### C variable coverage and budget closure

The large number of C cycle variables covered by ForC, and the general consistency between them, provide confidence that our overall reported means provide accurate and useful baselines for analysis (with the caveats that they are unlikely to be accurate representations of C cycling for any particular forest, and that these sample means almost certainly do not represent true biome means). Our findings are largely consistent with, but built from a far larger dataset than, those of Pregitzer and Euskirchen (2004 <http://dx.doi.org/10.1111/j.1365-2486.2004.00866.x>), who found that NPP and NEP to be higher in intermediate-aged forests than older forests, and emphasize the importance of forest age at the biome scale. Quickly-changing and age-dependent fluxes were also found in a number of previous syntheses (Amiro et al. 2010 10.1029/2010JG001390, Magnani et al. 2007 10.1038/nature05847).

KAT: Have you looked at above/belowground C allocation questions? I was thinking of comparing to Reich et al. (10.1073/pnas.1216053111).

There are of course notable holes in the ForC variable coverage, as discussed by Anderson-Teixeira et al. (xxxx), that limit the scope of our inferences here. Notably, ForC lacks coverage of fluxes to herbivores and higher consumers, along with the woody mortality and dead wood stocks. Geographically, all variables are poorly covered in Africa and Siberia, a common problem in the carbon-cycle community (Xu and Shang 2016 10.1016/j.jplph.2016.08.007, Schimel et al. 2015 10.1073/pnas.1407302112). ForC does not include soil carbon, which is covered by other efforts (e.g. Köchy et al. 2015 10.5194/soil-1-351-2015). ForC is not intended to replace databases that are specialized for particular parts of the C cycle analyses, e.g. land-atmosphere fluxes (Baldocchi et al. 2001 10.1175/1520-0477(2001)082<2415:FANTTS>2.3.CO;2), soil respiration (Jian et al. 2020 10.5194/essd-2020-136), or the human footprint in global forests (Magnani et al. 2007 10.1038/nature05847).

In this analysis, the C cycle budgets for mature forests (Figs. 2-5) generally “close”–that is, the sums of component variables do not differ from the larger fluxes by more than one standard deviation. On the one hand, this reflects the general fact that ecosystem-scale measurements tend to close the C budget more easily and consistently than, for example, for energy balance (Stoy et al. 2013 10.1016/j.agrformet.2012.11.004). On the other, however, as noted above ForC derives data from multiple heterogeneous sources, often with large errors (standard deviations); as a result, the standard for C closure is relatively loose (cf Houghton 2020 10.1111/gcb.15050). Nonetheless, the lack of closure, in the few instances where it occurs, is probably more reflective of differences in the representation of forest types (e.g., disproportionate representation of US Pacific NW for aboveground woody biomass relative to AGB; Fig. 4) than of methodological accuracy.

The overall high degree of closure implies that ForC gives a consistent picture of C cycling within biomes. This is an important and useful test, because it allows for consistency checks within the C cycle, for example leveraging separate and independently-measured fluxes to constrain errors in another (Phillips et al. 2017 10.1007/s11104-016-3084-x, Williams et al. 2014 10.1016/j.rse.2013.10.034, Harmon et al. 2011 10.1029/2010JG001495), or producing internally consistent global data products (Wang et al. 2018 10.5194/gmd-11-3903-2018).

Orphan text:

In terms of C stocks, there is a paucity of data on dead wood and organic layer (Pan et al. ?). These can be significant. (**Note that we’ve given a lot of emphasis to dead wood (work by Abby, and also Jenny), and as a result this work really advances knowledge of dead wood. We’ll want to highlight that here.**) *(give some stats/ cite figures)*.