Abiotic resource depletion potentials (ADPs) for elements revisited-updating ultimate reserve estimates and introducing time series for production data

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Abstract

Purpose: In 1995, the original method for assessing the impact category abiotic resource depletion using abiotic depletion potentials (ADPs) was published. The ADP of a resource was defined as the ratio of the annual production and the square of the ultimate (crustal content based) reserve for the resource divided by the same ratio for a reference resource (antimony (Sb)). In 2002, ADPs were updated based on the most recent USGS annual production data. In addition, the impact category was sub-divided into two categories, using two sets of ADPs: the ADP for fossil fuels and the ADP for elements; in this article, we focus on the ADP for elements. Since then, ADP values have not been updated anymore despite the availability of updates of annual production data and also updates of crustal content data that constitute the basis of the ultimate reserves. Moreover, it was known that the coverage of elements by ADPs was incomplete. These three aspects together can affect relative ranking of abiotic resources based on the ADP. Furthermore, dealing with annually changing production data might have to be revisited by proposing new calculation procedures. Finally, category totals to calculate normalized indicator results have to be updated as well, because incomplete coverage of elements can lead to biased results. Methods: We used updated reserve estimates and time series of production data from authoritative sources to calculate ADPs for different years. We also explored the use of several variations: moving averages and cumulative production data. We analyzed the patterns in ADP over time and the contribution by different elements in the category total. Furthermore, two case studies are carried out applying two different normalization reference areas (the EU 27 as normalization reference area and the world) for 2010. Results and discussion: We present the results of the data updates and improved coverage. On top of this, new calculation procedures are proposed for ADPs, dealing with the annually changing production data. The case studies show that the improvements of data and calculation procedures will change the normalized indicator results of many case studies considerably, making ADP less sensitive for fluctuating production data in the future. Conclusions: The update of ultimate reserve and production data and the revision of calculation procedures of ADPs and category totals have resulted in an improved, up-to-date, and more complete set of ADPs and a category total that better reflects the total resource depletion magnitude than before. An ADP based on the cumulative production overall years is most in line with the intent of the original ADP method. We further recommend to only use category totals based on production data for the same year as is used for the other (emission-based) impact categories.

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