D. Temporal Coordination of the Fluxes

Two time scales will be resolved by nested loops in the coupler. The outer loop advances all models one day per iteration. The ocean model, which will not resolve the diurnal cycle, will be invoked only once per iteration of the outer loop. Thus this model will use one fixed set of input fluxes to advance one day each time it is invoked. For the atmosphere, land and sea–ice models, which will resolve the diurnal cycle, there is an inner loop which invokes/advances these models several times per outer loop iteration. Each iteration of the inner loop will advance the atmosphere, land and sea–ice models one atmospheric time step (*e.g.,* 20 min for the T42 CCM3 or 30 min for the R15 CCM3). Thus these models will use one fixed set of input fluxes to advance in the inner loop each time they are invoked.

The number of internal atmosphere model steps that correspond to one day is *ndaya*, and will dictate the number of iterations in the driver's inner loop. When invoked, the atmosphere model will advance for one atmosphere model step, after which it will provide the coupler with an updated model state $\vec{W}_A$ (see section C. *V*), along with the fluxes it computes internally.

The number of internal land model steps that correspond to one day is *ndayl*. When invoked, the land model will advance *ndayl*/*ndaya* steps (this must be an integer quantity), after which it will provide the coupler with an updated model state $\vec{W}_B$, along with the inner loop time average of the fluxes it computes internally (see section C. *VIII*).

The number of internal ice model steps that correspond to one day is *ndayi*. When invoked, the ice model will advance *ndayi*/*ndaya* steps, (this must be an integer quantity) after which it will provide the coupler with an updated model state $\vec{W}_C$, along with the inner loop time average of the fluxes it computes internally (see section C. *VII*).

The number of internal ocean model steps that correspond to one day is *ndayo*. When invoked, the ocean model will advance *ndayo* steps, after which it will provide the coupler with an updated model state $\vec{W}_H$, along with the daily average of the fluxes it computes internally (see section C. *VI*).

Input flux means fluxes given by the coupler to a model. Output flux means fluxes computed within a model and given to the coupler. All input fluxes for one model were either computed by the coupler or were the output flux of another model. In general, a given flux field between any two component models may have been computed in one of three places: within either of the two models or within the coupler.

One function of the coupler is to gather, merge, sum, and/or time-average various flux fields from various sources and form a complete set of input fluxes for each component model. This gathering and merging process will generally involve mapping flux fields between various model grids and combining like fields from several grids onto one grid. A summation might be required, *e.g.*, net heat flux = solar + latent + sensible + longwave (see encircled crosses in Fig. 1). Also, for some flux fields the coupler might be required to form time-averaged quantities. Thus component fluxes are mapped, merged, summed, and/or time-averaged by the coupler in order to form complete input fluxes for the models. Component fluxes that are gathered, merged, summed, and/or time–averaged to form the complete input fluxes:

	(Section C)
o $Faid$ = atm/ice flux, computed by the drv	(F_1d)
o $Faia$ = atm/ice flux, computed by the atm model (an atm output flux)	(F_1a)
o $Fald$ = atm/lnd flux, computed by the drv	(F_2d)
o $Fala$ = atm/lnd flux, computed by the atm model (an atm output flux)	(F_2a)
o $Fall$ = atm/lnd flux, computed by the lnd model (an lnd output flux)	(F_2l)
o $Faod$ = atm/ocn flux, computed by the drv	(F_3d)
o $Faoa$ = atm/ocn flux, computed by the atm model (an atm output flux)	(F_3a)
o $Fiod$ = ice/ocn flux, computed by the drv	(F_4d)
o $Fioo$ = ice/ocn flux, computed by the ocn model (an ocn output flux)	(F_4o)
o $Fioi$ = ice/ocn flux, computed by the ice model (an ice output flux)	(F_4l)
o $Flol$ = lnd/ocn flux, computed by the lnd model (an lnd output flux)	(F_5l)

Examples:	(Section C)
o $Faid$: momentum flux between the atm and ice	$(\vec{\tau}_1)$
o $Faia$: net shortwave radiation between the atm and ice	(S_1)
o $Fald$: momentum flux between the atm and lnd	$(\vec{\tau}_2)$
o $Fala$: net shortwave radiation between the atm and lnd	(S_2)
o $Faod$: momentum flux between the atm and ocn	$(\vec{\tau}_3)$
o $Faoa$: net shortwave radiation between the atm and ocn	(S_3)
o $Fiod$: momentum flux between the ocn and ice	$(\vec{\tau}_4)$
o $Fioi$: net shortwave radiation between the ocn and ice	(S_4)
o $Fioo$: ice formed within the ocn	(Q_H)
o $Flol$: ocean runoff formed within the lnd	(F_S)

Complete input fluxes (an overbar denotes a daily average):

- o $Faxx$ = all atm model input fluxes: a mapping/merging/summation of: $Faod$, $Faid$, $Fald$, $Fall$
- o $Flxx$ = all lnd model input fluxes: a mapping/merging/summation of: $Fald$, $Fala$
- o $Foxx$ = all ocn model input fluxes: a mapping/merging/summation/time-averaging of: $\overline{Faod}$, $\overline{Faoa}$, $\overline{Fioi}$, $\overline{Fiod}$, $\overline{Flol}$
- o $Fixx$ = all ice model input fluxes: a mapping/merging/summation/time-averaging of: $Faid$, $Faia$, $\overline{Fioo}$, $Fiod$

These time-average fluxes will need to be formed:

- o $\overline{Faid}$ = atm/ice fluxes, computed by the driver, time averaged by the driver
- o $\overline{Faia}$ = atm/ice fluxes, computed by the atm model, time averaged by the driver
- o $\overline{Faoa}$ = atm/ocn fluxes, computed by the atm model, time averaged by the driver
- o $\overline{Faod}$ = atm/ocn fluxes, computed by the driver, time averaged by the driver
- o $\overline{Fioo}$ = ice/ocn fluxes, computed by the ocn model, time averaged by the ocn
- o $\overline{Fioi}$ = ice/ocn fluxes, computed by the ice model, time averaged by the ice