Integrating knowledge and getting insights on chemosynthetic-based ecosystems: a modelling approach

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Remote chemosynthetic-based ecosystems, such as deep-sea hydrothermal vents, are difficult to study and new integrative methods are needed to further explore their functioning. In forty years of research, significant insights have been gained on vent field geology, on the chemistry of emitted fluid and on the ecology of the communities inhabiting hydrothermal ecosystems. The high spatio-temporal variability of the hydrothermal fluid has a strong influence on species distribution. However, the mechanisms determining the species response to this variability is still poorly understood. In order to investigate this issue, a modelling approach is presented. Data collected for more than 20 years on the Eiffel Tower edifice, on the Lucky Strike vent filed (Mid-Atlantic Ridge) were integrated in order to identify meaningful elements for our problem. An integrative study of the faunal biomasses on the edifice showed that these are dominated by the mussel Bathymodiolus azoricus. This bivalve is likely to have a significant influence on the ecosystem functioning and is thus the object of a first model. Once parametrized, the model showed promising results when compared to existing literature and provided quantitative estimates of unknown fluxes. The simulation of hydrothermal flow interruption provided some hypotheses on the mussel biomass response to its environment variability.