{q_l}^{autor}$
FQLACCR	$F_{q_l}^{accr}$
FQLRIMS	$F_{q_l}^{rim}$
FQLWETG	$F_{q_l}^{wetg}$
FQLDRYG	$F_{q_l}^{dryg}$
FQLMLTI	$F_{q_l}^{mlti}$
FQLBERFI	$F_{q_l}^{berfi}$

2.6 Rain

FQRNEGC	$F_{q_r}^{negc}$
FQRSEDI	F_{rp}
FQRSFR	$F_{q_r}^{sfrz}$
FQRAUTO	$F_{q_r}^{autor}$
FQRACCL	$F_{q_r}^{accr}$
FQRREVA	$F_{q_r}^{reva}$
FQRACCS	$F_{q_r}^{accs}$
FQRCFRZ	$F_{q_r}^{cfrz}$
FQRWETG	$F_{q_r}^{wetg}$
FQRDRYG	$F_{q_r}^{dryg}$
FQRMLTG	$F_{q_r}^{mltg}$

2.7 Cloud ice

FQINEGC1	$F_{q_i}^{negc1}$
FQICDEPI	$F_{q_i}^{cdepi}$
FQICONV	$F_{q_i}^{conv}$
FQITURB	$F_{q_i}^{tur}$
FQINEGC	$F_{q_i}^{negc}$
FQISEDI	F_{ip}
FQIHENU	$F_{q_i}^{henu}$
FQIHON	$F_{q_i}^{hon}$
FQIAGGS	$F_{q_i}^{agg}$
FQIAUTS	$F_{q_i}^{autoi}$
FQICFRZ	$F_{q_i}^{cfrz}$
FQIWETG	$F_{q_i}^{wetg}$
FQIDRYG	$F_{q_i}^{dryg}$
FQIMLT	$F_{q_i}^{mlti}$
FQIBERFI	$F_{q_i}^{berfi}$

2.8 Snow

FQSNEGC	$F_{q_s}^{negc}$
FQSSEDI	F_{sp}
FQSDEPS	$F_{q_s}^{dep}$
FQSAGGS	$F_{q_s}^{agg}$
FQSAUTS	$F_{q_s}^{autoi}$
FQSRIM	$F_{q_s}^{rim}$
FQSACC	$F_{q_s}^{accs}$
FQSCMEL	$F_{q_s}^{cmel}$
FQSWETG	$F_{q_s}^{wetg}$
FQSDRYG	$F_{q_s}^{dryg}$

2.9 Graupel

FQGNEGC	$F_{q_g}^{negc}$
FQGSEDI	F_{gp}
FQGSFR	$F_{q_g}^{sfr}$
FQGDEPG	$F_{q_g}^{dep}$
FQGRIM	$F_{q_g}^{rim}$
FQGACC	$F_{q_g}^{accs}$
FQGCMEL	$F_{q_g}^{cmel}$
FQGCFRZ	$F_{q_g}^{cfrz}$
FQGWETG	$F_{q_g}^{wetg}$
FQGDRYG	$F_{q_g}^{dryg}$
FQGMLT	$F_{q_g}^{mltg}$

3 Common Dynamics-Physics Interface (CDPI) fluxes

FQVPL1	P'_l
FQVPI1	P'_i
FQLPL2	P''_l
FQIPI2	P''_i
FQRPL3	P'''_l
FQSPI3	P'''_i
FQGPG3	P'''_g
FQRPR0	P_r
FQIPI0	P_i
FQSPS0	P_s
FQGPG0	P_g

4 Modificaions in program

Here, a list of modified subroutines and modules is given. For thotogh description of modifications see a draft version of manual.

4.1 Modified modules

YOMARPHY
YOMLDDH
YOMPHY

4.2 New modul

YOMPHFT

4.3 Modified subroutines

APL_AROME
AROEND_BUDGET
CPDYDDH
CPG_DIA
CPG
SU0PHY
SUPHMNH
SUNDDH
PPFIDH

4.4 New subroutines

ARO_CPPHDDH
ADDFT
ARO_INIPFT