

Supplement of Biogeosciences Discuss., 12, 5907–5940, 2015
<http://www.biogeosciences-discuss.net/12/5907/2015/>
doi:10.5194/bgd-12-5907-2015-supplement
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Supplement of

Quantifying the influence of CO₂ seasonality on future ocean acidification

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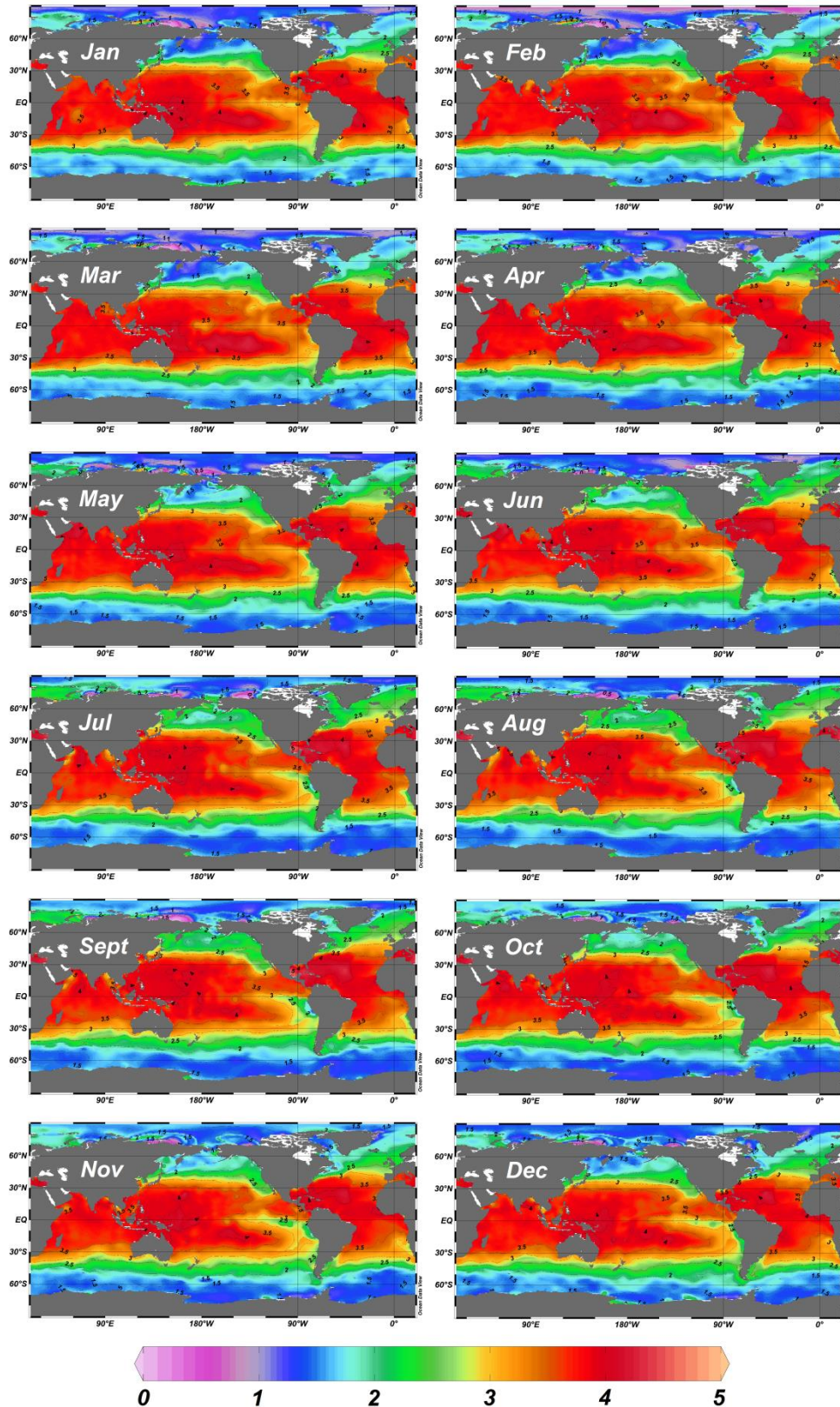
1 **Supplement S1: Monthly ocean surface Ω_{Ar} predictions**

2 **Supplement S2: Aragonite under-saturation in the year 2000**

3 Figure S2 shows the locations where our results suggest at least month-long aragonite under-
4 saturation ($\Omega_{Ar} < 1$) occurs in the year 2000.

