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Dominant transport pathways in oceanic and atmospheric flows

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The last decades have seen very important developments in the Lagrangian description of geophysical fluid transport. Most of the new techniques have focused in the determination of barriers to transport, or of coherent regions with little fluid interchange with the surrounding medium. Less tools are available to identify the actual routes of transport, the dominant pathways along which fluid particles travel and reach different regions.
Building on tools from network theory, applied to a discretization of the advection dynamics driven by available velocity fields, we determine optimal paths connecting different regions, quantify the fraction of transport following alternative routes, and highlight regions crossed by a large number of pathways. The approach is illustrated for the surface circulation of the Mediterranean Sea and for an atmospheric blocking event over Eastern Europe.