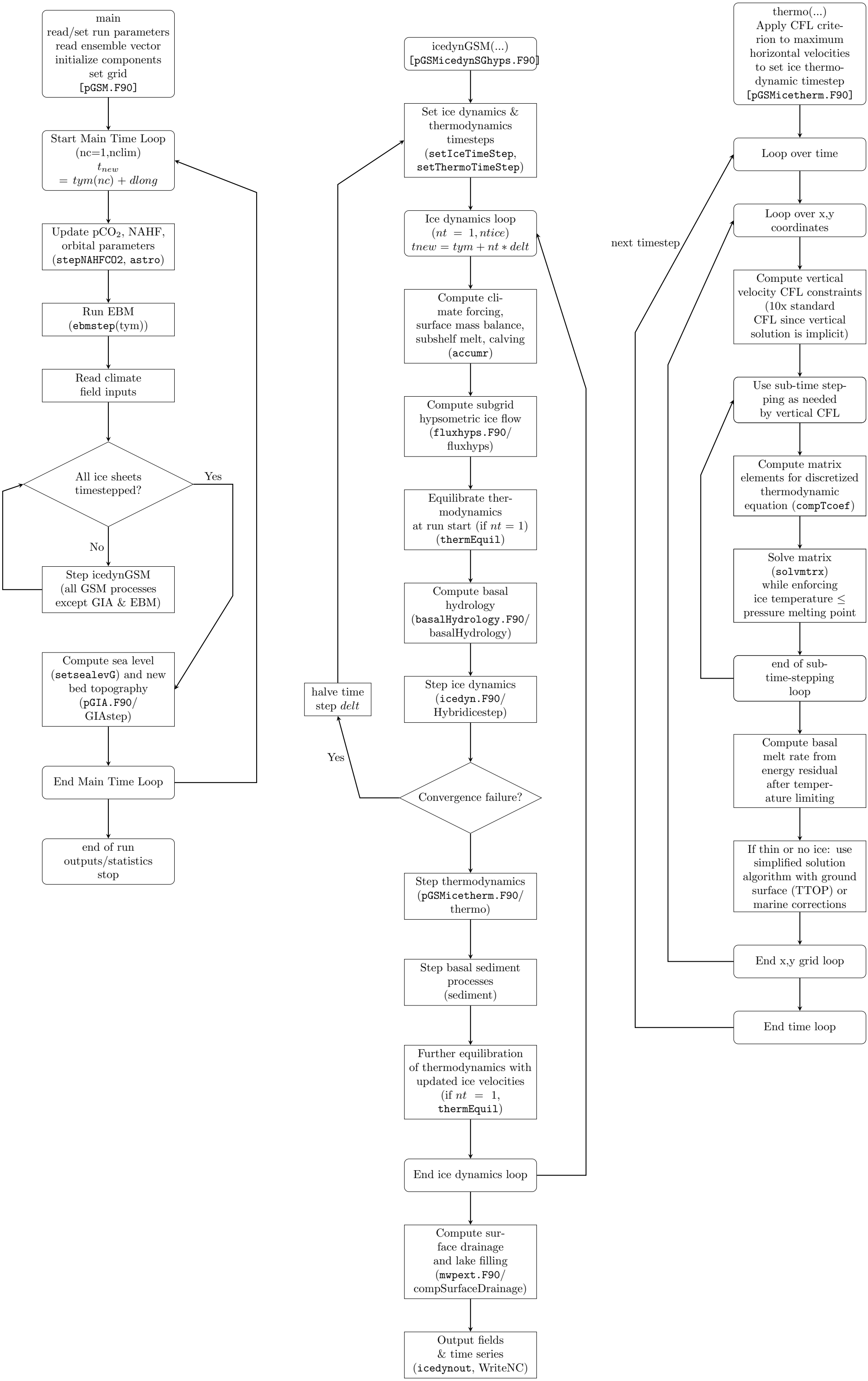
main
read/set run parameters
read ensemble vector
initialize components
set grid
[pGSM.F90]
Start Main Time Loop
(nc=1,nclim)
t_{new}
$= tym(nc) + dlong$
Update pCO$_2$, NAHF,
orbital parameters
(stepNAHFCO2, astro)
Run EBM
(ebmstep(tym))
Read climate
field inputs
All ice sheets
timestepped?
Yes
No
Step icedynGSM
(all GSM processes
except GIA & EBM)
Compute sea level
(setsealevG) and new
bed topography
(pGIA.F90/
GIAstep)
End Main Time Loop
end of run
outputs/statistics
stop
icedynGSM(...)
[pGSMicedynSGhyps.F90]
Set ice dynamics &
thermodynamics
timesteps
(setIceTimeStep,
setThermoTimeStep)
Ice dynamics loop
$(nt = 1, ntice)$
$tnew = tym + nt * delt$
Compute cli-
mate forcing,
surface mass balance,
subshelf melt, calving
(accumr)
Compute subgrid
hypsometric ice flow
(fluxhyps.F90/
fluxhyps)
Equilibrate ther-
modynamics
at run start (if $nt = 1$)
(thermEquil)
Compute basal
hydrology
(basalHydrology.F90/
basalHydrology)
Step ice dynamics
(icedyn.F90/
Hybridicestep)
halve time
step $delt$
Yes
Convergence failure?
Step thermodynamics
(pGSMicetherm.F90/
thermo)
Step basal sediment
processes
(sediment)
Further equilibration
of thermodynamics with
updated ice velocities
(if $nt = 1$,
thermEquil)
End ice dynamics loop
Compute sur-
face drainage
and lake filling
(mwpext.F90/
compSurfaceDrainage)
Output fields
& time series
(icedynout, WriteNC)
next timestep
thermo(...)
Apply CFL crite-
rion to maximum
horizontal velocities
to set ice thermo-
dynamic timestep
[pGSMicetherm.F90]
Loop over time
Loop over x,y
coordinates
Compute vertical
velocity CFL constraints
(10x standard
CFL since vertical
solution is implicit)
Use sub-time step-
ping as needed
by vertical CFL
Compute matrix
elements for discretized
thermodynamic
equation (compTcoef)
Solve matrix
(solvmtrx)
while enforcing
ice temperature ≤
pressure melting point
end of sub-
time-stepping
loop
Compute basal
melt rate from
energy residual
after temper-
ature limiting
If thin or no ice: use
simplified solution
algorithm with ground
surface (TTOP) or
marine corrections
End x,y grid loop
End time loop