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Newsletter - December 2010

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7th SedNet conference 6-9 April 2011: Sediments and Biodiversity: bridging the gap between science and policy

The conference program is being processed right now and will become available in January. Then also the registration of participants will start. We will keep you informed.

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New SedNet Steering Group members

Recently the following parties joined as SedNet Steering Group member:

BRGM: this French research institute will provide direct links for SedNet to the French Ministry of Environment and key problem owners in France (ports and waterways managers). The strong involvement of BRGM in major national research programs and scientific clusters dedicated to sediments will also facilitate scientific exchanges within SedNet. Christophe Mouvet and Philippe Négrel will participate in steering group meetings on behalf of BRGM.
Christophe Mouvet (PhD, hydrogeochemist) is project leader on the topic

of Contaminated soils, sites and sediments within BRGM Research Directorate. He is the stimulating person of the working group set up by the French Ministry of Environment to assess how criteria H14 and H15 of the EU Directive on wastes can be applied to sediments disposed of on land.
Philippe Négrel, (PhD in Geochemistry and Ability to supervise research work) is presently Deputy Head of the Metrology Monitoring Analysis Department and Research project leader for the Isotope thematic within BRGM Research Directorate. He applied isotopes for studying the transport and quantification of dissolved and particulate element flux in rivers; the continental erosion; the element flux in marine environments: estuaries, coastal erosion, and transport of solid and dissolved matter.

Ivana Teodorovic of the University of Novi Sad, Serbia.
Dr. Teodorovic's research interest covers ecotoxicology - mainly aquatic toxicology, but other interests include water management issues and environmental policy in general. In 2006 she was the cofounder of LECOTOX, Laboratory for Ecotoxicology at UNSFS (www.lecotox.net). Since 2005 till the end of 2010 she was the president, while since January 2011 will act as a vice-president of IAD (International Association for Danube Research – www.iad.gs), the oldest professional association (founded in 1956) in the field of aquatic ecology and water management in the Danube River Basin, with observer status in ICPDR. Since May 2010 acts also as a vice-president of SETAC CEE Branch. Dr Teodorovic is/has been participating in many national (Serbian) and several international/regional research projects and coordinated a few so far. Publishes mainly in the field of ecotoxicology and environmental policy. She is/has been reviewer for several journals and serves as a section editor of River Systems.

Damiá Barcelò of IDAEA-CSIC, Barcelona, Spain, has been involved in SedNet from the start.
Dr Barceló is a full-time Research Professor at the Institute of Environmental Assessment and Water Studies IDAEA-CSIC and the Head of the Environmental Chemistry Department (Barcelona, ES). Since May 2008, he has served as the Director of the Catalan Institute of Water Research (ICRA) (Girona, ES). He has published more than 512 scientific papers in scientific journals and has a Hirsch Index of 60. He is the editor of 13 books on environmental analysis and a co-author of a pesticide book. Other relevant activities include the following: networking experience at the EU (1997-2002); coordinator of the Waste Water Cluster (2002-2004), EMCO (2004-2007) and INNOVA MED (2007-2009) and partner of projects related with water and soil quality at the European Union Level. He has been supervising 24 Ph.D. theses on environmental analysis (1992-2008). In November 2007, he received the Spanish Prize King Jaime I on the Protection of the Nature.
Dr. Barceló's scientific focus is on method development and monitoring of priority, new and emerging pollutants, including endocrine disrupting compounds, using advanced mass spectrometric analysis such as LC-MS/MS and hybrid instruments like LC-Q-TOF-MS and LCMS-MS-LIT combined with bioassays, biosensors and endocrine effect studies.

The Steering Group is very pleased with these new members.
If you are interested in playing a strategic role in SedNet and would like to consider a position in the Steering Group, then please contact the SedNet secretariat.

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Invitation to participate to the public consultation on the continuation of LIFE+

A public consultation on the financial instrument for the environment for the period 2014-2020 (continuation of LIFE+) has been launched, and will be open until 15 February 2011.
You are warmly encouraged to participate to this consultation. A high level of response is strongly needed in order to ensure the best future

EU funding for the environment!

