Multiobjective 4D Optimization of a Trajectory-based Air Traffic Management

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Weather conditions have a major impact on air traffic management in planning as well as in flight. Ever since the volcanic eruptions in 2010 caused enormous disturbance of air traffic over Europe, much effort has gone into the task of finding clear routes to deal with aviation obstacles like ash clouds or hazardous weather. In this contribution the development of a 4D optimization model of a trajectory-based air traffic management is described. The model makes use of a multicriteria cost function which takes into account fuel flow, time, distance and the specialized performance parameters for an aircraft. We create an individual network for each flight in which the Single Flight Routing Problem can be formulated as a minimum cost single commodity network flow problem, widely known as the shortest path problem. Solutions are generated using the A* algorithm, which is a modified version of Dijkstra's algorithm. The Multiple Flight Routing Problem is formulated as a dynamic multicommodity network flow problem. We generate feasible solutions using Lagrangian relaxation in combination with a Lagrangian based heuristic.