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# Extended statistical entropy analysis as a quantitative management tool for water resource systems

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The use of entropy in hydrology and water resources has been applied to various applications. As water resource systems are inherently spatial and complex, a stochastic description of these systems is needed, and entropy theory enables development of such a description by providing determination of the least-biased probability distributions with limited knowledge and data. Entropy can also serve as a basis for risk and reliability analysis. The relative entropy has been variously interpreted as a measure freedom of choice, uncertainty and disorder, information content, missing information or information gain or loss. In the analysis of empirical data, entropy is another measure of dispersion, an alternative to the variance. Also, as an evaluation tool, the statistical entropy analysis (SEA) has been developed by previous workers to quantify the power of a process to concentrate chemical elements.
Within this research programme the SEA is aimed to be extended for application to chemical compounds and tested for its deficits and potentials in systems where water resources play an important role. The extended SEA (eSEA) will be developed first for the nitrogen balance in waste water treatment plants (WWTP). Later applications on the emission of substances to water bodies such as groundwater (e.g. leachate from landfills) will also be possible. By applying eSEA to the nitrogen balance in a WWTP, all possible nitrogen compounds, which may occur during the water treatment process, are taken into account and are quantified in their impact towards the environment and human health. It has been shown that entropy reducing processes are part of modern waste management. Generally, materials management should be performed in a way that significant entropy rise is avoided. The entropy metric might also be used to perform benchmarking on WWTPs. The result out of this management tool would be the determination of the efficiency of WWTPs. By improving and optimizing the efficiency of WWTPs with respect to the state-of-the-art of technology, waste water treatment could become more resources preserving.