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| **In FVCOM44\_source:** | | |
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| **New added(2)** | | |
| mod\_mld\_rho.F | | Added module MOD\_MLD\_RHO to calculate mixing layer depth based on density profile |
| mod\_tvd.F | | Added TVD advection scheme by Akvaplan-niva (Håvard Espenes and Ole Anders Nøst) in 2018 |
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| **Modified (69):** | | |
| adv\_s.F | a. Added the TVD scheme by Akvaplan-niva in 2018 (see mod\_tvd.F)  b. Improved the MPDATA method by Akvaplan-niva in 2018 | |
| adv\_t.F | a. For HEATING\_TYPE as ‘body’, fixed a bug of calculating RF(I,K):  added \*DZ(I,K) after DT(I)  b. Added a choice of HEATING\_TYPE as ‘surface’  c. Added the TVD scheme by Akvaplan-niva in 2018 (see mod\_tvd.F)  d. Improved the MPDATA method by Akvaplan-niva in 2018 | |
| bcond\_gcn.F | Added CALL UPDATE\_ICEIN for wave only with ice case | |
| bcond\_gcy.F | Added CALL UPDATE\_ICEIN for wave only with ice case | |
| brough.F | Added reading drag coefficient from the bottom roughness file | |
| cntrl\_prmtrs.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| enkf\_ncdio.F | Added NETCDF4 and compression facility | |
| fvcom.F | a. Uncommented and added the Eulerian velocity and Lagrangian velocity conversion (only for WAVE\_CURRENT\_INTERACTION):    !for Eulerian velocity output  U = U-U\_STOKES\_3D  V = V-V\_STOKES\_3D  UA=UA-U\_STOKES\_2D  VA=VA-V\_STOKES\_2D  CALL ARCHIVE  !Convert Eulerian velocity back to Lagrangian velocity to maintain consistent with Mellor's equation  U = U+U\_STOKES\_3D  V = V+V\_STOKES\_3D  UA=UA+U\_STOKES\_2D  VA=VA+V\_STOKES\_2D  b. Added the TVD scheme by Akvaplan-niva in 2018 (see mod\_tvd.F)  c. Added initialization of MPI\_COMM\_FVCOM and MPI\_IO\_GROUP  d. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| genmap.F | MPI\_COMM\_WORLD → MPI\_COMM\_FVCOM | |
| genmap\_lsf.F | a. Added code for MPI PIO  b. NPROCS → NPROCS\_TOTAL | |
| genmap\_obc.F | a. Added code for MPI PIO  b. NPROCS → NPROCS\_TOTAL | |
| grid\_metrics.F | ISONB(NEXT\_OBC(I)) = 3 → ISONB\_3(NEXT\_OBC(I)) = 3 for semi-implicit scheme | |
| ice\_albedo.F | Removed the comments that cause the warning in compilation | |
| ice\_init.F | Removed the comments that cause the warning in compilation | |
| ice\_itd.F | Removed the comments that cause the warning in compilation | |
| ice\_itd\_linear.F | Removed the comments that cause the warning in compilation | |
| ice\_mechred.F | Removed the comments that cause the warning in compilation | |
| ice\_therm\_itd.F | Removed the comments that cause the warning in compilation | |
| ice\_therm\_vertical.F | Removed the comments that cause the warning in compilation | |
| internal\_step.F | a. Uncommented the conversion from Lagrangian velocity to Eulerian velocity for tracer models  b. Added the semi-implicit scheme for dye module  c. Improved the SST assimilation or SSTGRD assimilation methods  d. Added the SST mixing layer depth assimilation mrthod | |
| make.inc | a. Added FLAG\_44 = -DTVD for TVD scheme  b. Added FLAG\_USE\_NETCDF4 = -DUSE\_NETCDF4 for version 4 of NETCDF output  c. Added FLAG\_USE\_COMPRESSION = -DUSE\_COMPRESSION for compression facility of NETCDF4 output  d. Added FLAG\_80 = -DPIO for parallel NetCDF output | |
