Out of the frying pan; into the acid bath?

(What is the relative importance of temperature vs. ocean acidification pressures on tropical coral reefs?)

Andy Ridgwell, Elena Couce, Erica Hendy (University of Bristol)
Modern ocean surface environmental relationships

Temperature (°C) vs. Aragonite saturation
Modern ocean surface environmental relationships
Tropical coral reef locations (ReefBase)
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Modern ocean surface environmental relationships
Reef environmental conditions @2070 under RCP 8.5

Max (annual $\Omega$)?
Modern ocean surface environmental relationships
An alternative, thought experiment ...

Temperature (°C)

Aragonite saturation

T-Ω ‘trade-off’?
Modern ocean surface environmental relationships
An alternative, thought experiment ... (future implications)
Species Distribution Models for coral ocean habitat suitability

Boosted Regression Trees (BRT)

MaxEnt

Couce et al. (J. Biogeography, 2012)
Species Distribution Models for coral ocean habitat suitability [Classification errors]

**Boosted Regression Trees (BRT)**

**MaxEnt**

False positives  False negatives  Missing data

Couce et al. (J. Biogeography, 2012)
Projected zonal average response of habitat suitability to different environmental stressors
Projected zonal average response of habitat suitability to different environmental stressors (A2 SRES emissions)

$\Omega_{\text{arg}}$ changes only
Projected zonal average response of habitat suitability to different environmental stressors (A2 SRES emissions)

\[ \Omega_{\text{arg}} \text{ changes only} \]

\[ \text{SST (annual mean) only} \]
Projected zonal average response of habitat suitability to different environmental stressors (A2 SRES emissions)

- $\Omega_{\text{arg}}$ changes only
- SST (annual mean) only
- $\Omega_{\text{arg}}$ + SST changes

MaxEnt SDM

- Training
- 2010
- 2020
- 2030
- 2040
- 2050
- 2060
- 2070
Projected zonal average response of habitat suitability to different environmental stressors (A2 SRES emissions)

- **$\Omega_{\text{arg}}$ changes only**
- **SST (annual mean) only**
- **$\Omega_{\text{arg}}$ + SST changes**
- **$\Omega_{\text{arg}}$ + SST [substrate limited]**

MaxEnt SDM

<table>
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<th>Year</th>
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Patterns of environmental change induced by geoengineering
Solar Radiation Management – SRM (aka: ‘Giant Mirrors in Space’)

Patterns of environmental change induced by geoengineering
Solar Radiation Management – SRM (aka: ‘Giant Mirrors in Space’)

year 2070 under RCP 8.5, 0% SRM
year 2070 under RCP 8.5, 100% SRM

SST anomaly (°C)
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Aragonite saturation
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Potential implications for tropical coral habitat suitability

Future change in tropical coral habitat suitability (normalized to training) as a function of the degree of CO$_2$ radiative forcing cancelling geoengineering (SRM) [BRT species distribution model]
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