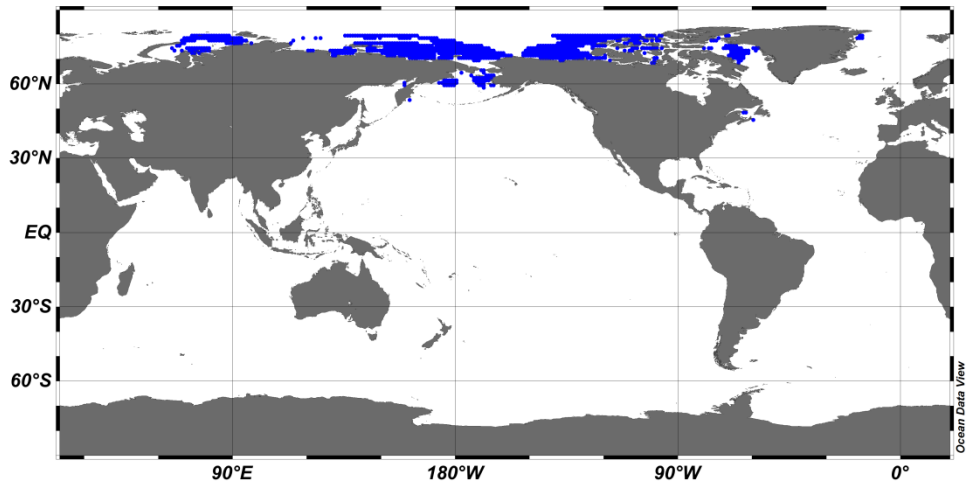
5 **Supplement S3: Statistical plots comparing in-situ to independently Ω_{Ar} values**
6 **partitioned by season**

7 **Supplement S4: Comparison between our data-based and model-based seasonal**
8 **amplitudes**



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2 **Figure S1:** Monthly Ω_{Ar} climatologies for the nominal year of 2000 calculated using the
 3 dissolved inorganic carbon and total alkalinity climatologies of Sasse et al (2013), in
 4 combination with the World Ocean Atlas 2013 Temperature, salinity and nutrient surface
 5 decadal averages.



