Geophysical Research Abstracts
Vol. 19, EGU2017-13762, 2017
EGU General Assembly 2017

Recharge heterogeneity and high intensity rainfall events increase contamination risk for Mediterranean groundwater resources

Andreas Hartmann (1,2), Scott Jasechko (3), Tom Gleeson (4), Yoshihide Wada (5,6,7), Bartolomé Andreo and Juan Antonio Barberá (8), Heike Brielmann (9), Jean-Baptiste Charlier (10), George Darling (11), Maria Filippini (12), Jakob Garvelmann (13), Nico Goldscheider (14), Martin Kralik (15), Harald Kunstmann (13), Bernard Ladouche (10), Jens Lange (1), Matías Mudarra and José Francisco Martín (8), Alon Rimmer (16), Damián Sanchez (8), Christine Stumpp (17), Thorsten Wagener (2,18)

(1) University of Freiburg, Chair of Hydrology, Freiburg, Germany (andreas.hartmann@hydrology.uni-freiburg.de), (2) Department of Civil Engineering, University of Bristol, United Kingdom, (3) Department of Geography, University of Calgary, Canada, (4) Department of Civil Engineering and School of Earth and Ocean Sciences, University of Victoria, Canada, (5) International Institute for Applied Systems Analysis, Schlossplatz 1, A-2361 Laxenburg, Austria , (6) NASA Goddard Institute for Space Studies, 2880 Broadway, New York, NY 10025, USA and Center for Climate Systems Research, Columbia University, 2880 Broadway, New York, NY 10025, USA , (7) Department of Physical Geography, Utrecht University, Utrecht, The Netherlands, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands, (8) Department of Geology and Centre of Hydrogeology at the University of Malaga (CEHIUMA), Malaga, Spain, (9) Austrian Federal Environmental Agency, Vienna, Austria, (10) BRGM, Montpellier, France, (11) British Geological Survey, Wallingford, United Kingdom, (12) Biological Geological and Environmental Sciences Department, University of Bologna, Italy, (13) Institute of Meteorology and Climate Research, Karlsruhe Institute of Technology, Campus Alpin, Garmisch-Partenkirchen, Germany, (14) Institute of Applied Geosciences, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany, (15) Department of Environmental Geosciences, University of Vienna, Austria, (16) Israel Oceanographic and Limnological Research, Kinneret Limnological Laboratory, Migdal, Israel, (17) Institute of Groundwater Ecology, Helmholtz Zentrum München, German Research Center for Environmental Health, Germany, (18) Cabot Institute, University of Bristol, United Kingdom

Karst develops through the dissolution of carbonate rock and results in pronounced spatiotemporal heterogeneity of hydrological processes. Karst groundwater in Europe is a major source of fresh water contributing up to half of the total drinking water supply in some countries like Austria or Slovenia. Previous work showed that karstic recharge processes enhance and alter the sensitivity of recharge to climate variability. The enhanced preferential flow from the surface to the aquifer may be followed by enhanced risk of groundwater contamination. In this study we assess the contamination risk of karst aquifers over Europe and the Mediterranean using simulated transit time distributions. Using a new type of semi-distributed model that considers the spatial heterogeneity of karst hydraulic properties, we were able to simulate karstic groundwater recharge including its heterogeneous spatiotemporal dynamics. The model is driven by gridded daily climate data from the Global Land Data Assimilation System (GLDAS). Transit time distributions are calculated using virtual tracer experiments. We evaluated our simulations by independent information on transit times derived from observed time series of water isotopes of >70 karst springs over Europe. The simulations indicate that, compared to humid, mountain and desert regions, the Mediterranean region shows a stronger risk of contamination in Europe because preferential flow processes are most pronounced given thin soil layers and the seasonal abundance of high intensity rainfall events in autumn and winter. Our modelling approach includes strong simplifications and its results cannot easily be generalized but it still highlights that the combined effects of variable climate and heterogeneous catchment properties constitute a strong risk on water quality.