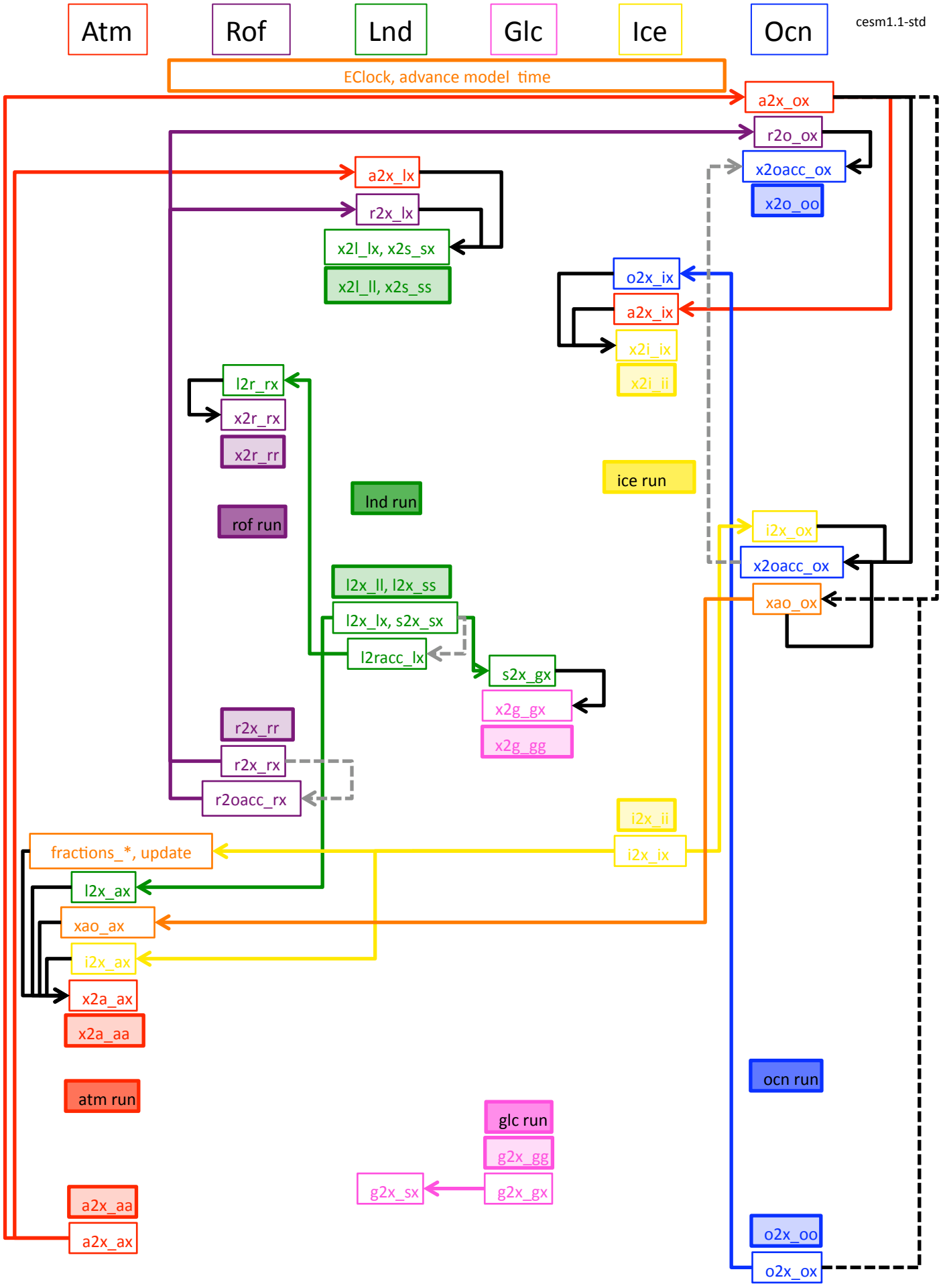
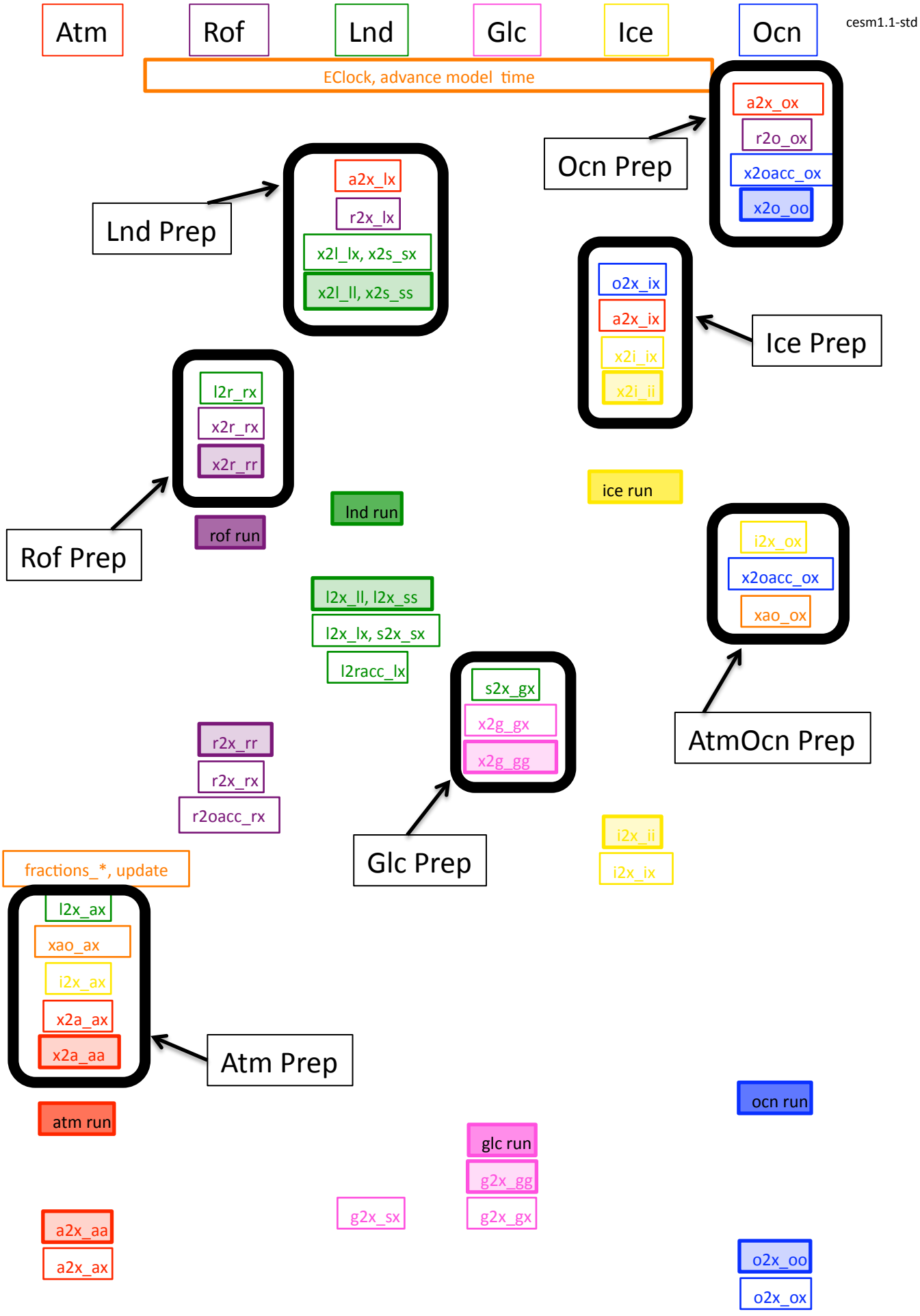
CESM1.1 Coupler Flow Diagram
Standard Default Configuration

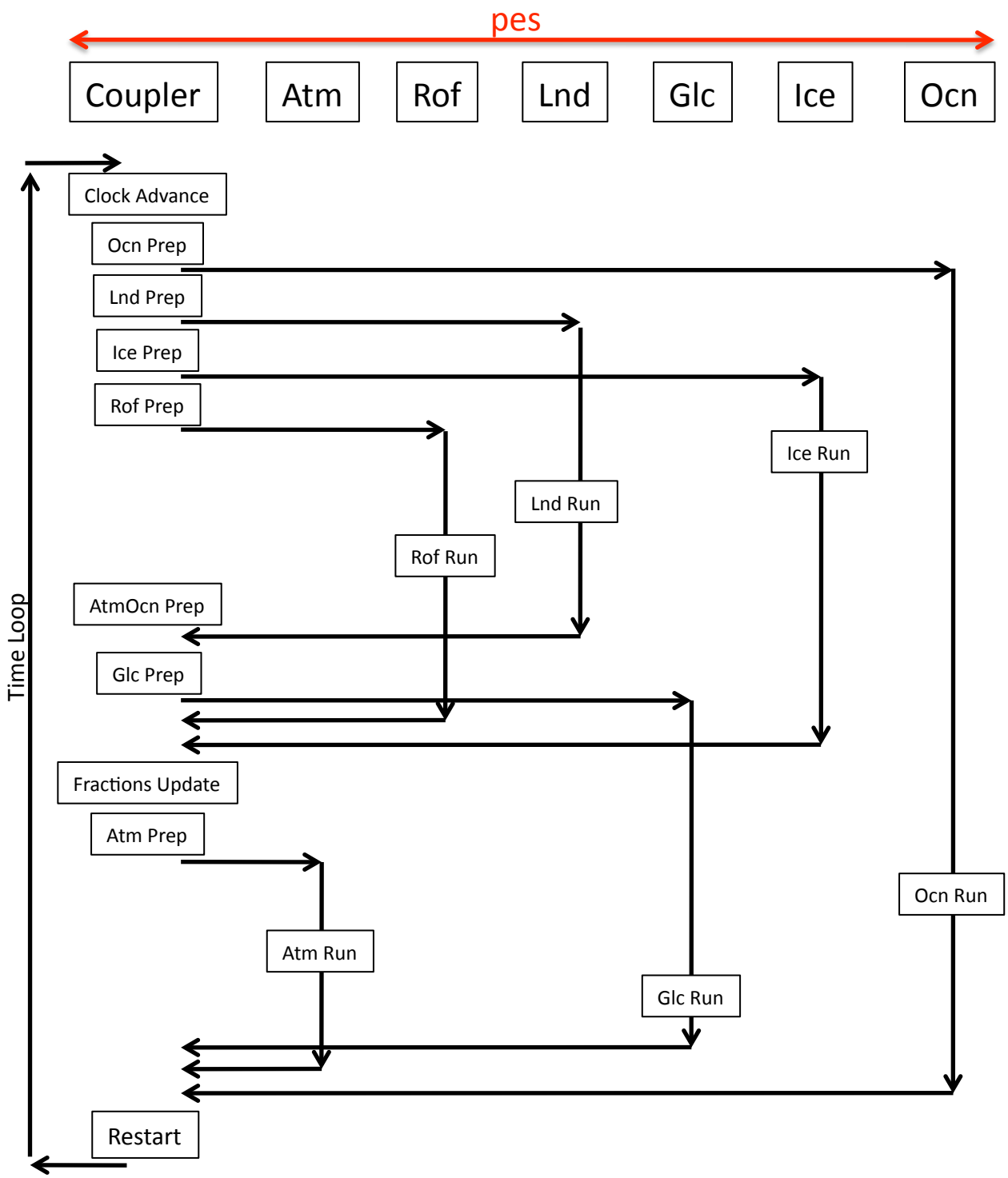
- The diagram represents the flow of data in the driver/coupler in a coupler timestep from top to bottom. (Note that because of the ability to couple the runoff and ocean models a lower frequencies, not every action is necessarily taken every coupler timestep)
- Boxes represent coupler data. Each colored box is associated with data from or for a particular component
  - atm = red
  - runoff = purple
  - land = green
  - glc (land ice) = pink
  - sea ice = yellow
  - ocean = blue
  - coupler = orange (coupler data is data that cannot be readily directly associated with just a single component model)
- Each column is associated with data on a component's grid. The time evolution of coupling data for a particular component can be traced by moving down a column. The columns do NOT represent work done on different processors.
