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Cascading processes on multiplex networks: Impact of weak layers KYU-MIN LEE, KWANG-IL GOH, Korea University — Many real-world complex systems such as biological and socio-technological systems consist of manifold layers in multiplex networks. The multiple network layers give rise to the nonlinear effect for the emergent dynamics of systems. Especially, the weak layers plays the significant role in nonlinearity of multiplex networks, which can be neglected in single-layer network framework overlaying all layers. Here we present a simple model of cascades on multiplex networks of heterogeneous layers. The model is simulated on the multiplex network of international trades. We found that the multiplex model produces more catastrophic cascading failures which were the result of collective behaviors from coupling layers rather than the simple summation effect. Therefore risks can be systematically underestimated in simply overlaid network system because the impact of weak layers is overlooked. Our simple theoretical model would have some implications to investigate and design optimal real-world complex systems.

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