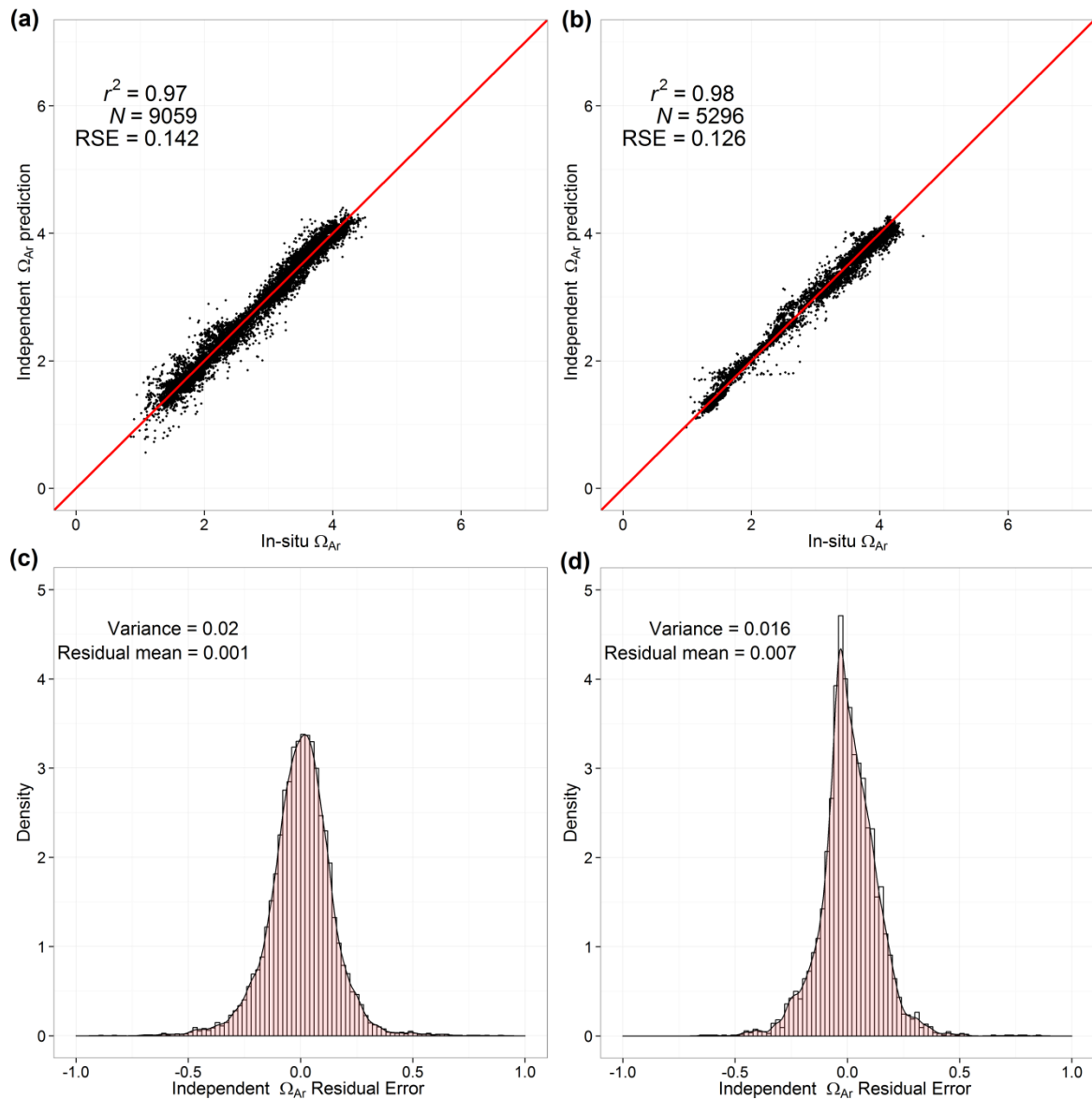
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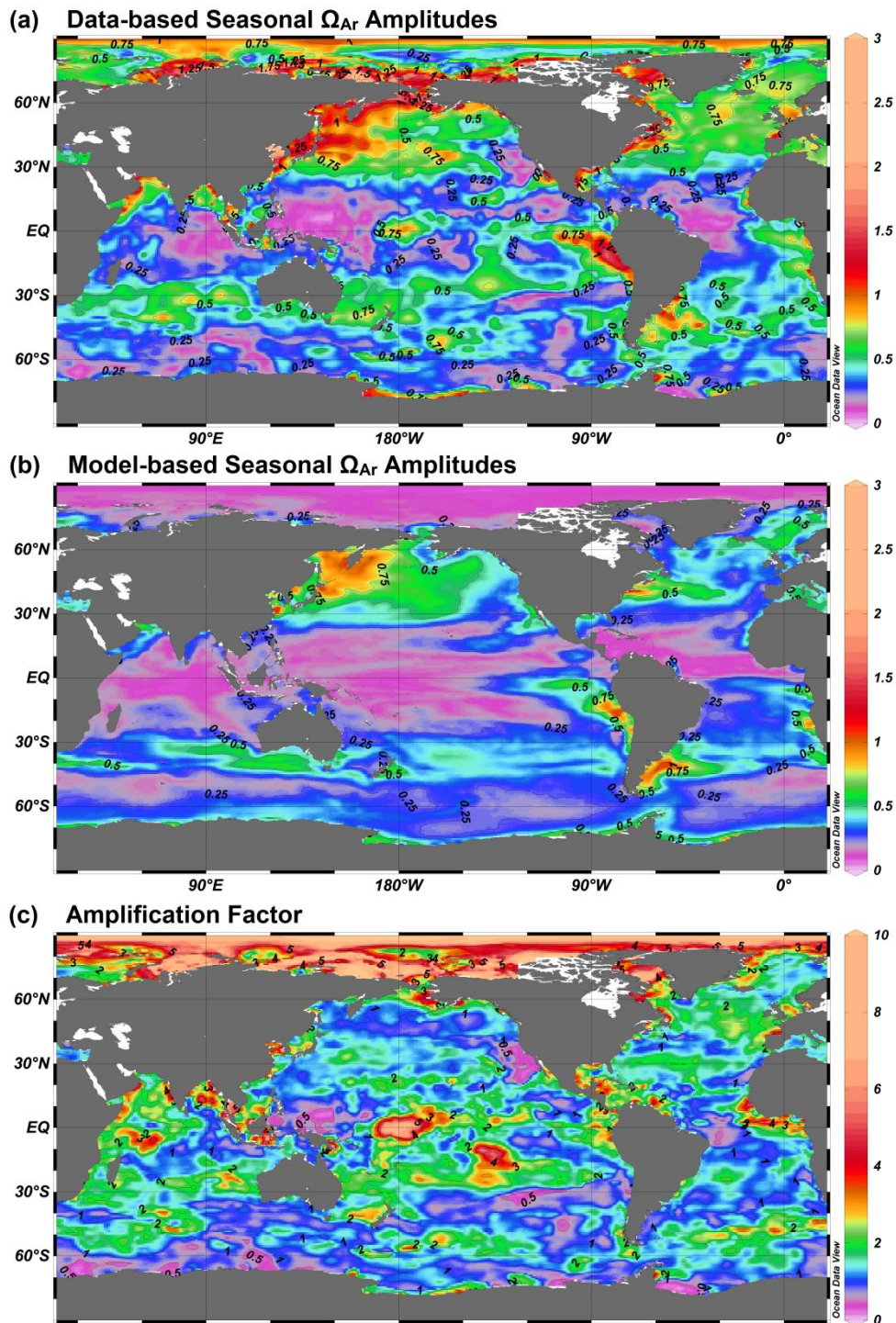
Figure S2: Locations where our Ω_{Ar} predictions suggest at least month-long aragonite under-saturation occurs in the year 2000.



