Simplify E3SM Ocean File Generation

I'd like to discuss how we could simplify the current, disjoint process of making SCRIP, domain, mapping, runoff, graph, sea ice mesh etc. etc. to actually get an E3SM run started.

Our current how-to page is here: Making mapping, runoff, domain files and adding grids to ACME

We will be creating a substantial number of new meshes in the coming months: Southern Ocean refined, Arctic refined, coastal refined, and more. E3SM file generation is a substantial impediment to testing and running new meshes.

Goals:

1. Fast
2. Easy
3. Expert knowledge not required
4. Available to any E3SM/COSIM member
5. No hidden processes
6. As automated as possible

Here are the current files and processes:

file	current process	issues	potential improvements
1. MPAS global mesh generation	COMPASS: Changing over global mesh generation to Jigsaw: https://github.com/MPAS-Dev/MPAS-Model/pull/59		
2.Cull land cells	COMPASS + c++ executables: MpasMeshConverter, MpasCellCuller, MpasMaskCreator	need to point to several repos: MpasTools, geometric features. Need to compile Mpas mesh tools with c++ API netcdf 4.2	need to be able to manually add/subtract land cells after the first pass using the bathymetric data (Mathew Maltrud).
3.MPAS ocean initial condition	COMPASS / MPAS-Ocean executable: init mode	Note: need to better document and label: 1. number of layers (60, 80, 100) 2. choice of bathymetry Need to think about method of producing bathymetry.	Note: make sure meshDensity is actually variable for variable resolution mesh. I (Mark Petersen) need to make this intrinsic in process. Currently here: inject_meshDensity.py
4.MPAS ocean spin-up	COMPASS / MPAS-Ocean executable: forward mode	spin up - is often resolution dependent, requires trial and error for high-res. Then rename restart file, remove xtime	
5.MPAS mesh (sea ice)	COMPASS - straight from step 2 above	Then rename restart file, remove xtime	
transects and region files	Uses MpasMaskCreator and input geojson files. Right now we repeat this process by hand to create MOC mask files and transect files.	groups of regions and groups of transects are not tested	Creation of transect and region files could easily be automated with COMPASS, with the mapping files.
6. graph files: ocean	gpmetis by hand	Need to choose likely set of partitions needed by E3SM	could add to COMPASS: small med large collections,
7. graph files: sea ice	gpmetis partition is inefficient. Adrian has newer process.	Currently, need to ask Adrian for these files.	
8. SCRIP file	python $(MPAS-Tools)/mesh_tools/create_SCRIP_files/create_SCRIP_file_from_MPAS_mesh.py -m mpasmesh.nc -s scripfile.SCRIP	This is great! With ice shelves, need to add a mask for open ocean.	Add this to COMPASS after step 2 (cull cells). Make every time.

9. mapping files	Fortran compiled ESMF_RegridWeightGen, now in CIME. e.g. previously, we always used E3SM/cime/tools/mapping/gen_mapping_files/gen_ESMF_mapping_file/ E3SM unified 1.2.0 has this as an executable. On IC: module use /usr/projects/climate/SHARED_CLIMATE/modulefiles/all module unload python openmpi module load e3sm-unified/1.2.0 ./ESMF_RegridWeightGen --source sourcegrid.SCRIP --destination destgrid.SCRIP --weight weight-c.nc --method conserve create_ESMF_map.sh -fsrc mpas_LR_30km_12172013.nc -nsrc MLR30K -fdst /glade/p/cesmdata/cseg/mapping/grids/T62_040121.nc -ndst T62 -map aave	conservative maps for B cases must be done with tempest. With ice shelves, needs to work with MPI (Mathew Maltrud)	Add to compass, optionally, after cell culling. For G case, tempest not needed. T62_040121.nc Add to compass for B case: ne30*.nc for low res ne120*.nc for high res ne4 ne11
9.tempest	Fortran with dependancies, must be compiled, input deck must be adjusted depending on atmospheric resolution. Input: ocean and atmosphere scrip files.	Must be recompiled on each machine. Currently on IC.	load tempest on LANL IC: module load gcc/4.8.2 module load netcdf/4.4.0 module load acml/5.3.1 module load tempest/1.0 Note: Jon's version of tempest isn't the latest so we might want to build a newer version. Also, we may want to use a different NetCDF version if the 4.4.0 module clashes with other needs.
10. domain file	Fortran compiled E3SM/cime/tools/mapping/gen_domain_files e.g. ./gen_domain -m map_MLR30K_TO_T62_aave.131217.nc -l T62 -o MLR30K	Must be made from the conservative remap.	Could be easily automated once conservative mapping files are made.
11. runoff file	This tool doesn't work, can't read Mosart files: E3SM/cime/tools/mapping/gen_mapping_files/runoff_to_ocn Newer better fixed version of runoff_to_ocn is used by Jon.	Talk to Jon. For ice shelf cavities,	
12. runoff smoothing	Smoothing is done by Fortran executable. Must choose filter radius and e-folding scale. Mat and Adrian have the Fortran code.	Can take a long time and a lot of memory - lightshow for 25 hours.	
13. runoff file alterations for ice shelf cavities	Python tool by Darin and Matthew Hoffman Darin Comeau for post-process: removed runoff below ice shelves. Matt's python script. Note steps are needed before this script can be run, indicated in python script comments.	A separate shell script is available on IC (Jon Wolfe & Darin Comeau have this) to read the runoff from the coupler, to visually verify correct runoff.	
14. Salinity restoring file	For a G case. ** add instructions here **		