Corrigendum for Schmittner et al. [2008] “Future changes in climate, ocean circulation, ecosystems, and biogeochemical cycling simulated for a business-as-usual CO₂ emission scenario until year 4000 AD”, Global Biogeochemical Cycles 22, GB1013

Andreas Schmittner, College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, Oregon, USA

Andreas Oschlies, Leibniz Institute of Marine Sciences at the Christian-Albrechts University of Kiel (IFM-GEOMAR), Kiel, Germany

H. Damon Matthews, Planning and Environment, Concordia University, Montreal, Quebec, Canada

Eric D. Galbraith, Atmospheric and Ocean Sciences, Princeton University, Princeton, New Jersey, USA
1. Typos in Appendix A

In equations A5 and A7 $\mu_P$ should be replaced by $\mu^* P$. The correct equations are:

\[
S(P_D) = J_D P_D - G(P_D) Z - \mu^* P_D \tag{A5}
\]

\[
S(D) = (1 - \gamma) [G(P_O) + G(P_D)] Z + \mu P_D + \mu P^2 \tag{A7}
\]

In table A1 $\mu_P$ should be replaced by $\mu_{p2}$, its correct terminology (Parameter column) should be “Quadratic mortality coefficient”, and its unit should be (mmol m\(^{-3}\))\(^{-1}\) d\(^{-1}\). The correct unit of the (quadratic) zooplankton mortality $\mu_Z$ must be (mmol m\(^{-3}\))\(^{-1}\) d\(^{-1}\).

In equation A14 $\mu^* P_0$ should be replaced by $\mu_{P0}$.

2. Error in the Calculation of Light Limitation

The results shown in Schmittner et al. [2008] were obtained with a coding error in the calculation of light limitation of phytoplankton growth. The function

\[
\Phi(u) = \ln(u + \sqrt{1 + u^2}) - (\sqrt{1 + u^2} - 1)/u, \tag{1}
\]

which is used in the calculation of the daily averaged growth as described in Schmittner et al. [2005], was approximated by

\[
\Phi(u) = (0.555588u + 0.004926u^2)/(1 + 0.188721u) \tag{2}
\]

as recommended by Evans and Garçon [1997] for 0<u<20. In the code 0.04926 was erroneously used instead of 0.004926. This caused too little light limitation. We have also found that in many places $u>20$ such that approximation (2) has large errors. We changed the code and implemented the original light limitation function (equation 1). This required some retuning of the other biological parameters in order to yield an essentially identical simulation of the biogeochemical tracer distributions. In addition to the parameter values reported in Schmittner et al. [2008] we now recommend the following parameter setting.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum growth rate</td>
<td>$a$</td>
<td>0.20</td>
<td>d(^{-1})</td>
</tr>
<tr>
<td>Linear mortality coefficient</td>
<td>$\mu_{p0}$</td>
<td>0.014</td>
<td>d(^{-1})</td>
</tr>
<tr>
<td>Quadratic mortality coefficient</td>
<td>$\mu_{p2}$</td>
<td>0.05</td>
<td>(mmol m(^{-3}))(^{-1}) d(^{-1})</td>
</tr>
<tr>
<td>CaCO3 over nonphotosynthetic POC production ratio</td>
<td>$R_{CaCO3:POC}$</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>Molar C:N ratio of organic matter</td>
<td>$R_{C:N}$</td>
<td>6.625</td>
<td></td>
</tr>
<tr>
<td>Molar O$_2$:N ratio of aerobic remineralization</td>
<td>$R_{O:N}$</td>
<td>10.0</td>
<td></td>
</tr>
</tbody>
</table>
Acknowledgements. Thanks to Heiner Dietze (Leibniz-Institute for Marine Sciences, University Kiel) and Jim Christian (Canadian Centre for Climate Modelling and Analysis at the University of Victoria) for pointing out some of the inconsistencies of the original paper.

References

Evans, G. T., and V. C. Garçon (1997), One-dimensional models of water column biogeochemistry; Report of a Workshop held in Toulouse, France; November-December 1995, Bergen.
