



Environmental relevance of pharmaceuticals: The global perspective

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Background

Pharmaceuticals are ubiquitously found in European surface waters. An analysis of monitoring data (Bergmann et al. 2011) showed that in Europe nearly 300 pharmaceutical substances and degradation products were detected in different environmental matrices. Although information on the global occurrence of pharmaceuticals in the environment has become available recently, a concise picture on the prevailing concentrations and potential effects on human and ecosystem health is still elusive. The International Society of Doctors for the Environment has proposed the topic "Environmentally Persistent Pharmaceutical Pollutants" for nomination as an emerging issue under the Strategic Approach on International Chemicals Management (SAICM) of the United Nations Environmental Programme (UNEP). In order to define the state of knowledge on the global relevance of pharmaceuticals in the environment, the German Federal Environment Agency has initiated a research project in 2012.

Research Project

The German Federal Environment Agency currently runs a research project on the global relevance of Pharmaceuticals in the Environment.

Goals of the project are:

- Compile Measured Environmental Concentrations (MEC) of human and veterinary pharmaceuticals from all five UN regions
- Compare regional consumption data and future trends
- Assess the relevance of emission pathways (production, use, disposal) on a global scale
- Assess the role of infrastructure, population, pharmaceutical availability, agricultural practice, etc. on emissions of pharmaceuticals
- Provide databases and maps to illustrate the global relevance of pharmaceuticals in the environment as an emerging issue under SAICM

Methods: Comprehensive literature search and analysis, expert interviews and a questionnaire campaign

First results

- Pharmaceuticals have been detected in the environment in ≥ 52 countries, covering all five UN regional groups (Fig.1)
- 331 different pharmaceuticals and metabolites have been found so far
- Currently 56 000 MEC entries from 352 publications are available
- MEC data for the analgesic diclofenac are available globally in 32 countries (3 075 database entries for surface water, Fig. 2)
- There are order-of-magnitude more data available in WEOG countries than in emerging and developing countries. Less data is available in Africa, Latin America and in Eastern European Countries.
- In every UN regional group, pharmaceuticals could be proven to be present in surface water, ground water and drinking water as well
- There is considerable overlap in pharmaceuticals that have been detected globally (Fig.3)
- Discharge of urban waste water is the dominant emission pathway
- The role of pharmaceutical production on global pollution patterns has not yet intensely studied besides specific areas such as India and China

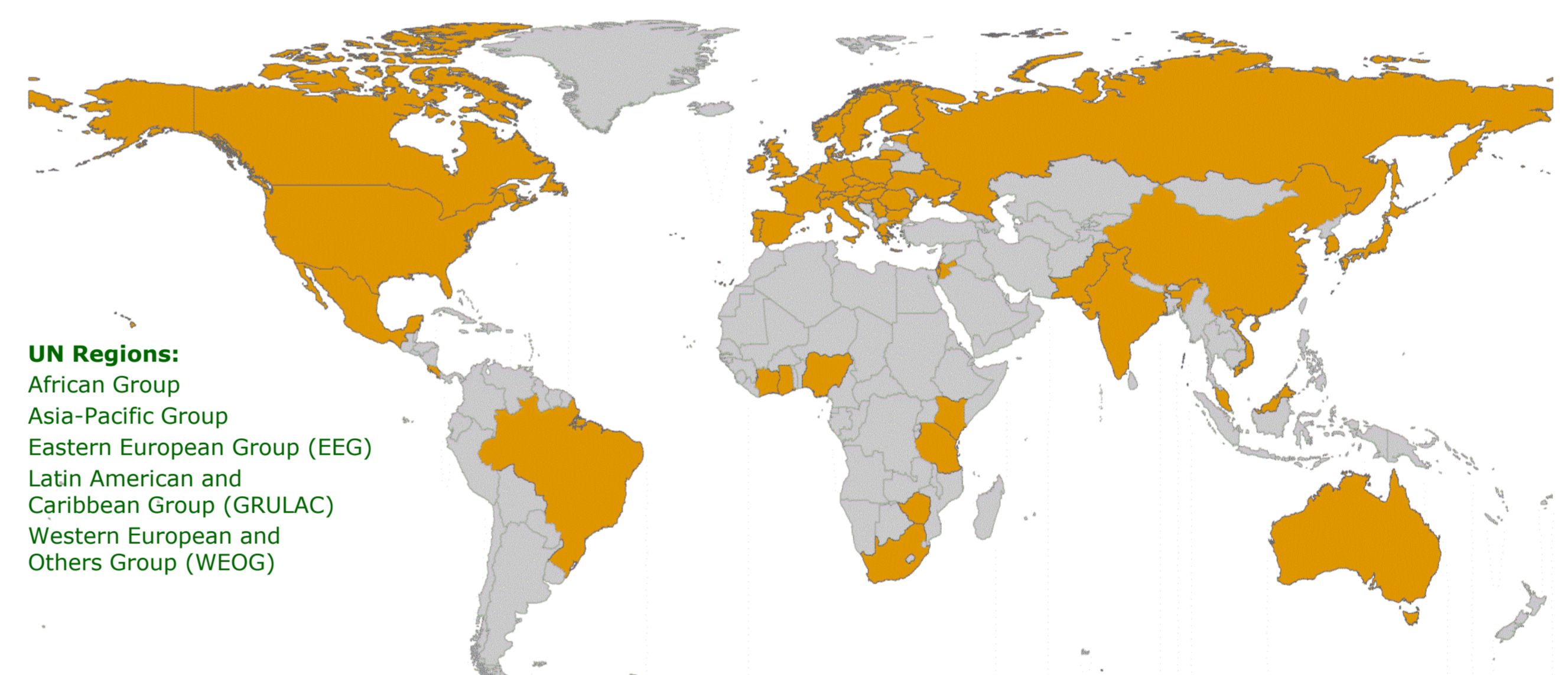


Fig. 1: Global occurrence of pharmaceuticals with at least one measured environmental concentration (MEC)

