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A system for the optimal management of transportation systems affected by recurrent adverse weather conditions

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The occurrence of adverse (extreme) weather events on traffic networks represents the cause of significant costs both for the private and the public sectors with related effects on economy, safety and environment.

High-resolution meteorological data, derived from ground truth and specific models, coupled with optimization techniques can give a valuable support to traffic managers in order to avoid or, at least, mitigate the effects that such events can have on traffic circulation.

The authors present a Decision Support System (DSS), fully developed in Matlab environment, able to integrate the information generated by a high resolution Meteorological Limited Area Model (i.e., COSMO LAMI I 2,8), a meshed meteorological network and an original macroscopic traffic model, aiming at suggesting a set of control actions toward an optimal management of the traffic system.

In particular, the DSS is based on: 1) an optimisation module supporting decision makers in allocating or reallocating resources along the traffic network during the preventive phase and the pre-operative phase; 2) a dynamic assignment algorithm, based on Variable Message Signs protocol, which provide motorists with alternative paths to be used in case of road closing and traffic congestion.

The performances of the whole DSS have been evaluated with reference to a real case of study relevant to an Alpine motorway frequently interested by accidents or disturbances due to intensive snowfall and ice formation.