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2 **Figure S3:** Independent Ω_{Ar} predictions versus in-situ values for (a) summer and (b) winter.
 3 Distributions of independent residual errors for (c) summer and (d) winter. Summer months
 4 were defined as November through to March for the Southern Hemisphere and May through
 5 to September for the Northern Hemisphere. Winter months differ by 6 months.

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2 **Figure S4:** Comparison between seasonal Ω_{Ar} amplitudes derived using our data-based
 3 climatologies for the nominal year of 2000 and the Earth System Model (ESM) ensemble
 4 median. (a) Our data-based Ω_{Ar} seasonal amplitudes (monthly max - min) for the nominal
 5 year of 2000. (b) The model based 2006-2016 mean seasonal Ω_{Ar} amplitudes (monthly max-
 6 min). (c) Amplification factor of our data-based seasonal amplitudes compared to the model-
 7 based estimates (i.e. data-based / model-based seasonal Ω_{Ar} amplitudes). An amplification
 8 factor of 1 indicates that our data-based amplitude equals the model-based estimate, whereas
 9 an amplitude factor of 2 indicates that our data-based amplitude was twice as large as the
 10 model-based estimate.

1 **References:**

2 Sasse, T. P., McNeil, B. I., and Abramowitz, G. (2013), A novel method for diagnosing
3 seasonal to inter-annual surface ocean carbon dynamics from bottle data using neural
4 networks, *Biogeosciences*, 10, 4319-4340, DOI: 10.5194/bg-10-4319-2013

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