NWP-Seminar

Date: 10 April 2025
Time: 14h00 CEST
Place: MeteoSwiss, Zurich Airport, OPC 1, Room 5-331
Online: see Microsoft Teams link at the bottom of this text

Jan Keiser: The Role of Wind to Estimate Airplane Approach Times

Airports are increasingly operating at the limits of their capacity, with air traffic congestion and runway throughput posing major challenges to air traffic management. This is particularly the case at highly frequented airports like Zurich Airport, located within the complex topography of the Swiss Plateau. Among the many factors influencing runway operations, wind variability plays a key role in determining aircraft approach times — and thus affects achievable landing rates.
This study investigates how wind variability along the approach path impacts the predictability of aircraft arrival times. We develop and compare two simplified models: a constant headwind model (RHM), which assumes the vertical wind profile at the runway threshold applies along the entire descent, and a variable headwind model (GHM), which accounts for spatial wind changes along the glide path. Both models use high-resolution wind fields from the ICON numerical weather prediction model as input.
We compare the conventional distance-based separation method with the adaptive time-based method to investigate the impact on the aircraft landing frequency. Additionally, we simulate optimal sensor placements along the approach to minimize prediction errors. Results reveal notable temporal variability between the RHM and GHM models, with intra-day fluctuations of up to 1.3 min and inter-hourly differences of approximately 0.3 min. Spatial wind variability increases with longer approach distances, further affecting approach times. Our findings suggest that sensor placement towards the centre of the approach distance yields the lowest prediction errors, reducing them to within a few seconds. Furthermore, time-based separation strategies demonstrate potential reductions in approach times by nearly 10 % compared to distance-based methods, offering notable gains in landing efficiency.

In this talk, we will show the results of these studies, present insights into the impact of wind on approach times, and discuss how these findings could help improve runway efficiency in the future.

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We are looking forward to seeing many of you!
Numerical Prediction division of MeteoSwiss

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