# Editorial

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This special issue of the *International Journal of Environment and Pollution* is to present the latest research results of modelling for the management of environmental pollution problems in a number of areas covering solid waste, wastewater, water resources, sediment, air pollution, as well as soil and groundwater. A broad range of topics were selected, including municipal solid waste management, waste composting, air pollution abatement and air quality planning, water resources management, soil erosion,

environmental chemistry, contaminated site management, and environmental risk assessment.

This issue includes five papers on environmental modelling for air pollution management. One of them developed a 3-D multi-box air quality prediction model and proposed the concept of Urban-Airshed Carrying Capacity (UACC) for managing the urban air pollutant emission abatement through a case study in an industrial city of northern China. The model was used to simulate the daily average concentrations of $SO_2$, TSP and $PM_{10}$ in each sub-box while various air pollutant transport mechanisms were taken into account, including wind turbulence, dispersion and diffusion, chemical reaction, phase change, and dry/wet depositions. The UACC was defined as the maximum allowable pollutant emissions from the point and area sources without violating the local ambient air quality standards, and its calculation consisted of a six-step procedure where the developed 3-D model played a crucial role. One paper presented the options for modelling air pollution and emission source apportionment by combining traditional multivariate statistical methods (i.e., cluster analysis and principal components analysis) with advanced approaches such as Chemical Mass Balance (CMB). A number of receptor-oriented methods were applied to two different air pollution case studies in Vienna (Austria) and Cracow (Poland) for the evaluation of source contribution to $PM_{10}$ concentration, including CMB, principal components analysis-absolute principal components scores (PCA-APCS), positive matrix factorisation (PMF), and UNMIX model. Another paper investigated the effects of meteorological conditions (i.e., such as temperature, precipitation, wet day frequency and cloud cover) on local urban air quality in Delhi, India through the multi-regression approaches. The pollutants of interest included Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM), sulphur dioxide ($SO_2$) and nitrogen dioxide ($NO_2$). The findings from this paper indicated that the local meteorological conditions had significant impacts on the air quality of Delhi. The fourth paper applied a prognostic model called TAPM (The Air Pollution Model version 3) for the first time to simulate carbon monoxide (CO) concentrations in Bangkok, Thailand. The modelling experiments illustrated that TAPM would have a good accuracy in simulating CO concentrations during the winter season when a well-defined boundary layer existed over Bangkok, but the simulation accuracy was decreased during the summer monsoon season due to the inability of TAPM to simulate deep convection. The last paper for air quality modelling deals with uncertainty issues associated with atmospheric dispersion models. An Error-Component Adjustment approach for Atmospheric Dispersion Modelling (ECA-ADM) was proposed while the stochastic component was based on Conditional Autoregressive (CAR) modelling, and the method was illustrated using field tracer experimental data from Kincaid power plant in Illinois, USA. The posterior inference and model choice were computationally assessed through Markov Chain Monte Carlo (MCMC) techniques, the Deviance Information Criterion (DIC), and Mean Squared Predicted Error (MSPE).

Two papers are related to environmental modelling for solid waste management. One of them deals with optimisation of municipal solid waste management under uncertainty by developing a hybrid Interval-Fuzzy Possibilistic linear Programming (IFPP) model, through the combination of Fuzzy Possibilistic Programming (FPP), Interval Mathematical Programming (IMP), and the Mixed Integer Linear Programming (MILP) techniques. The modelling solutions were presented as combinations of deterministic, interval and possibility-distribution information, and could facilitate communications for different types of uncertainties. The second paper reported