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Legal opinion on sediment management

There are several EU directives with relevance for sediment management, but only in some of them the word sediment can be found. This leads to discrepancies and uncertainties when dealing with sediments. Another question can be how these directives may be of use to solve sediment problems.
Due to a changing environment, increasing amounts of dredged sediments, new requirements etc. the Hamburg Port Authority together with the German Federal Waterways Administration recently developed a River Engineering and Sediment Management Concept for the Tidal Elbe. The concept has to fulfill not only engineering demands, but also supports ecological requirements. Still ongoing contamination of Elbe sediments from the entire catchment is a challenge not only for the Port, but also the Elbe community.
On this background Prof. Rüdiger Breuer, Köln, undertook a thorough examination of existing legislation. The study clarifies whether the measures contained in the concept are consistent with the requirements and objectives of the European and German law.
This study is now being published under the title “Sediment Management for the Elbe”.
Unfortunately the legal opinion as well as the Concept are only available in German. The book can be bought at Nomos-Verlag, a summary can be found here.
The River Engineering and Sediment Management Concept for the Tidal Elbe can be downloaded here.

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German Working group on "Sediments and Water Quality"

The Gesellschaft Deutscher Chemiker (GDCh) is the largest chemical society in continental Europe with members from academe, industry and other areas. The society was founded in 1949 but builds on a long tradition that began in 1867 when its first predecessor organization, the Deutsche Chemische Gesellschaft was founded in Berlin. The work of the society is structured by divisions and working groups, among them the Waterchemical Society. Under the umbrella of the Waterchemical Society in 2002 a working group on "Sediments and Water quality" was established. The recent meeting of this group was held in May 2010 in Frankfurt/Main. One of the topics dealt with the occurrence of bound residues in sediments. Another one dealt with chemometric aspects of sediment assessment.

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Non-extractable residues (NER) in aquatic sediments

Non-extractable residues (NER), also called bound residues, have been studied for a prolonged period of time. Particularly, the incorporation and fixation of pesticides in soil as non-extractable residues has been investigated since the early 70'ies. Although the aquatic particulate matter is also highly affected by anthropogenic organic contaminants studies on the formation of aquatic bound residues are rarely reported and have focused mainly on the interaction of xenobiotics with dissolved organic matter DOM but ignored the sediments. Noteworthy, in a bound state several environmentally relevant properties of pollutants are alterated significantly including bioavailability, toxicity, metabolisation and mobility. Hence, for a comprehensive view on the contamination of

riverine systems the non-extractable fraction in sediments has to be considered additionally.
In urban and industrialized regions the organic matter in riverine sediments is highly controlled by the anthropogenic input due to enhanced emissions of organic pollutants. The importance of NER for the environmental evaluation of man-made chemicals has been demonstrated by investigations on DDT and its metabolites in industrially higly affected sediments and adjanced surface and ground water systems. Main focus has lain on the influence of aquatic NER for its distribution and long term behavior in both compartments, the water phase and the particulate matter.
Generally, the distribution of the bound DDT-related compounds (DDD, DDE, DDMS, DDM, DDCN, DDA etc.) was found to differ distinctly from the substances distribution within the extractable fraction. The main metabolite of the anaerobic degradation pathway (DDD) was most abundant in the sediment extracts, but occurred only in insignificant concentrations in the bound fraction. The most abundant DDT-metabolites released from NER were DBP, DDA and DDM. The overall amount of bound DDT-related compounds was in the same range as compared to the extractable fraction.
Since most of the DDT metabolites are lipophilic, they do not contribute significantly to the water contamination. However, this is not valid for DDA, which exhibits an acidic functional group leading to enhanced water solubility. Therefore, DDA represented the most important DDT related contaminant in ground as well as surface water samples. Based on stable carbon isotope analysis the origin of DDA in more remote ground water shallows was attributed to the origin of DDA from riverine sediments. In particular, the bound DDA residues were pointed out to be the most important sources for DDA water contamination. Hence, it was evident, that metabolism in combination with the formation of NER has a major influence on the distribution and the impact of the DDT contamination on the aquatic environment.

