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Global-scale assessment of agrochemicals contamination — the case study of glyphosate

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The need for comprehensive assessments of agrochemicals use and its potential risk of environmental contamination are imperative, but studies currently exist only at regional and watershed scales. By coupling the recently developed PEST-CHEMGRIDS data product to the BRTSim (BioReactive Transport Simulator) computational framework, we conducted the first mechanistic assessment of the environmental hazard of glyphosate (GLP) use at global scales. PEST-CHEMGRIDS provides the annual application rate of 95 active ingredients, including GLP, on various dominant and aggregated crops (Maggi et al., 2019), and is used to feed the biogeochemical reaction network of GLP biogeochemistry embedded in BRTSim (la Cecilia et al., 2018). Deployment of BRTSim over a georeferenced global-scale grid allowed us to assess four key quantities that determine the level of environmental hazard, namely: (i) soil residue, (ii) biodegradation recalcitrance, (iii) leaching rate below the root zone, and (iv) persistence in the root zone. Our assessment (Maggi et al., 2020) shows that the total average residue in the root zone and leaching below root zone is important only in minor areas globally, but also show that biodegradation recalcitrance and persistence can lead to an environmental hazard in vast agricultural areas worldwide. The latter were largely related to the GLP transformation product, aminomethylphosphonic acid (AMPA), because of slow reaction kinetics, further inhibited by the presence of aqueous inorganic phosphate. With the four key quantities, we have mapped the aggregated hazard geographically to identify hotspots where GLP contamination may have to be assessed with greater level of detail. High hazard hotspots cover less than 1% of the agriculture area (inclusive of pastures) and are identified in north Europe, USA, Brazil, and China.

Maggi F., Tang F.H.M., la Cecilia D., McBratney A., (2019), Scientific Data 6(1), 1-20.

la Cecilia D., Tang F.H.M., Coleman N., Conoley C., Veervort R.W., and Maggi F., (2018), Water Research, 146, 37-54.

Maggi F., la Cecilia D., Tang F.H., & McBratney A., (2020). Science of the Total Environment, 717, 137167.