WP 3 Break Out Discussion

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PRIMAVERA

Interactions with Streams 1 and 2

- WP3A: Clouds and aerosols: feeds into stream 1 and possibly stream 2; cloud microphysics only for frontier runs (WP4)
- WP3B: Land surface: interaction with stream 1 is only through metrics, will feed stream 2.
- WP3C: Sea-Ice: feeds streams 1 and 2.
- WP3D: Ocean mixing: feeds only stream 2.

Following discussions with WP6 (see three last slides here, but not discussed now):

- WP3 needs to undertake tests in coupled mode before passing to WP6 for Stream 2.
- Stream 2 might need to be re-thought, doing fewer runs with benefits directly from WP3, and including some targeted process runs.

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WP3a Science: Clouds and Aerosols

- HiResMIP protocol: models spin up own Pre-Industrial (PI) climatology for aerosols then apply radiative forcing anomalies from Easyaerosol (EA) prescribed aerosols (anthropogenic, from Hamburg, plus stratospheric aerosols (from volcanoes) from a Swiss model).
- Need to clarify how each group will specify the indirect effect of the aerosols (interactions with the clouds) in stream 1 and whether they will make changes for stream 2. This may or may not require new runs in stream 2.
- Frontier runs: cloud microphysics will only feed into the frontier runs at 5km resolution (UM and ECMWF). Are the microphysics suitable for these scales and will convective parameterisation be disabled (for both deep and shallow convection).
- Frontier runs: have the groups developed suitable ABL exchange coefficients suitable for 5km runs, and will they use a local or non-local scheme?

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WP3a Technical: Clouds and Aerosols

- Readiness of the groups for stream 1: EA aerosols should be ready in UM, EC-Earth, CMCC, ECHAM-MPIOM, and ECHAM-FESOM. CERFACS will not implement EA because of structural incompatibilities.
- Issue: need further discussion of whether CERFACS will then be part of HiResMIP (and may have different stratospheric aerosols).
- What is the strategy for tuning the aerosols eg use AMIP runs only, and need to specify an acceptable range of TOA for all groups.

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WP3b Science: Land Surface

- Need to document what's in each land surface scheme (vegetation and soil types, albedo, complexity of physics) and river catchment scheme.
- Modifications to the above should be provided to stream 2 (attempt to get similarity between different landscape and river network schemes).
- Need to develop a 20km resolution version of the river networks.
- Need to know the relation of the land surface type to orography, as vegetation extent is affected by height, to ensure consistency between groups.
- Need to know about surface roughness as will affect turbulent exchanges with the ABL.

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WP3b Technical: Land Surface

- Discharge from rivers (WP1 metric): need to check integrated rainfall into basin catchment equals what comes out of rivers. Stream 2 should have common catchments. Need to talk to WP1 about this.
- Observational discharges exist but may not be up to date – need to find out their status. WP2 interaction – they should provide this.
- Turbulent flux observations only exist (in large numbers) from the 1990's so we need to find out what to use before that. WP2 interaction – they should provide this.
- Need to use the metrics from WP1 (re: land-atmosphere coupling strength; soil moisture, river discharge) and check we are able to use them in all models (eg. on different grids).

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WP3c Science: Sea-Ice

- All groups will use either CICE (Met O and CMCC) or LIM3 sea-ice models (except for ECMWF: LIM2 in NEMO 3.4 for stream 1, but LIM3 and NEMO 3.6 for stream 2)
- All groups use melt ponds (re: Daniela Flocco, CPOM scheme) – affects coupling with atmosphere and albedo.
- Thermodynamics: similar between CICE and LIM although LIM3 has multilayer snow scheme.
- LIM3: Snow layers and melt ponds should be ready for stream 2, but brittle rheology probably won't be.
- Melt ponds will be in stream 1 for CICE runs (for Met O and possibly CMCC).

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WP3c Technical: Sea-Ice

- No detailed observational data available for melt ponds – sat obs limited because errors are large. Need to solve this using process oriented diagnostics – as in paper in Nature from Schroeder et al 2014.
- GELATO sea-ice model: was listed in the proposal but not yet available in final version, so BSC will use LIM3 instead rather than GELATO.
- Brittle rheology at UCL: being developed for NEMO-LIM3.5, needs to got into 3.6 and then into EC-Earth. Will be used by all groups with LIM if available in time (except possibly ECMWF).