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Lower pollution in water and sediment – New challenges for chemometrics

In the aquatic environment, there are always different compartments to be taken into account (sediment, suspended matter, filtrate). Next to a tremendous number of possible parameters to be measured this will unconditionally lead to a large amount of data not easy to be surveyed. This can be dealt with chemometrics, i.e. multivariate statistical methods of data evaluation. Typical means are those of unsupervised learning (without previous knowledge) like cluster analysis and factor analysis and those of supervised learning (with structures or groups within the data set already known) like discriminant analysis.
These techniques have been used to interpret the results of an investigation of the German river Saale during the years 1993/94 [1]. Sediments had been taken at 29 sampling sites along the whole river. After drying and sieving (< 20 µm), a microwave assisted digestion with aqua regia had been performed to enable the determination of 14 metals. A cluster analysis according to Ward performed for this data set revealed three distinct groups of sampling sites: upper course, middle and lower course, and barrages in the upper course. This can be interpreted in such way that sediments are differently loaded with metals in these three sections. The three groups could be affirmed by discriminant analysis. In order to get a better knowledge of the reasons of the grouping and of discharger and influents along the Saale, factor analysis has been used. In the upper course, leather industry (characterized by Cr) and the

Thuringian slate mountains (Co, Mn, Ni) form important factors. In the middle and lower course, two significant dischargers are identified: the chemical works Schwarza (factor loaded with Pb and Zn) and Buna (factor loaded with Cu and Hg), respectively.
As the investigation had taken place right after the expiration of the German Democratic Republic with its low environmental standards, impacts in sediments have been high at that time. Applying chemometric means might therefore be more difficult for data sets of more recent investigations of sediments in the river Saale. In that case, newer methods like cluster imaging or support vector machines might be helpful. However, another case study of waterbodies in the Polish Tatra Mountains [2] shows that chemometric techniques are also helpful for the interpretation of investigations in low or unpolluted areas. Within this study, in filtrate of 22 water samples 35 elements and classical water parameters have been determined. A cluster analysis according to Ward revealed the principal separation of the sampling sites into those from Western Tatras and those from High Tatras with the exception of one sampling site from Western Tatras that grouped with those of High Tatras. Hence, the chemometric data evaluation gives a strong hint that rechecking the border of the two mountain areas should be done. Furthermore, a difference of samples taken in different months could clearly be shown.
With this second case study in mind, there still seem to be good possibilities also helping to interpret current studies of sediments from the river Saale by chemometrics, which is checked presently.

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The role of sediments for microbial water quality under a changing climate

SComputer-based climate change projections for Northern Europe involve changes in surface water temperatures as well as in the patterns, intensities and duration of precipitation and droughts. Heavy rainfall and run-off may promote the entry of faeces-derived microbial pathogens into surface waters and alter their transport and dissemination within the water bodies. Rising water temperatures may affect the survival and growth of these faecal microbes, however may also provide favourable growth conditions for pathogenic micro-organisms that are naturally present in these waters. Two projects within the German departmental research programme KLIWAS (2009-2013; www.kliwas.de/) by the German Federal Ministry of Transport, Building and Urban Affairs, aim to investigate the potential effects of climate change on microbial water quality in coastal and inland waters. The research area covers the German North Sea coast of Lower Saxony, the Baltic Sea coast of Mecklenburg-Western Pomerania as well as the major inland waterways. The role of sediments and sediment re-suspension for microbial water quality is one of the main focal points of these two projects. Sediments are believed to be a refuge for faecal and pathogenic bacteria that otherwise would not withstand unfavourable conditions – e.g. nutrient limitation or cold temperatures – in the water. Within the research program, we thus enter the question whether 1) re-suspension of sediments may influence microbial water quality in the cause of minor or

