**GLERL FVCOM v3.2 updates – 12/1/2017 (slightly updated from version sent in 2016)**

**COARE updates (required for LMHOFS)**

cntrl\_prmtrs.F

* Added HEATING\_CALCULATED\_GL to flag that initializes radiation coefficients (original code only read radiation coefficients from namelist file for HEATING\_CALCULATED)

mod\_heatflux\_gl

* Added initialization of radiation coefficients so they can be read from the *casename*\_run.nml file for HEATING\_CALCULATED\_GL

mod\_obcs.F

* add line to exchange Air Pressure (AEXCHANGE) for multiprocessor runs

**Heat flux output updates**

bcond\_gcn.F

* Added variables to track and output heat flux components “HSENS\_WATTS”, “HLAT\_WATTS”, “LWRAD\_WATTS”
  + Added to each heating option (e.g. HEATING\_CALCULATED, etc.)

bcond\_gcy.F

* Same changes as noted above in bcond\_gcn.F

mod\_force.F

* Added heat flux output variables to HEAT\_CALCULATED, HEAT\_CALCULATED\_GL, and HEATING\_SOLAR subroutines: “HEAT\_SENSIBLE, HEAT\_LATENT, HEAT\_RLN”

mod\_ice.F

* Added heat flux component variables for output

mod\_ncdio.F

* Add variables for heat flux components output (FSH\_P, FLH\_P, FLWUP\_P, FLW\_P, TSFC\_P) and then modify output to include in NetCDF file
* Allocated HSENS\_WATTS, HLAT\_WATTS, LWRAD\_WATTS

mod\_main.F

* Allocated variables for heat flux outputs (HSENS, HLAT, LWRAD)

mod\_solar.F

* Add variables for heat flux output from SOLAR (HS, HL, RLN)

ice\_flux.F

* initialize flwtot for net longwave radiation from ice output

ice\_coupling.F

* add flwtot for net longwave radiation from ice output

**Miscellaneous**

mod\_clock.F

* Make adjustment to screen-dump output formatting to avoid truncation

mod\_force.F

* Initialization problem for variables detected with Intel15.0.3. Variables initialized to avoid assignment of random values, which at times causes a “hanging” problem during model execution: tide\_elv\_p, river\_forcing, OBC\_T\_N, OBC\_S\_N, heat\_net\_p, heat\_net\_n, heat\_swv\_n, heat\_swv\_p, t\_air\_n, rh\_air\_n, pa\_air\_n, dlw\_air\_n, dsw\_air\_n, tdew\_n, ccov\_n, ice\_sat\_n, ice\_spq\_n, ice\_cld\_n, winds\_strx\_n, winds\_stry\_n,
* Added line to use “air\_temperature” variable in case “SAT” variable not found during ice model runs
* Added line to use “Q2” if “SPQ” is not found in ICE\_FILE

mod\_setup.F

* correct bug in gravity-latitude calculation

mod\_solar.F

* Fix bug in ALBEDO calculation in SOLAR (was being set to 0)

vdif\_ts.F

* In no-ice case, if net heat flux is cooling and SST is at freezing point, suppress further cooling (code change to WFTMP)

**Ice Model updates**

bcond\_gcn.F and bcond\_gcy.F

* Add “use ice\_state” for ice flux at open boundaries
* Add open boundary ice flux formation in “CASE (4)” based on Chen’s advice

make.inc

* Add a flag to define “FRESHWATER” for ice model code adjustments detailed below

ice\_constants.F

* If defined “FRESHWATER” then make ice\_ref\_salinity = 0.

ice\_coupling.F

* Added variable for net longwave upward heat flux (flwtot)

ice\_flux.F

* Added variables for heat flux outputs from the ice model (fsh, flh, flwup, flwtot)

ice\_init.F

* If defined “FRESHWATER” then set kstrength=0, based on Hibler’s parameterization

ice\_itd.F

* If defined “FRESHWATER” then set different ice thickness categories
* add i0vis and floediam for *casename*\_run.nml setting

ice\_mechred.F

* If defined “FRESHWATER” then adjust mu\_rdg for freshwater ice

ice\_therm\_itd.F

* If defined “FRESHWATER” then set minimum thickness for new frazil ice

ice\_therm\_vertical.F

* If defined “FRESHWATER” then max salinity at ice base set to zero
* If defined “FRESHWATER” then reduce iterations in temperature solver to 10
* If defined “FRESHWATER” then perform an isnan check
* Fix bug to avoid division by zero (in “compute qin and increment new energy”)
* If defined “FRESHWATER” then reduce fraction of penetrating solar radiation to 0.068 based on Parkinson & Washington 1979, JGR
* If defined “FRESHWATER” then add “if statement” to avoid zero division
* If defined “FRESHWATER” then perform isnan check during “compute new ice thickness”
* initialize i0vis and floediam for inclusion in *casename*\_run.nml instead of being hardcoded (necessary for freshwater / lake tuning)

makedepends (requirements for FRESHWATER)

* Remove ice\_ocean.o dependency line
* Remove ice\_ocean.o from mod\_ice.o dependency

makefile

* Remove ice\_ocean.F from MODS list

mod\_force.F

* If defined “FRESHWATER”, use SOLAR-derived shortwave radiation (or without SOLAR, use supplied short-wave data)

mod\_ice2d.F

* If defined “FRESHWATER” then make turning angle equal to zero
* If defined “FRESHWATER” then reduce iterations in ALLOC\_UVICE
* Adjust wind stress on ice calculation for freshwater
* Fix bug to eliminate (1) underestimation of control volume, overestimation of flux; (2) fix ice advection problem, before ice only advected to other ice cells
* add XFLUX\_ICE=XFLUX for ice open boundary fix, per Chen’s suggestion

mod\_ice.F

* If defined “FRESHWATER” then do not use ice\_ocean
* If defined “FRESHWATER” then when supercooling, T1 is set to Tf in subtroutine to\_coupler
* If defined “FRESHWATER” then short-wave radiation is used from SOLAR if solar is enabled, otherwise for non-solar heat algorithm shortwave radition comes from the supplied forcing data
* Modify to\_coupler so that net heat flux (wtsurf) comes from either COARE or SOLAR with ice model
* If defined “FRESHWATER” calculate shortwave radiative flux without the albedo adjustment, since this is already taken care of in SOLAR subroutine (or SOLAR-generated forcing files)
* Bug fix in calculation of WTSURF, to include emissivity, assume similar to ice surface
* Modify QPREC calculation to eliminate mass flux due to ice melting/freezing
* Comment out the check\_state and zap\_small\_areas calls (which removes categories with very small areas) as the mass loss is significant
* If defined “FRESHWATER”, surface ice temperature (Tsfcn) won’t go below T\_air – 10 degrees C

mod\_obcs.F

* for ice open-boundary fix, allocate UIARD\_OBCN and XFLUX\_ICE\_OBC, per Chen’s suggestion

ice\_state.F

* add xflux\_ice variable for open-boundary ice flux, per Chen’s suggestion