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A decision support system for vessel speed decision in maritime logistics using weather archive big data. (English) Zbl 1391.90348

Comput. Oper. Res. 98, 330-342 (2018).

Summary: Speed optimization of liner vessels has significant economic and environmental impact for reducing fuel cost and green house gas (GHG) emission as the shipping over maritime logistics takes more than 70% of world transportation. While slow steaming is widely used as best practices for liner shipping companies, they are also under the pressure to maintain service level agreement (SLA) with their cargo clients. Thus, deciding optimal speed that minimizes fuel consumption while maintaining SLA is managerial decision problem. Studies in the literature use theoretical fuel consumption functions in their speed optimization models but these functions have limitations due to weather conditions in voyages. This paper uses weather archive data to estimate the real fuel consumption function for speed optimization problems. In particular, Copernicus data set is used as the source of big data and data mining technique is applied to identify the impact of weather conditions based on a given voyage route. Particle swarm optimization, a metaheuristic optimization method, is applied to find Pareto optimal solutions that minimize fuel consumption and maximize SLA. The usefulness of the proposed approach is verified through the real data obtained from a liner company and real world implications are discussed.

MSC:

90B50 Management decision making, including multiple objectives
90B06 Transportation, logistics and supply chain management
62P30 Applications of statistics in engineering and industry; control charts
62C05 General considerations in statistical decision theory
90C90 Applications of mathematical programming
90B20 Traffic problems in operations research
90B90 Case-oriented studies in operations research
90C59 Approximation methods and heuristics in mathematical programming

Keywords:

speed optimization; sustainable maritime logistics; weather archive data; liner shipping; particle swarm optimization

Software:

NetCDF

Full Text: DOI

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