major flood events and whether 2) contaminated sediments themselves may pose a human health risk. While in inland waterways (KLIWAS project 5.03), our main concern is with the faecal contamination of sediments and the role of flood events for microbial water quality, priority is given to the role of rising water temperatures for the propagation of naturally occurring pathogens along the coastlines (KLIWAS project 3.04). The special focus of the latter project lies on pathogenic Vibrio bacteria, such as V. vulnificus, which have been constituting an increasing problem during hot summer events at coastal beaches, particularly in the Baltic Sea. The detection of Vibrio spp. is not regulated by the European Bathing Water directive and voluntary tests by the governmental public health institutes in Lower Saxony and Mecklenburg-Western Pomerania were so far limited to water samples. Preliminary results of our study suggest, however, that these potential pathogens may occur in significantly higher numbers in sediments than in water, thus posing a potential human health risk that has so far been neglected.

Both projects aim at contributing to a fundamental understanding of the processes that drive microbial contamination of sediments and surface waters. Information is compiled for a future-oriented health risk management that considers both public health and safety provisions for workers handling sediments in German waterways and accounts for climatic trends.

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Sediment Quality Guidelines (SQG) for freshwater in Flanders

Ward De Cooman, Martin Verdievel & Rudy Cautaerts – Flemish Environment Agency (VMM) – Division Reporting Water (ARW)

The sediment monitoring programme of the Flemish Environment Agency (VMM) in Flanders (the northern part of Belgium) is a monitoring programme in which chemical, biological and ecotoxicological data are generated from collected sediment. More than hundred chemical parameters are analysed, the benthic community is inventoried and both the pore water as well as the sediment is tested in bioassays of samples from more than 600 different locations. By monitoring these locations in a cycle of 4 years the results of a sediment quality assessment of more than 1500 samples are gathered in a database.
These data of the routine monitoring programme have been used to calculate different types of sediment effect concentrations (SEC's). Lowest Effect Level (LEL) and Severe Effect Level (SEL) *(Persaud et al. 1992)* values are calculated as ecological SEC's. The Threshold Effect Level (TEL) and Probable Effect Level (PEL) values are calculated as ecotoxicological SEC's *(MacDonald et al. 1992, MacDonald 2003, Smith et al. 1996)*. These SEC's were derived for single compounds, both for individual heavy metals, polycyclic aromatic hydrocarbons (PAH's) as for polychlorinated biphenyls (PCB's) and chlorinated pesticides (OCP). Consensus values were calculated as the average of LEL and TEL (long term objective or good ecological sediment status) and the average of SEL and PEL (acute or short term objective).

Ideally, all sites should reach chemical concentrations below the lowest consensus value or a good ecological sediment status. If we use these values, only 4% of the more than 1000 samples in Flanders seem to be nonpolluted. If the first aim would be to obtain a good ecological sediment status for all substances on all sites, 96% of all sites in Flanders would have to be remediated dramatically. In view of management this is not feasible in short time. Therefore the first aim is to have all concentrations below consensus value 2 (or the average of SEL and PEL) as soon as

possible. Over a longer and more realistic period in time, it is proposed that all sites should achieve consensus values 1 (the average of LEL and TEL). This resulted in the implementation of sediment quality guidelines based on these consensus values 1 in the Flemish legislation on 9 July 2010.

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Decision support system (DSS) for investigative monitoring of freshwater sediments in Flanders

Ward De Cooman, Martin Verdievel & Rudy Cautaerts – Flemish Environment Agency (VMM) – Division Reporting Water (ARW)

TIn cooperation with other agencies and under the care of the Coordination Committee Integrated Water Policy, the Flemish Environment Agency (VMM) has developed a methodology to obtain an efficient and cost effective aproach to prioritise the investigation (and remediation) of contaminated sediments in surface waters of Flanders. In a first phase, the VMM created a decision support system (DSS) based on a multicriteria analysis (MCA). By analysing monitoring results of more than 5000 samples gathered in a large database, contaminated sediments are ranked to differences in quality status. In a second phase, a final ranking of contaminated sediments with an ecological potential for remediation is made in cooperation with experts and watercourse managers.

