**Supplementary**

**Impact of spatial soil and climate input data aggregation on regional yield simulations**

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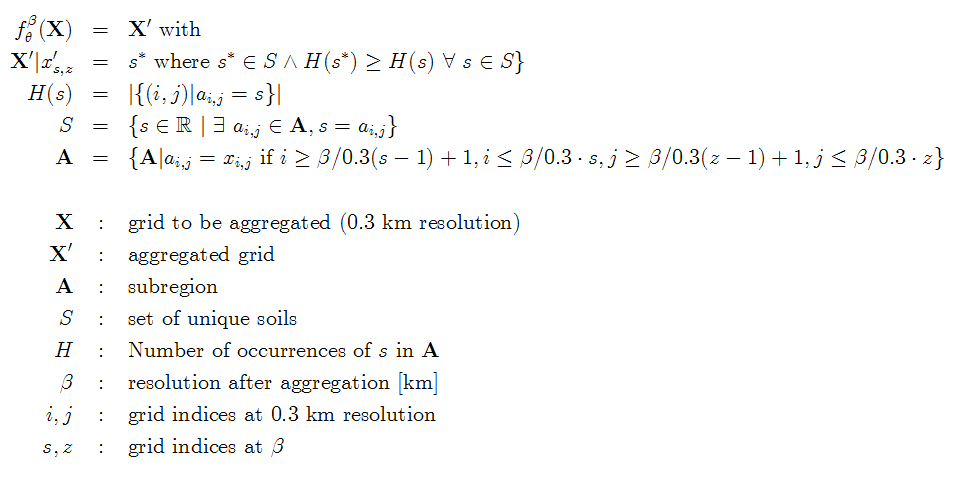
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**Equations**

**Soil surface albedo.** Soil surface albedo (α; [-]) was calculated from soil organic content (; [g/100 g]) using the following equation (Thomas Gaiser, personal communication):

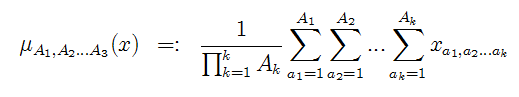
 (A)

**Grids and aggregation.** We used spatial grids of cells of approximately equal longitudinal and latitudinal side length (<http://spatialreference.org/ref/epsg/31467/>; [1]). Grids of aggregated climate data were obtained by taking the spatial mean of data at 1 km resolution (see [1] for equations). Grids of aggregated soil data were obtained by selecting the dominant soil by area majority. For this purpose, we counted all soil profiles at 0.3 km resolution, which fall into a given cell of a coarser resolution. The most abundant soil (= area majority) was selected to represent the given cell at coarser resolution. For soil aggregation, the following equations were used:

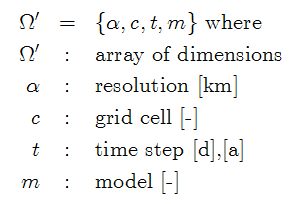
(B)

Five grids of resolutions of 1, 10, 25, 50 and 100 km with the corresponding number of grid cells 34168, 20, 80, 24 and 9 were constructed. Coarser grids were technically set-up starting in the north-west corner of the study region. Empty grid cells (data unavailable) were ignored in the calculations. Maps displaying main regional climate variables are given by [2].

**Variable notation.** A simplified notation will be used in the following, indexing variables in their dimensions. In the following, equations are conducted over all elements of a given dimension and are applied to all dimensions indicated. For instance, averages are given by

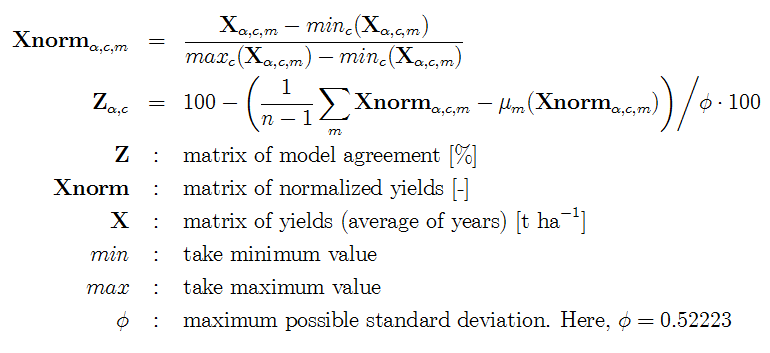
(C)

where the function *µ* averages *x* over dimensions . In the following, these dimensions were considered

(D)

e.g. refers to a yield of a given resolution, grid cell, year and model.

**Model agreement.** In order to calculate the spatial agreement of the model ensemble in yields, single model yields were first normalized by the minimum and maximum yield simulated by that model (eq. 5). Subsequently, model agreement Z was obtained by calculating the standard deviation across models and relating it to the maximum possible deviation (eq. 6). Large values of Z indicate better model agreement.

(E)

(F)

**References**

1. Hoffmann H, Zhao G, van Bussel LGJ, Enders A, Specka X, Sosa C, et al. Variability of aggregation effects of climate data on regional yield simulation by crop models. Clim Res. 2015; 65: 53-69.
2. Zhao G, Hoffmann H, Van Bussel LGJ, Enders A, Specka X, Sosa C, et al. Effect of weather data aggregation on regional crop simulation for different crops, production conditions, and response variables. Clim Res. 2015; 65: 141-157.