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WP3d Science: Ocean Mixing

- OSMOSIS (OSBL) scheme (Langmuir turbulence) should be fully tested in global NEMO (up to 0.25° resolution) by end 2017 in time for stream 2.
- Caveat: OSBL examined in mid latitudes only so far, with shallow mixed layer depths (MLDs), not tested against deep polar MLDs or equatorial / tropical situations. So may need extensive testing.
- OSBL ideally needs a wave model to force this, but by assuming a strong link between wind and Stokes drift (which actually forces the OSBL) this can be circumvented (amounts to assuming La = 0.3, constant.)
- Only ECMWF will include a wave model.
- IDEMIX (internal and inertial wave breaking). Currently in PyOM, will be put into the TKE mixing scheme using the same approach as used for PyOM. Stream 2 for MPIOM will include TKE scheme (following successful testing of MPIOM+TKE versus OWS Papa), and will provide the route in for IDEMIX (ie through TKE).

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WP3d Technical: Ocean Mixing

- OSBL provides diffusivities over the upper ocean only, so will need to match onto deeper diffusivities from GLS scheme below the surface mixed layer.
- Robustness: OSBL is not written as a TKE scheme so cannot easily be coupled with MPIOM. IDEMIX, however, could in principle be used in NEMO coupled runs as NEMO uses TKE as an option.
- Diagnostics needed to check on energy conservation: C. Eden has done lot of work on this and tools are available in PyOM (to work with IDEMIX). G. Madec working to introduce similar into NEMO (for OSBL).
- Summary: most likely – OSBL into all NEMO stream 2 runs, IDEMIX into MPI stream 2 runs. Will do low res eg 10 year runs as coupled simulations before passing to WP6 (M30 – mid 2018).

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External science interactions

- Polar prediction meeting early 2017.
- Aquaplanet aerosol perturbation experiments paper in 2017
- UCL will present sea ice results at EGU 2017
- Links to APPLICATE (improving NWP/ climate runs with surface processes, snow and ice/ land use) – impact of arctic changes on northern hemisphere climate and weather.

Timescales

- Discussed above

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Deliverables and Milestones over the next year

- **D3.1:** Quantification of robustness of aerosol-radiation-cloud interactions across models and resolutions (**M24**).
- **MS 3**: Assess performance of metrics package for Stream 1 and WP3 integrations. (**M24)**
- **MS 7**: Deliver recommendations and model configurations with improved physics for Stream 2 of the core integrations. (**M24**)
- Delay likely to D3.1 and MS 3 due to delays in Stream 1. Delay in MS 7 likely due to delays with process developments and recruitments. **Probable delivery in M30 now for all these.**

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WP3 + 6 discussions

- Stream 2 runs should finish by M40, so should start M 30.
- Main issue – many improvements will be tested only in forced ocean only mode before stream 2 so may not work or be of benefit in coupled mode.
- Its up to the individual groups to test out their params in coupled mode before passing to stream 2. WP3 needs to assess benefit to European climate so this implies that each group in WP3 needs to do some coupled runs (short) before passing to WP6.
- WP3 needs to evaluate in coupled stream 1 configs.
- Stream 1 will provide input into CMIP6 but not stream 2 runs. Stream 2 runs will be unconstrained in this sense and will not be a full set of the stream 1 runs, just used to test the benefits of improvements .
- Robustness – hope to put idemix into NEMO through TKE. Better to prioritise processes which go into several models. OSBL can go into all NEMO based runs.
- WP6 runs – can't decide exactly now what is needed, WP3 needs to prioritise the benefits of each process, keep a flexible approach for now.

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WP3 + 6 discussions

- WP3 also needs to provide input to WP4 for the frontier runs eg eddy-resolving ocean in coupled mode – should these also have the improved parameterisations?
- Need a plan for what happens if stream 2 doesn't happen because of delays. Targeted process based studies could be done instead Eg additional runs to assess impact of Arctic on europe; and/or apply special filter in the coupler to remove the eddy effect (but maintain large scale gradients) to assess impact of SST on jet stream and storm tracks – could also be used to assess the importance of ocean mixing rather than doing repeat of stream 1 simulations.
- Need to decide on what WP6 should do (what sort of runs) – the break point for this is probably about M24 – at the GA3 (Nov 2017). But a change of plan would need negotiation with the EU. Will depend on progress in WP3, but there's already been a delay to stream 1 so all the deliverables will be pushed back. Secondary effect of this is what to do with stream 2 and everything else.

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WP3 + 6 discussions

- WP4: stochastic physics. Issue of number of members in ensembles versus run length.
- Stream 2: could do a bit less of the originally planned runs (ie those with improvements from WP3) and add some additional process-study runs? Should design stream 2 to maximise the benefit from processes, including advice and input from WP2.

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