In the multicriteria analysis model criteria are grouped in 3 levels. (1) Quality of sediments, (2) quality of the aquatic ecosystem and (3) criteria that enhance a successful ecological recovery after remediation. By assigning weights to criteria and using statistical techniques like standardization and imputation, an ecological investigation priority (EIP) is calculated. Ranking the samples is done by using the EIP.

In an additional consultation round all water course managers get the opportunity to make a thorough evaluation of the set of theoretical priorities and adjust this with the in situ situation by

(1) controlling the quality of input data in the DSS model,
(2) discarding and adjusting data in the model taking into account extra relevant information that can not be fitted into the model,
(3) adding extra relevant known upstream discharges that, after expert judgment, still can affect the sediment quality,
(4) paying extra attention to water course imbedded in an area sensitive to erosion and
(5) paying extra attention to contaminated banks where no real chance of ecological recovery is expected.

By using a DSS-model to set priorities in the investigation of contaminated sediments in surface waters of Flanders, a more efficient and cost effective remediation approach is obtained. Cooperating closely and combining forces and knowledge of different environment agencies leads to a broader level of consensus and support. As a consequence this leads to better sanitation strategy and solutions.

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Global Threats to Human Water Security and River Biodiversity

Rivers maintain unique biotic resources and provide critical water supplies to people. The Earth's limited supplies of fresh water and irreplaceable biodiversity are vulnerable to human mismanagement of watersheds and waterways. Multiple environmental stressors, such as agricultural runoff, pollution and invasive species, threaten rivers that

serve 80 percent of the world's population. These same stressors endanger the biodiversity of 65 percent of the world's river habitats putting thousands of aquatic wildlife species at risk. Efforts to abate fresh water degradation through highly engineered solutions are effective at reducing the impact of threats but at a cost that can be an economic burden and often out of reach for developing nations.
An analysis, reported in the September 30 issue of "Nature" represents the first global-scale initiative to quantify the impact of these human-induced stressors on human water security and riverine biodiversity. Map figures show global threats to River Biodiversity (BD) and global threats to Human Water Security (HWS) accounting for beneficial investments in infrastructure. See for detailed info www.riverthreat.net.

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Other networks

SedNet is interested in cooperation with other networks. The SedNet steering group invites regularly representatives of other networks, to discuss whether and where we can strengthen each other.
Recently, representatives of the following networks attended a SedNet steering group meeting.

The COMMON FORUM on Contaminated Land in the European Union

COMMON FORUM, initiated in 1994, is a network of contaminated land policy makers and advisors from national ministries and Environment Agencies in European Union Member States. The general objectives of COMMON FORUM are to develop strategies for the management and treatment of contaminated sites and for land recycling with respect to "sustainable resource protection" for contaminated land and groundwater.

COMMON FORUM intends to continue to provide this "mutual professional support" by:

- being a platform for exchange of knowledge and experiences, and for initiating and following-up of international research or demonstration projects,
- establishing a discussion platform on policy, research, technical and managerial concepts of contaminated land,
- offering an exchange of expertise to the European Commission and to European networks (such as NICOLE, EURODEMO+, etc.).

Within the network, the Risk Based Land Management Concept, developed in 2000, could be one option for solving the problem of the management and reclamation of Contaminated Land in Europe. The proposed solutions can be characterised by three elements:
1] Suitability for use: This is achieved by reducing human health risks and ecological risks as necessary to permit the safe (re)use of the land. It is focussed on quality requirements of the land for uses and functions.
2] Protection of the environment: For example preventing further spreading of pollution by surface water and groundwater. Environmental protection of soils as a resource may also lead to policies favouring redevelopment of brownfields over greenfields.
3] Long term care: Sustainable solutions minimise the burden of aftercare. Endless pump and treat solutions or containment walls that require control and maintenance forever may be less desirable in view of the amount of aftercare required.

Sediments being part of the overall environment system (Soil–Sediment–Surface waters– Groundwater), gives a need for a proper analysis of the water–soil cycle functioning for any prevention and remediation action programme.

