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HydroCrowd: Citizen-empowered snapshot sampling to assess the spatial distribution of stream

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Large parts of groundwater bodies in Central Europe shows elevated nitrate concentrations. While groundwater samplings characterize the water quality for a longer period, surface water resources, in particular streams, may be subject of fast concentration fluctuations and measurements distributed in time cannot by compared. Thus, sampling should be done in a short time frame (snapshot sampling). To describe the nitrogen status of streams in Germany, we organized a crowdsourcing experiment in the form of a snapshot sampling at a distinct day. We selected a national holiday in fall 2013 (Oct, 3rd) to ensure that a) volunteers have time to take a sample, b) stream water is unlikely to be influenced by recent agricultural fertilizer application, and c) low flow conditions are likely. We distributed 570 cleaned sample flasks to volunteers and got 280 filled flasks back with coordinates and other meta data about the sampled stream. The volunteers were asked to visit any stream outside of settlements and fill the flask with water from that stream. The samples were analyzed in our lab for concentration of nitrate, ammonium and dissolved organic nitrogen (DON), results are presented as a map on the web site http://www.uni-giessen.de/hydrocrowd.
The measured results are related to catchment features such as population density, soil properties, and land use derived from national geodata sources. The statistical analyses revealed a significant correlation between nitrate and fraction of arable land (0.46), as well as soil humus content (0.37), but a weak correlation with population density (0.12). DON correlations were weak but significant with humus content (0.14) and arable land (0.13). The mean contribution of DON to total dissolved nitrogen was 22%. Crowdsourcing turned out to be a useful method to assess the spatial distribution of stream solutes, as considerable amounts of samples were collected with comparatively little effort at a single day.