- All operations are run on the coupler processors except
  - the darker shaded boxes are the component run methods and they run on the processors assigned to each component.
  - the lighter shaded boxes represent movement of coupling data from the coupler processors to the component processors (or vice versa). the light shaded boxes are the points where the coupler processors and component processors synchronize in time. At those points, the receiver is blocking and the sender is non-blocking.
- Arrows indicate coupler operations
  - Colored Solid arrows are associated with mapping data from one grid to another (colored arrows are always associated with the same data in two columns)
  - Black Solid arrows are associated with merging data
  - Black Dashed arrows are associated with coupler flux computations
  - Grey Dashed arrows are assoicated with coupler averaging
  - Arrows that are pointed up are indicative of data used from the previous timestep and will need to be saved to the coupler restart file.
- Data Naming convention follows CESM (ie. i2x_ox)
  - x, a,l,s,r,g,o,i mean coupler, atm, lnd, sno, rof, glc, ocn, and ice respectively
  - the first part of the naming convention (ie. x2i) indicates the coupling data
    - x2* is input data to component *. (ie. x2a is coupler to atm data)
    - *2x is output data from component *. (ie. o2x is ocean to coupler data)
  - the second part of the naming convention (ie. _lx) indicates the grid and processors associate with the data respectively. _lx means data on the land grid on the coupler processors. _ll means land data on the land processors. All unshaded boxes will have second character x because they are all on the coupler processors. Data passed between the coupler and component take the naming convention of the component model.


Atm
Rof
Lnd
Glc
Ice
Ocn
cesm1.1-std
EClock, advance model time
a2x_ox
r2o_ox
x2oacc_ox
x2o_oo
a2x_lx
r2x_lx
x2l_lx, x2s_sx
x2l_ll, x2s_ss
o2x_ix
a2x_ix
x2i_ix
x2i_ii
l2r_rx
x2r_rx
x2r_rr
ice run
lnd run
rof run
i2x_ox
x2oacc_ox
xao_ox
l2x_ll, l2x_ss
l2x_lx, s2x_sx
l2racc_lx
s2x_gx
x2g_gx
x2g_gg
r2x_rr
r2x_rx
r2oacc_rx
i2x_ii
i2x_ix
fractions_*, update
l2x_ax
xao_ax
i2x_ax
x2a_ax
x2a_aa
ocn run
atm run
glc run
g2x_gg
g2x_sx
g2x_gx
a2x_aa
a2x_ax
o2x_oo
o2x_ox


Atm
Rof
Lnd
Glc
Ice
Ocn
cesm1.1-std
EClock, advance model time
a2x_ox
r2o_ox
x2oacc_ox
x2o_oo
Ocn Prep
Lnd Prep
a2x_lx
r2x_lx
x2l_lx, x2s_sx
x2l_ll, x2s_ss
o2x_ix
a2x_ix
x2i_ix
x2i_ii
Ice Prep
l2r_rx
x2r_rx
x2r_rr
Rof Prep
rof run
lnd run
ice run
i2x_ox
x2oacc_ox
xao_ox
l2x_ll, l2x_ss
l2x_lx, s2x_sx
l2racc_lx
s2x_gx
x2g_gx
x2g_gg
AtmOcn Prep
r2x_rr
r2x_rx
r2oacc_rx
Glc Prep
i2x_ii
i2x_ix
fractions_*, update
l2x_ax
xao_ax
i2x_ax
x2a_ax
x2a_aa
Atm Prep
atm run
ocn run
glc run
g2x_gg
g2x_sx
g2x_gx
a2x_aa
a2x_ax
o2x_oo
o2x_ox

CESM1.1 Concurrency Sequencing
Standard Configuration

- Plot of concurrency sequencing in CESM1.1 for standard default setup. Down is time, horizontal is processor layout.
