[P14] Cascading failure dynamics on multiplex networks: Strength of weak layers

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Many real-world complex systems across natural, social, and economical domains consist of manifold layers to form multiplex networks. The multiple network layers give rise to nonlinear effect for the emergent dynamics of systems. Especially, weak layers that can potentially play significant role in amplifying the vulnerability of multiplex networks might be shadowed in the aggregated single-layer network framework which indiscriminately accumulates all layers. Here we present a simple model of cascading failure on multiplex networks of weight-heterogeneous layers. By simulating the model on the multiplex network of international trades, we found that the multiplex model produces more catastrophic cascading failures which are the result of emergent collective effect of coupling layers, rather than the simple sum thereof. Therefore, risks can be systematically underestimated in single-layer network analyses because the impact of weak layers can be overlooked. We anticipate that our simple theoretical study can contribute to further investigation and design of optimal risk-averse real-world complex systems.