ON METHODS OF REPRESENTATION, VISUALIZATION, AND ANALYSIS OF LARGE-SCALE DATA SETS IN THE EXPLORATION OF SYSTEMIC RISKS: AN EXAMPLE OF COLLAPSE ANALYSES IN FOODWEBS

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In this presentation, we show results of the analysis of collapse dynamics in ecological food webs. A food web is represented by a weighted directed graph, in which links represent flows of energyor matter (such as carbon, nitrogen, or phosphorus), while nodes represent the corresponding stocks in species or species groups. Examining the consequences of the collapse (removal) of each node, we model the resultant dynamic responses of entire food webs and evaluate a range of robustness indicators (such as the change in total biomass or the number of secondary extinctions). Across the studied food webs, the numbers of nodes typically vary between 20 and 60, and their connectance is high. Collapse analyses are carried out for about 100 empirically derived food webs, resulting in several thousand collapse trajectories. Based on this large-scale data set, we investigate statistical relations between robustness indicators and structural indicators of the analyzed food webs, aiming at revealing network topologies conferring higher resilience to species extinctions. Our results are obtained using specially designed software for consistently evaluating robustness indicators and structural indicators, for systematically assessing correlations between these indicators, and for effectively visualizing the results.