A novel approach to predict bioirrigation and increase predictability of biogeochemical cycling

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Increasing anthropogenic activities on land and at sea underline the demand for easily applicable indices to effectively predict human mediated changes in ecosystem functioning. Here, we propose a novel bioirrigation index (IPc) that is based on body mass, abundance, burrow type, feeding type and injection pocket depth of bottom dwelling animals. Results from both community and single-species experimental incubations indicate that IPc is able to predict the bioirrigation rate in different sediment types (mud, fine sand, sand). Further, IPc increased the predictability of biogeochemical cycling (i.e. changing concentrations of phosphate, silicate, ammonium, nitrate and nitrite) under different environmental conditions (i.e. sediment type, temperature, faunal inventory, gradients across the sediment water interface), compared to trait based bioturbation potential (BPc). The trait-based index thus demonstrated robustness in the prediction of animal-mediated functional processes that support biogeochemical functions. Additionally our results confirm that biogeochemical cycling is more closely linked to irrigation traits than to sediment reworking traits. Based on these findings we argue that trait-based indices provide a useful tool for the prediction of ecosystem processes as effect traits provide a direct link to the behavioral mechanisms that drive ecosystem functioning.