Figure 10. The call path flow of a tuned 240-PE benchmark with HDF5 1.8.20/netCDF-4. It is classified into 3 layers i.e. netCDF, MPI-IO and system I/O functions. The maximum PE time together with the total number of PEs from the invoker are labelled above each path line and the maximum PE time on each function are labelled within the node block.
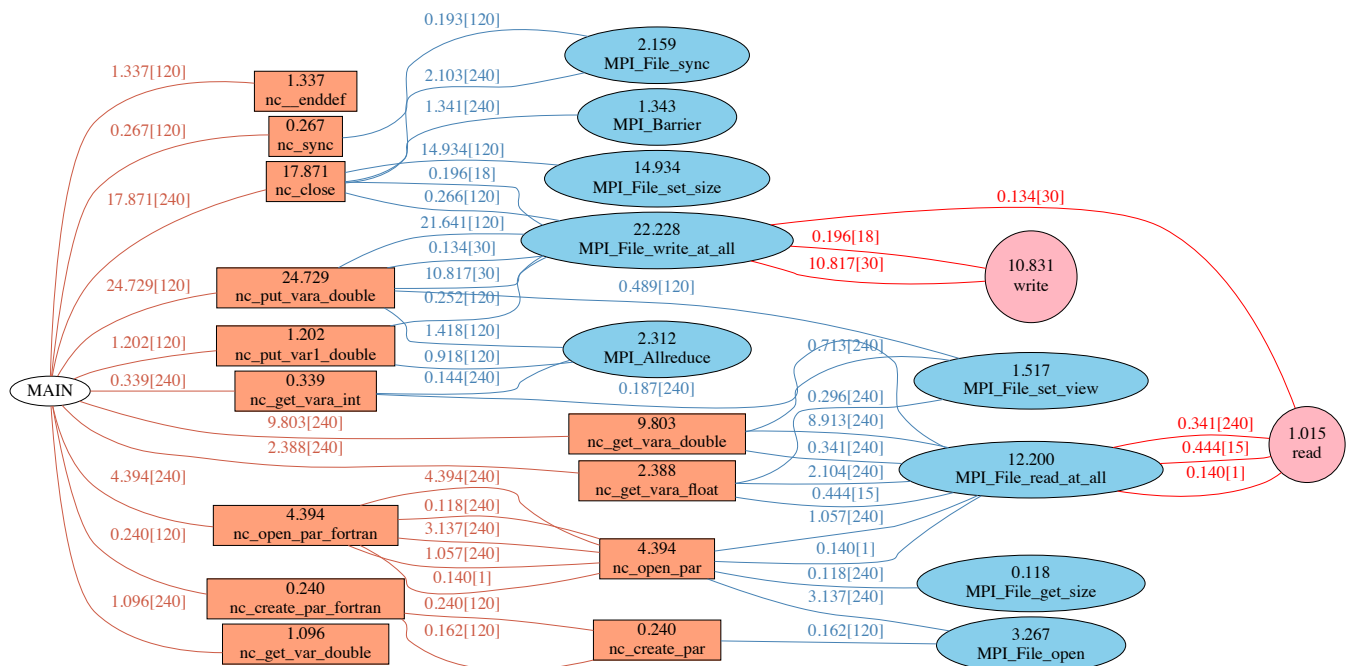

Figure 11. The call path flow of tuned 240-PE benchmark with HDF5 1.10.2/netCDF-4. It is classified into 3 layers i.e. netCDF, MPI-IO and system I/O functions. The maximum PE time together with the total number of PEs from the invoker are labelled above each path line and the maximum PE time on each function are labelled within the node block.

Figure 12. The callpath flow of tuned 240-PE benchmark with PnetCDF. It is classified into 3 layers i.e. netCDF, MPI-IO and system I/O functions. The maximum PE time together with the total number of PEs from the invoker are labelled above each path line and the maximum PE time on each function are labelled within the node block.
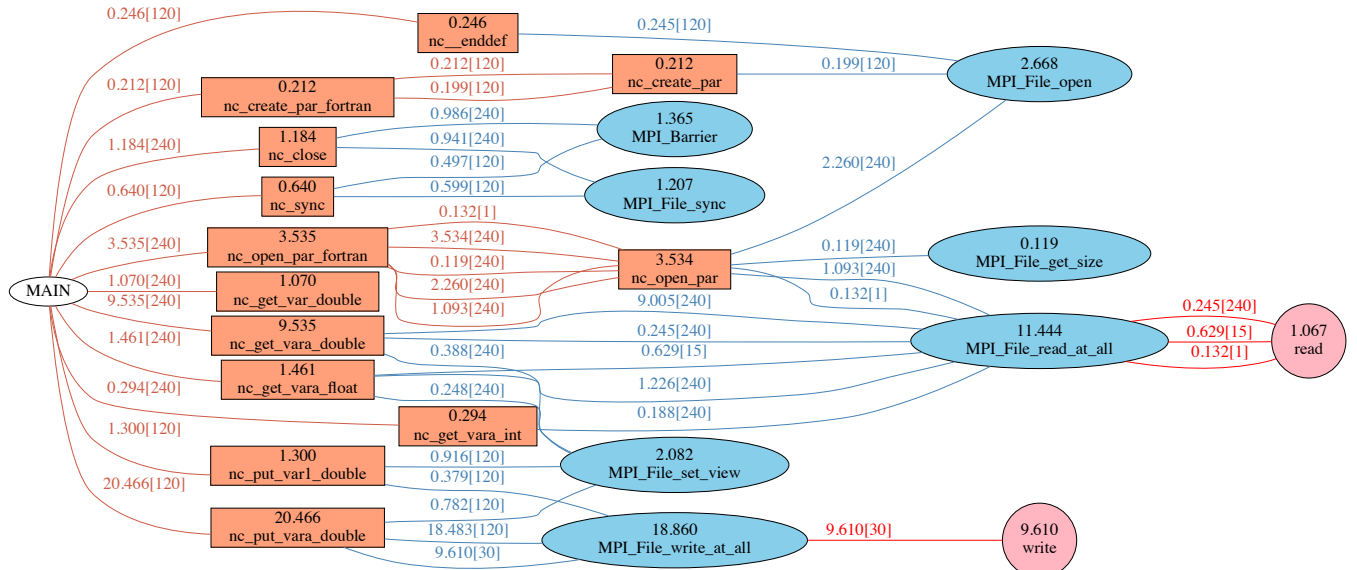
Table 6. The time metrics of 0.1° model in 720-PE and 1440-PE runs with less I/O frequencies, i.e. write per 1 day and 4 days in 8-day simulations. SIO represents the original single threaded write; PIO represents parallel shared write. The I/O time composes of contributions from `mpp_open`, `mpp_read`, `mpp_write` **and** `mpp_close`**. The I/O time ratio is given between the I/O time and total runtime. All values are taken from the maximum walltime among all PEs.**

I/O pattern&Format		SIO in netCDF4_classic		PIO in netCDF-4		PIO in netCDF-3	
I/O frequency		1-day	4-day	1-day	4-day	1-day	4-day
720 PEs	Total runtime (sec.)	8114	7817	7685	7569	7666	7469
	I/O time / `mpp_write` (sec.)	494/453	302/265	75/40	62/27	57/17	49/11
	I/O ratio	6.09%	3.87%	0.98%	0.82%	0.74%	0.66%
1440 PEs	Total runtime (sec.)	4118	3743	3547	3578	3518	3549
	I/O time / `mpp_write` (sec.)	452/421	269/238	59/24	48/14	51/14	40/7
	I/O time ratio	10.98%	7.18%	1.67%	1.35%	1.45%	1.14%