- Horizontal Lines are Coupler-Component Communication.
- Vertical Lines Indicate when a component can run if concurrent.



CESM1.1 Coupler Flow Diagram
Tight Ocean Coupling Configuration

- With the tight ocean coupling option, the ocean run returns before the atmocn prep step instead of the end of the time loop.
- The diagram represents the flow of data in the driver/coupler in a coupler timestep from top to bottom. (Note that because of the ability to couple the runoff and ocean models a lower frequencies, not every action is necessarily taken every coupler timestep)
- Boxes represent coupler data. Each colored box is associated with data from or for a particular component
  - atm = red
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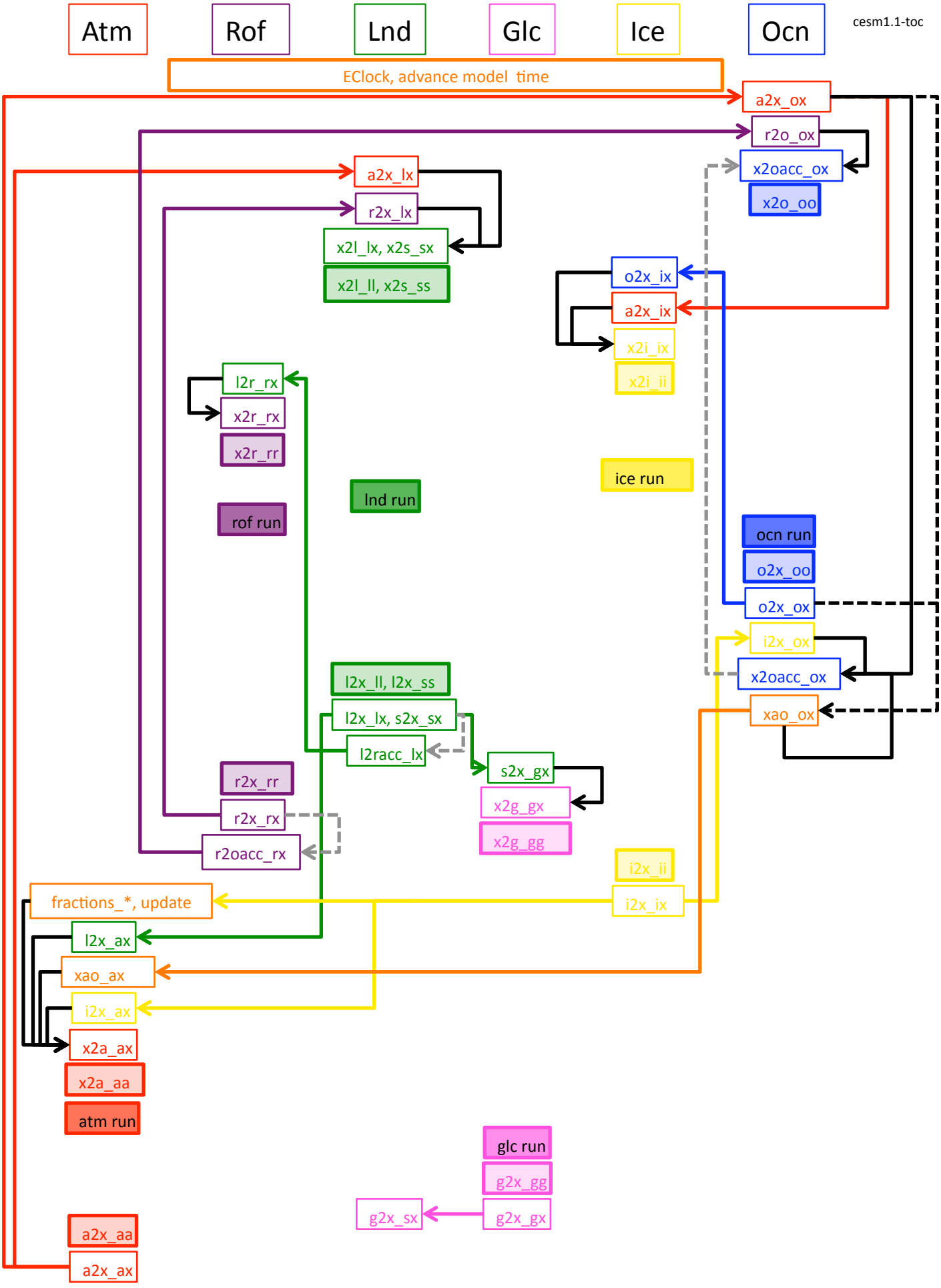
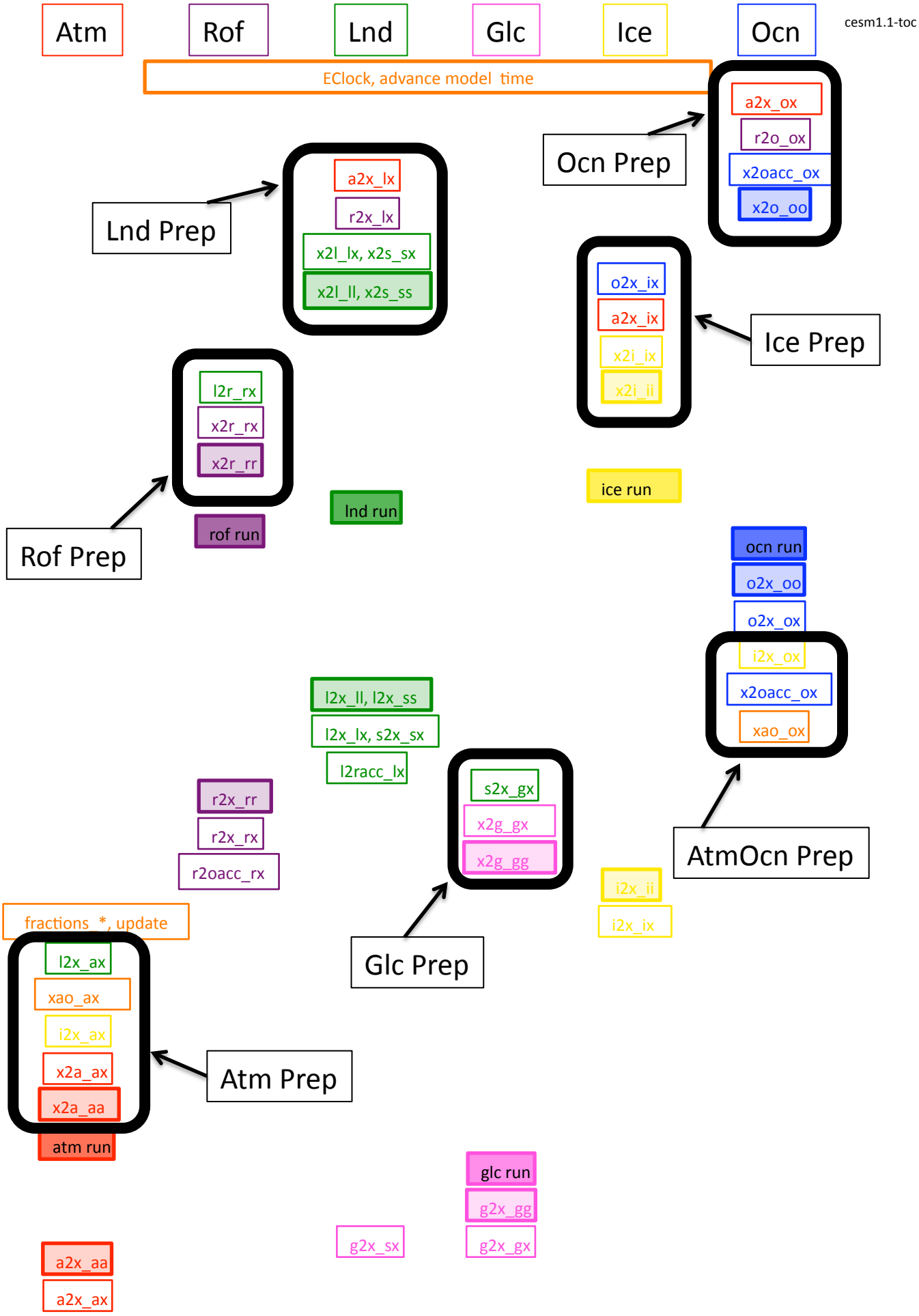
  - Black Dashed arrows are associated with coupler flux computations
  - Grey Dashed arrows are assoicated with coupler averaging
  - Arrows that are pointed up are indicative of data used from the previous timestep and will need to be saved to the coupler restart file.