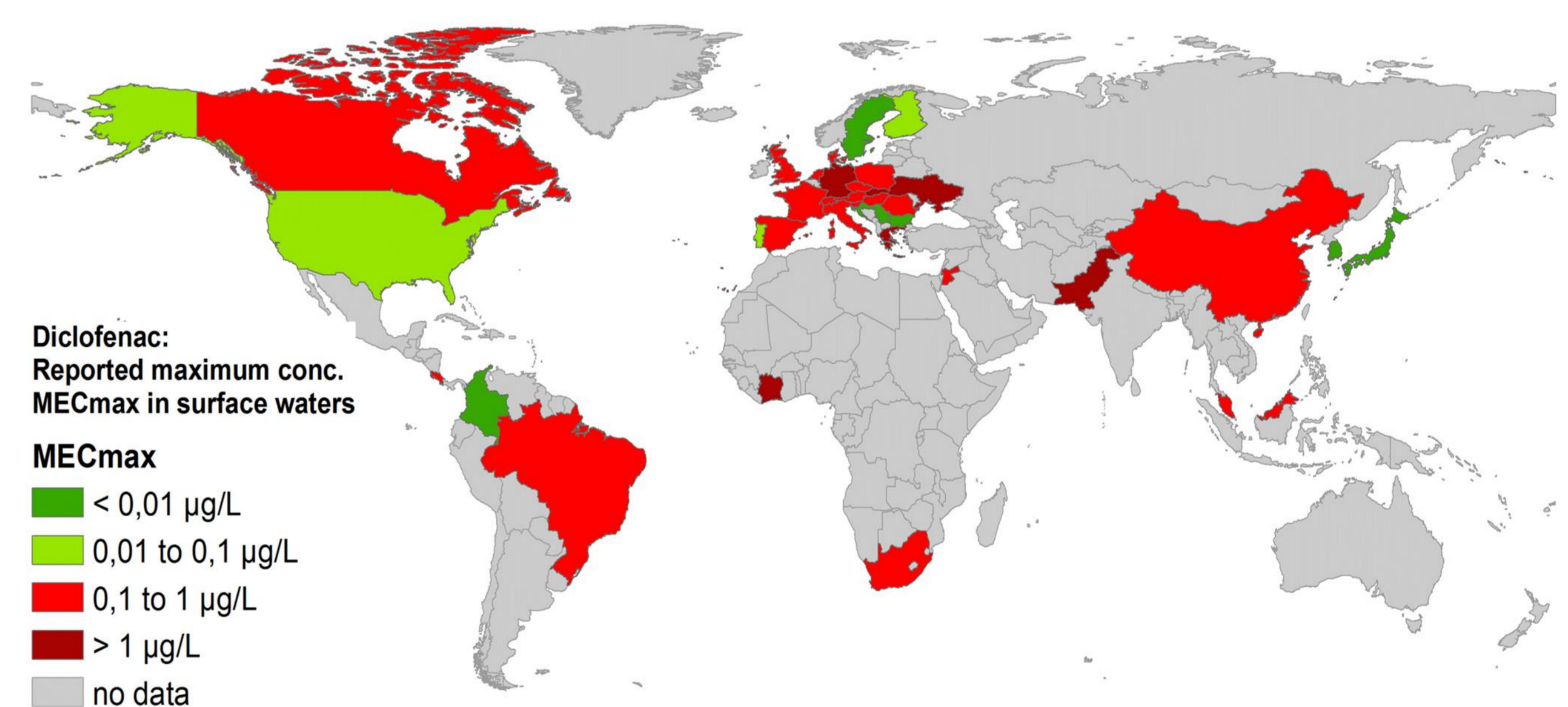


Fig. 2: Environmental concentrations of the analgesic Diclofenac in different UN regions

Name	Therapy Group	Number of Countries with Positive Detection in Surface Water, Groundwater, Drinking Water					
		African Group	Asia Pacific Group	EEG	GRULAC	WEOG	global
Diclofenac	Analgesics	2	5	10	3	12	32
Carbamazepine	Antiepileptic drugs	2	3	10	2	12	29
Ibuprofen	Analgesics	2	4	8	2	13	29
Naproxen	Analgesics	1	4	10	2	12	29
Sulfamethoxazole	Antibiotics	4	4	8	2	11	29
Trimethoprim	Antibiotics	1	5	3	2	9	20
Paracetamol	Analgesics	1	2	4	2	9	18
Estrone	Estrogens	1	1	6	1	4	13
Ofloxacin	Antibiotics	1	2	1	1	6	11
17-alpha-Ethinylestradiol	Estrogen	1	1	1	1	5	9
17-beta-Estradiol	Estrogen	2	1	2	1	3	9
Norfloracin	Antibiotics	1	2	1	2	3	9

Fig. 3: Pharmaceuticals that have been detected in each of the UN regions and the respective number of countries with positive detection

Preliminary conclusion:

Pharmaceuticals in the environment is a topic of global relevance, not just an issue for industrialized countries

Collaboration wanted

The project team is interested in collaboration with researchers, universities, governmental agencies, policy makers etc. to

- to compile additional monitoring data from different countries especially EEG, GRULAC and African countries
- to discuss different emission pathways and regional trends e.g. on pharmaceutical availability and agricultural practice
- to collect information on consumption and future consumption trends in the UN regions

An International Workshop on intermediate results will be held in March/April 2014, Geneva, CH.
For further information please visit the project`s homepage: www.pharmaceuticals-in-the-environment.org