the optimisation of the co-composting process with rice straw waste and sludge from a hospital wastewater treatment plant in northern Thailand. The methods of composting were turned windrow and aerated pile systems, and the experiments were conducted by varying the mixing ratios of rice straw and hospital sewage sludge for composting. Based on the experimental modelling results, the correlation of chemical properties with time, moisture content, and initial C/N ratio was also developed for finding the optimal composting conditions. In this special issue, we also selected four papers in the field of environmental modelling for water quality and ecological management. One paper investigated the primary metabolites and possible bio-degradation pathways of nonylphenol (NP) during the biological wastewater treatment process using Sequencing Batch Reactor (SBR). The experimental results illustrated that the NP primary metabolites included a series of short-chain alkyl phenols with butyl, amyl or hexyls and benzene acetic with different methyl branch structures. The results would provide important information for water quality management due to the estrogenic effects of the degrading products from wastewater treatment plants. Another paper examined the sediment issues for the Lower Yellow River (LYR) in China by developing a numerical model for sediment transport. After calibration and verification using 40 years of measured data from the Sanmenxia reservoir and 25 years of data from the LYR in terms of the sedimentation processes, the developed model was applied to investigate the relationship between the sedimentation in the LYR and different incoming water-sediment conditions due to various reservoir operational modes. The third paper in water quality and ecological management field investigated the relationships between the Normalised Difference Vegetation Index (NDVI) and the climatic and hydrological parameters in a large-scale watershed (i.e., the Yellow River basin as well as its sub-regions) in China through linear correlation and partial correlation analysis methods. The investigated climatic/hydrological parameters include precipitation, temperature, runoff and runoff coefficient. The modelling results indicated close correlations between monthly NDVI values and precipitation as well as temperature, and such results would be useful for effective decision making in ecological management. The last paper in the field of water quality modelling reported the evaluation of socio-economic impacts on water quality in a southern province of China by using the comprehensive water quality index method, and the relationship between economic development (i.e., per capita GDP) and water pollution was established using the Environmental Kuznets Curve (EKC) model.

This special issue also contains five papers in the areas of modelling for contaminated soil and groundwater systems as well as risk assessment. One of them proposed an integrated 3-D physical-numerical modelling approach for simulating petroleum contaminants (i.e. benzene) transport and the associated enhanced in situ bioremediation processes within the heterogeneous subsurface. A 3-D multiphase multi-component numerical model was presented to describe the subsurface processes while the experimental results from a 3-D physical model were used for verifying the numerical model. The second paper developed a Fuzzy Multi-Criteria Decision Analysis (FMCDA) approach for contaminated soil and groundwater management under uncertainty. Eight remediation evaluation criteria were selected ranging from ‘cleanup time’ to ‘maintenance requirement’, and each criterion was divided into five fuzzy-sets from ‘low’ to ‘high’. A fuzzy matrix multiplication process was then proposed to produce the fuzzy membership values of the alternatives and to calculate their utility values for ranking. The FMCDA method was applied to a case study on remedial alternative selection for a contaminated site in western Canada. The third paper reported a simple

method to examine the effects of Natural Attenuation (NA) processes in the groundwater under the abandoned waste disposal sites. The method is based on computing the ratio of normalised concentrations of tracer to suspected attenuation components in the groundwater, and the normalised ratio is expected to increase under natural attenuation condition (i.e., >1), but to remain constant (i.e., =1) in case of no attenuation. The method was applied to several abandoned landfill sites in the vicinity of Berlin, Germany. Several tracer components were selected (including $Na^+$, $Cl^-$, B, $HCO_3^{2-}$, and CFC F12), while the Total Organic Carbon (TOC) was selected as a natural attenuation indicator. The fourth paper developed an optimal solute transport simulation approach within the heterogeneous aquifer through coupled inverse modelling which incorporated the information from both the measured transmissivity data and solute concentration data, and the application of this method to a two-dimensional subsurface transport problem indicated improved accuracy for simulating the solute concentration field. The last paper proposed an integrated framework for environmental risk assessment of contaminated groundwater system under uncertainties. The fuzzy transformation method was used for simulating contaminant transport and fate in the subsurface under fuzzy parameter uncertainties. Five criteria were used to evaluate the possible adverse impacts of contaminants where the criteria weights were estimated using Fuzzy Analytical Hierarchical Process (FAHP), and the fuzzy relation analysis was then applied to assess the integrated risk level which ranged from 'low to moderately high' to 'moderate'. The method was applied to a case study where the risks posed by four petroleum hydrocarbon components were evaluated, including benzene, toluene, ethylbenzene, and xylenes (BTEX).

In summary, the effective management of environmental pollution has become one of the most important goals pursued by governments, industries, communities, and researchers. Environmental modelling is an effective measure for facilitating such an objective by providing a valuable framework for describing complex environmental processes and interactions, evaluating a variety of environmental problems, investigating sound pollution mitigation approaches, and examining different environmental management strategies. This special issue reports the latest research results in environmental modelling for a variety of areas and illustrates the effectiveness of modelling for pollution management, and we wish to extend our thanks to those who contributed to this issue.