| makefile | Added file mod\_tvd.F, mod\_mld\_rho.F in MODS | |
| mod\_action\_ex.F | Added wave only case with ice included | |
| mod\_action\_im.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_assim.F | a. Added EL(I)=EL(I)\*RAMP for SSHGRD assimilation  b. Added SST mld assimilation method  c. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_bio\_3D.F | Fixed bug: DT(I)/D(I) => DT(I)/DTFA(I) | |
| mod\_boundschk.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_clock.F | !Michael Dunphy (Michael.Dunphy@dfo-mpo.gc.ca)  !For longer simulations, the SECS/IT printout in the log gets a nonsense value  ! due to 32-bit int overflow; the patch changes the relevant ints to 64-bits  ! TYPE WATCH  ! INTEGER :: COUNT\_RATE,COUNT\_MAX  ! INTEGER :: COUNT\_0  ! INTEGER :: COUNT\_CURRENT, COUNT\_LAST  ! INTEGER :: Lap\_Count  ! END TYPE WATCH  TYPE WATCH  INTEGER(ITIME) :: COUNT\_RATE,COUNT\_MAX  INTEGER(ITIME) :: COUNT\_0  INTEGER(ITIME) :: COUNT\_CURRENT, COUNT\_LAST  INTEGER(ITIME) :: Lap\_Count  END TYPE WATCH  !Michael Dunphy | |
| mod\_dye.F | a. Added the TVD scheme by Akvaplan-niva in 2018 (see mod\_tvd.F)  b. Improved the MPDATA method by Akvaplan-niva in 2018  c. Fixed bugs in semi-implicit and MPDATA schemes | |
| mod\_enkfassim.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_enkf\_obs.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_etkf.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_force.F | a. Added name “SLP’ for variable of surface air pressure  b. Added code for wave onlt with ice included  c. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_ice2d.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_ice.F | Fixed bug: removed HEATING\_CALCULATED\_GL | |
| mod\_input.F | a. Added a choice for HEATING\_TYPE as ‘surface’  b. Added BR\_UDEF in BOTTOM\_ROUGHNESS\_TYPE  c. Added subroutine LOAD\_DRAG\_COEFFICIENT  d. Added file input of ice for wave only with ice affection  e. MPI\_COMM\_WORLD → MPI\_COMM\_FVCOM  f. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_lag.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_main.F | a. Added a node marker variable ISONB\_3 for semi-implicit scheme  b. Added MYID\_FGROUP, MYID\_IOGROUP, NPROCS\_IO, NPROCS\_FVCOM, NIO\_LIST, MPI\_COMM\_FVCOM, MPI\_IO\_GROUP, IO\_PROCESSOR, BR\_UDEF, ICEIN\_ON, ICEIN\_FILE, ICEIN\_KIND, CICE, CBC\_UD, CICE\_TEST | |
| mod\_meanflow.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_ncdio.F | a. Added new function GRID\_FILE\_OBJECT\_NCNEST to output h\_center, siglev\_center and siglay\_center only in nesting open boundary netcdf file  b. Added code for MPI PIO  c.  d. MPI\_COMM\_WORLD → MPI\_IO\_GROUP  e. Modified subroutines SETUP\_MPI\_IO\_MODE, MPI\_IO\_LOOP and MPI\_IO\_SYNCHRONIZE for MPI PIO | |
| mod\_nctools.F | a. Added NETCDF4 and compression facility  b. Added code for MPI PIO  c. MPI\_COMM\_WORLD → MPI\_IO\_GROUP  d. MPI\_COMM\_WORLD → MPI\_COMM\_FVCOM | |
