EPA 9/11/19

Coupling Hector and COMBO

Submitted Ocean Sciences Abstract\*:

\*Note – in case things were moving quicker than anticipated I added in CMIP5/6 emulation and aragonite saturation sensitivities

**Emulating probabilities of coral reef bleaching and mortality using a coupled model framework**

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In this study we explore the probabilities of coral reef bleaching and mortality along the Florida reef track, Hawaii, and the Caribbean under a range of emission scenarios consistent with the Nationally Determined Contributions. Using a reduced-form climate model, Hector, in combination with a spatially resolving climate emulator, we emulate atmospheric temperature and sea-surface temperature from a suite of CMIP5 and CMIP6 models. This information is used to drive the Coral Mortality and Bleaching Output mode (COMBO). COMBO integrates the impacts of future climate change, both thermal and ocean chemistry, on coral growth and mortality to estimate changes in coral cover with time. We simulate up to 3 episodic bleaching events, each with increasing sea surface temperature thresholds under 3 different aragonite saturation sensitivities to investigate which emission pathway reduces the probability of bleaching and mortality across the range of CMIP models considered.

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| --- | --- | --- | --- | --- |
| Task | Personal | Anticipated timeline | Level of effort | Actual timeline |
| Process historical SSTs | Stephanie Pennington | completed | N/A | X |
| Incorporate updated historical SSTs into COMBO | Corinne Hartin | Mid-October | Hard |  |
| Decide if we need to update or compare historical bleaching events | Corinne Hartin | \*currently assuming I don’t have to. I will get the model running and then re-evaluate if this is needed. | Hard |  |
| Compare to historical bleaching events if needed | Stephanie Pennington | November  \*up in the air depending on what we decide above |  |  |
| NDC Hector temperature pathways | Jon Hustler/Matthew Binstead | Preliminary pathways already completed | N/A | X |
| Updated COMBO with NDC temperature/CO2 | Corinne Hartin | Early to Mid – October  \*once I get everything running smoothly on an RCP45 case I will add in the NDC pathways | Easy |  |
| Regrid CMIP SST information | Abigail Snyder | End of September | Medium |  |
| Pattern scale SST for a few CMIP5 models | Abigail Snyder | Mid-October | Medium |  |
| Decide if mimicking MAGICC output or update COMBO matlab code | Corinne Hartin and Abigail Snyder | 9/13/19 | Easy |  |
| Decide if running annually or 5 year time steps | Corinne Hartin and Abigail Snyder | 9/13/19 | Medium |  |
| Put all the pieces together and hope it runs! | Corinne Hartin and Abigail Snyder | Mid-October | Hard |  |
| Update COMBO with any new pathways, added models, different models to emulate (CMIP6), sensitivities (ΩAr) | Corinne Hartin, Abigail Snyder, Kalyn Dorheim (emulation) | November | Medium |  |
| Re-run COMBO with new updates | Corinne Hartin and Abigail Snyder | Mid-November | Hard |  |
| Synthesize results and figures | Corinne Hartin + team | December/January | Hard |  |
| Ocean Sciences | Corinne Hartin | Mid-February |  |  |
| Submit manuscript | Corinne Hartin + team | End of February | Hard |  |