Therefore CF and SEDNET discussed this year the opportunity of better addressing sediments in this policy concept (through common technical guidance document, common tools for risk assessment and risk management). This could lead to:

- a new concept, a “sustainable risk based land management” to be implemented at the river basin scale,
- the identification of RTD gaps for better decision-making.

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Estuarine & Coastal Sciences Association, ECSA

Although ECSA is a charity registered in the UK, it is an international organisation that is dedicated to the study of all aspects of estuarine and coastal marine science, as well as the application of science to conservation and environmental management. Whereas the traditional focus of ECSA lies within Europe, its activities, interests and membership reach out to many other global regions. To date, ECSA has been involved in the organization of nearly 50 international conferences throughout the world, averaging one or more major international events each year. Future ECSA conferences are currently being planned for South Africa, China and various locations across Europe. In addition, ECSA organizes and supports ‘local’ meetings that provide a forum for the detailed discussion of individual estuaries or coastal areas. ECSA occasionally also arranges scientific workshops; for example, one on macronutrients is planned to be held in Plymouth in 2011. It will focus on practical techniques for the analysis of nitrogen and phosphorus (including the organic fractions) and it will also involve contextual presentations from internationally recognised researchers. If you are interested in attending, please contact Dr Mark Fitzsimons (m.fitzsimons@plymouth.ac.uk).

ECSA has an associated international journal: Estuarine and Coastal Shelf Science; it also supports the production of a variety of other scientific publications, including a Bulletin for members with two issues each year. It runs an email newsletter, produces the occasional publication: Coastal Zone Topics, and has published a number of handbooks that are in the process of being updated.

Through its membership ECSA has strong interests in sediments, including fine sediments and the interactions between sediments, sediment chemistry and biota and the ecology of estuaries and shallow coastal waters. When infrastructure developments are being considered in these environments, sediments are often characterized in terms of a few basic physical variables and parameters (e.g. location, size and sorting). This is a start, of course, but it is certainly not sufficient when the sediments are mud or muddy mixtures of sand and mud, partly because of the cohesive nature of fine-grained sediments, but also because an important factor to consider is biology. It is well known that biology can influence erosion thresholds and erosion rates of fine sediment and can enhance aggregation of fine-grained particles to form flocs, which have completely different settling characteristics to the original particles. An obvious example of where biology dominates the local hydrodynamics and sediment transport is within the saltmarsh environment. Perhaps less obvious, but nevertheless of importance (certainly local importance) are the effects that organisms such as e.g. mysid shrimps, cockles, mussels, snails and microalgae and bacteria have on sediment erosion, transport and behaviour.

ECSA membership is strongly represented by those concerned with environmental physical processes, environmental chemistry and ecology like measurements of the benthic nitrogen flux from suspended estuarine

particles, using mini-annular flumes, impacts of water injection dredging on water quality and ecotoxicity, physical behaviour and transport of fine sediment within estuaries, benthic fauna, flora and ecology of muddy and non muddy estuaries and coastal waters.

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Upcoming events

2011:

6-9 April 2011: 7th International SedNet conference “Sediments and Biodiversity: bridging the gap between science and policy”, hosted by Thetis SpA, Venice, Italy.
www.sednet.org

26-28 April 2011: Symposium on two-phase modelling for sediment dynamics in geophysical flows. Paris, France.
www.shf.asso.fr

2-6 May 2011: Coastal Sediments ’11; 7th International Symposium on Coastal Engineering and Science of Coastal Sediment Processes. Miami, Florida, USA.
http://coastalsediments.cas.usf.edu/

19-23 June 2011: 12th International Symposium on the Interactions between Sediments and Water, Dartington, Devon, England. Organised by the International Association for Sediment Water Science (IASWS)
www.IASWS.org and www.geog.plymouth.ac.uk/IASWS2011

10-11 November 2011: CEDA Dredging Days ‘Dredging and Beyond’, conference centre Ahoy, Rotterdam, the Netherlands.
www.cedaconferences.org/dredgingdays2011

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