| mod\_nesting.F | a. Added ‘CALL NULLIFY\_GRID\_POINTERS(GLOBAL\_NG)’ by Michael Dunphy ([Michael.Dunphy@dfo-mpo.gc.ca](mailto:Michael.Dunphy@dfo-mpo.gc.ca));  b. Added ‘\*RAMP’ for nesting variables;  c. Added NCF2 => GRID\_FILE\_OBJECT\_NCNEST(G) to output h\_center, siglev\_center and siglay\_center only here.  e. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_non\_hydro.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_obcs2.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_obcs.F | !Michael Dunphy (Michael.Dunphy@dfo-mpo.gc.ca)  ! TIME\_FLT = SECONDS( (TIME\_ELAPSED- (TIME\_16DAY-SpecTime-time\_adjust)) \* PI2/PERIOD(J))  TIME\_FLT = SECONDS((TIME\_ELAPSED-(TIME\_16DAY-SpecTime-time\_adjust)))\*PI2/PERIOD(J)  !Michael Dunphy  There are another three similar modifications. | |
| mod\_onedtide.F | !Michael Dunphy (Michael.Dunphy@dfo-mpo.gc.ca)  ! TIME\_FLT = SECONDS(TIME\_ELAPSED \* PI2/PERIOD(J))  TIME\_FLT = SECONDS(TIME\_ELAPSED) \* PI2/PERIOD(J)  !Michael Dunphy | |
| mod\_par.F | a. Added INTERFACE PDEAL\_IO, PCOLLECT\_IO  b. MPI\_COMM\_WORLD → MPI\_COMM\_FVCOM  c. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_par\_special.F | a. Added INTERFACE PDEAL\_IO, PCOLLECT\_IO  b. MPI\_COMM\_WORLD → MPI\_COMM\_FVCOM  c. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_petsc.F | a. MPI\_COMM\_SELF → PETSC\_COMM\_SELF  b. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_rrkassim.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_rrk.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_rrkf\_obs.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_semi\_implicit.F | a. Changed line IF(ISONB(I) < 2)THEN to IF(ISONB(I) /= 2 .AND. ISONB\_3(I) /= 3)THEN  b. Changed IF(ISONB(I)==3)THEN to IF(ISONB\_3(I)==3)THEN  c. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_set\_time.F | Fixed a bug ‘cycle’ → ‘cycles’ | |
| mod\_setup.F | a. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP  b. Add bottom roughness type selections | |
| mod\_sparse\_timeseries.F | a. Added NETCDF4 and compression facility  b. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_station\_timeseries.F | a. Fixed a mismatch vx → xm, vy → ym  b. Added NETCDF4 and compression facility | |
| mod\_time.F | !Michael Dunphy (Michael.Dunphy@dfo-mpo.gc.ca)  !A memory checker found this 10-byte write to an 8-byte string  ! D='1990-01-01'  D='19900101'  !Michael Dunphy | |
| mod\_types.F | Added subroutine NULLIFY\_GRID\_POINTERS(G) by Michael Dunphy (Michael.Dunphy@dfo-mpo.gc.ca) | |
| mod\_utils.F | a. Added MPI\_COMM\_FVCOM=MPI\_COMM\_WORLD and MPI\_IO\_GROUP=MPI\_COMM\_FVCOM  b. Replaced MPI\_FVCOM\_GROUP=MPI\_COMM\_WORLD with MPI\_FVCOM\_GROUP=MPI\_COMM\_FVCOM  c. MPI\_COMM\_WORLD → MPI\_MPI\_COMM\_FVCOM  d. MPI\_COMM\_WORLD → MPI\_IO\_GROUP | |
| mod\_wave\_current\_interaction.F | a. Changed KDMAX from 5.0 to 3.0 based on Mellor(2015)  b. Added the code to calculate Stokes drift when KD > KDMAX  c. Added the data exchange between processors for Stokes drift | |
| mod\_wavesetup.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| mod\_wqm.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| print\_vals.F | MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| setup\_domain.F | Added MPI\_IO\_GROUP in subroutine SETUP\_MPI\_IO\_MODE calling | |
| swanmain.F | a. Added wave only with ice part  b. MPI\_COMM\_WORLD → MPI\_FVCOM\_GROUP | |
| swanser.F | Changed the formula of significant wave height (Hsig) with the high frequency tail for Hsig | |
| vdif\_ts.F | Added code for HEATING\_TYPE as ‘surface’ and ‘body’ | |
| vdif\_ts\_gom.F | Added code for HEATING\_TYPE as ‘surface’ | |