

# Features of Europe's air transport network formation during 2020 in the context of the COVID-19 pandemic

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## Abstract:

ICAO's latest analysis of the economic impact of COVID-19 on civil aviation shows that global passenger traffic declined sharply by 60% in the combination second, third and fourth quarters of 2020, equivalent to a reduction of around 2.7 billion passengers compared to 2019 [1,2]. The European system of air traffic flows, which formed over decades, has been partially disrupted. As a response, the aviation industry's efforts have been focused on restarting and ensuring the continued operation of major transport and logistics hubs. The visualization of air traffic will provide a better understanding of the extent of the changes. However, the modelling of large volume spatio-temporal data is often a deeply structured chain of information with a low level of comprehension for the unfamiliar viewer.

The paper aims to visualize the European airspace in a hub network and then identify the most relevant links by considering airports as key points, enhancing the visual experience. The study is built on air traffic data by the OpenSky Network service, which provides access to archived flights [3]. Data sorting and conversion proceeded inside the Google Sheets environment [4]. Due to the FlowMap Blue platform, the data is visualized in a cluster format [5]. The resulting visualization identifies the most important transport network connections and their formation features based on incoming and outgoing flight statistics. The spatio-temporal model of describing data allows quarterly comparison of Europe's air transport system. In turn, this feature allows a visual comparison of traffic data for similar quarters of 2019 and indicates the negative impact of the pandemic on the number of flights. In addition, a study of the formation of the main transport networks through activity statistics determines the term key airport itself and what features make it so.

Due to these achievements, the researchers can improve the strategy for responding to crises caused by local air traffic. By identifying the most important hubs in the European transport network, it is possible to define a list of airports that must operate continuously regardless of circumstances to avoid a collapse, like in 2020. The future development of a sustainable aviation system must have a starting point as to how developed the adaptation component of the system is. The COVID-19 pandemic provided an opportunity to rethink the structure of the entire transport system from the basics [6]. By processing and visualizing flight statistics for 2020, it is possible to observe the unique process of shaping the main transport arteries of European airspace.

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## References

1. <https://www.icao.int/sustainability/Pages/Economic-Impacts-of-COVID-19.aspx>.
2. <https://www.statista.com/statistics/1104036/novel-coronavirus-weekly-flights-change-airlines-region>.
3. <https://opensky-network.org/>.
4. <https://docs.google.com/>.
5. <https://flowmap.blue/>.
6. Gössling, S. (2020). Risks, resilience, and pathways to sustainable aviation: A COVID-19 perspective. *Journal of Air Transport Management*, 89, 101933.