- Data Naming convention follows CESM (ie. i2x_ox)
  - x, a,l,s,r,g,o,i mean coupler, atm, lnd, sno, rof, glc, ocn, and ice respectively
  - the first part of the naming convention (ie. x2i) indicates the coupling data
    - x2* is input data to component *. (ie. x2a is coupler to atm data)
    - *2x is output data from component *. (ie. o2x is ocean to coupler data)
  - the second part of the naming convention (ie. _lx) indicates the grid and processors associate with the data respectively. _lx means data on the land grid on the coupler processors. _ll means land data on the land processors. All unshaded boxes will have second character x because they are all on the coupler processors. Data passed between the coupler and component take the naming convention of the component model.


Atm
Rof
Lnd
Glc
Ice
Ocn
cesm1.1-toc
EClock, advance model time
a2x_ox
r2o_ox
x2oacc_ox
x2o_oo
a2x_lx
r2x_lx
x2l_lx, x2s_sx
x2l_ll, x2s_ss
o2x_ix
a2x_ix
x2i_ix
x2i_ii
l2r_rx
x2r_rx
x2r_rr
ice run
lnd run
rof run
ocn run
o2x_oo
o2x_ox
i2x_ox
x2oacc_ox
xao_ox
l2x_ll, l2x_ss
l2x_lx, s2x_sx
l2racc_lx
s2x_gx
x2g_gx
x2g_gg
r2x_rr
r2x_rx
r2oacc_rx
i2x_ii
i2x_ix
fractions_*, update
l2x_ax
xao_ax
i2x_ax
x2a_ax
x2a_aa
atm run
glc run
g2x_gg
g2x_sx
g2x_gx
a2x_aa
a2x_ax


Atm
Rof
Lnd
Glc
Ice
Ocn
cesm1.1-toc
EClock, advance model time
Ocn Prep
a2x_ox
r2o_ox
x2oacc_ox
x2o_oo
Lnd Prep
a2x_lx
r2x_lx
x2l_lx, x2s_sx
x2l_ll, x2s_ss
o2x_ix
a2x_ix
x2i_ix
x2i_ii
Ice Prep
l2r_rx
x2r_rx
x2r_rr
rof run
Rof Prep
lnd run
ice run
ocn run
o2x_oo
o2x_ox
i2x_ox
x2oacc_ox
xao_ox
l2x_ll, l2x_ss
l2x_lx, s2x_sx
l2racc_lx
r2x_rr
r2x_rx
r2oacc_rx
s2x_gx
x2g_gx
x2g_gg
AtmOcn Prep
i2x_ii
i2x_ix
fractions_*, update
l2x_ax
xao_ax
i2x_ax
x2a_ax
x2a_aa
atm run
Glc Prep
Atm Prep
glc run
g2x_gg
g2x_sx
g2x_gx
a2x_aa
a2x_ax

CESM1.1 Concurrency Sequencing
Tight Ocean Coupling Option

- Plot of concurrency sequencing in CESM1.1 for tight ocean coupling configuration. Down is time, horizontal is processor layout. The only difference from the standard configuration is that the ocean run returns before the atmocn prep step instead of the end of the time loop.
- Horizontal Lines are Coupler-Component Communication.
- Vertical Lines Indicate when a component can run if concurrent.