Natural Hazards
and Earth System
Sciences

Open Access

Discussions

Interactive comment on "How severe Space Weather can disrupt global supply chains" *by* H. Schulte in den Bäumen et al.

H. Schulte in den Bäumen et al.

hagen@physics.usyd.edu.au

Received and published: 27 August 2014

Page 4464, lines 16-18. We suggest deleting the sentences in the lines 16-18.

Page 4465, line 9. We suggest deleting the paragraph between line 7 and 20.

Page 4465, lines 12-15. The authors agree to remove this sentence.

Page 4465, line 28. The referee comments on space weather effects while the authors describe effects of GICs in this sentence. However, we agree to change the reference to a more recent one: Royal Academy of Engineering, Extreme space weather: impacts on engineered systems and infrastructure, available at www.raeng.org.uk/spaceweather (last access: 27 August 2014), 2013.

C1895

Page 4466, lines 19-21. The authors suggest changing the sentence to: Studies and anecdotal evidence suggest the most severe space weather event in the last 150 years was the Carrington event of September 1859 (e.g., Cliver and Svalgaard, 2004).

Page 4466, lines 24-26. The authors suggest changing the sentence to: The strength of this storm has been estimated to be 850 nT < Dst < 1760 nT (Lakhina et al., 2005; Siscoe et al., 2006; Tsurutani et al., 2012). New reference: Siscoe, G., Crooker, N. U., and Clauer, C. R., Dst of the Carrington storm of 1859, Advances in Space Research 38 (2006) 173–179.

Page 4467, line 18. We agree to the referee's comment. For example, 5000 large key transformers have been retrofitted in the USA for mitigation. The number of 250 transformers for a medium sized country seems to be reasonable. However, we are unable to estimate the amount of transformers produced globally and suggest deleting the corresponding sentence in the manuscript.

Page 4467, lines 13-27. We don't think this is relevant for our study, since the novelty lies in the consideration of indirect economic effects due to global trade. All studies mentioned in the manuscript consider only domestic damage, i.e. economic losses in those countries directly affected by the storm. For example, the study by Lloyds estimates the economic cost of the outage scenario by calculating the percentage of residential, commercial, and industrial customers without power and using the average amount of electricity consumed by each sector. The economic losses are then the total amount of electricity lost in their scenario.

Page 4467, lines 25-27. We suggest changing the sentence to: None of the cost estimates consider global effects due to international trade.

Page 4468, line 6. We agree to a section break after line 6.

Page 4468, line 7-9. We suggest changing the sentence in lines 7-8 to: The reduction of production capacities gamma_el of the electricity sector for each country C = 1, 187

C1896

is dependent on the size S and the location phi_0 of the event. Specifically,

gamma_el = ... (1)

Note: The right hand side of equation (1) stays the same in lines 9 and 10.

Page 4468, line 14. We suggest changing the wording to: ..., times the sum of Gaussian distributions in latitude that model the event-dependent auroral ovals centered at +/- theta_0(S) with standard deviations sigma_theta(S).

Page 4468, line 23. We suggest deleting the word nominal.

Page 4469, line 24. We agree to the comment.

Page 4470, line 5. The reference to include is: Lenzen et al., 2013.

a) The referee's impression is correct. The vectors y and x consist of N elements and each element represents demand or output of a particular economic sector.

b+c) We suggest including the following paragraph in the beginning of section 2 for a better understanding of the general reader:

IO tables show transactions occurring within an economy - the flow of money and the counter flow of goods and services. The intermediate transaction matrix T contains transactions occurring between industries or sectors. For example, the manufacturing industry buys basic steel from the steel manufacturing industry, which in turn purchases iron ore from the mining sector. The purchasing sectors are listed horizontally along the columns while the sectors running vertically down the rows are selling the goods and services. The transactions contained in T are termed intermediate because the purchases are products which are themselves used in the production of other products. The purchase of final products occurs in the final demand vector y. These are products produced for the final consumer. A basic requirement of IO tables is that they balance; the inputs to an economy must equal the outputs. The total output of the economy is equal to the output of industry plus the output to final consumers. To accomplish

C1897

the addition of the corresponding matrices a summation operator is used: $x = T1 + y$, where $1 = \{1, 1,...,1\}'$.

Most often...

Page 4470, line 18. We suggest changing the sentence to: ..., where the summation operator is of dimension (N x 1).

Page 4471, line 6. We suggest adding the following sentence: The disaster impact method and the derivation of the gamma matrix are described in detail in Appendix A.

Page 4472, line 16. We don't see any grammar issue.

Page 4473, line 13. We suggest changing to: ... (red shading in Figure 3-5).

Page 4475, lines 15-20. We suggest removing this part of the discussion.

Page 4476, line 9. We suggest changing to: ...that loss could be up to USD 3.4 trillion or 5.6 % of global GDP...

Page 4476, line 11. We suggest changing to: In comparison, global financial crisis...

Page 4483, line caption of Figure 2. We suggest changing to: ..., for scenario 2 is 5 times 10^{-5},...

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 4463, 2014.