JOAS

EDITORIAL

Reviews and responses for

Analysing the Impact of Go-Around Occurrences at Large European Airports

Authors: Benoit Figuet, Rainer Koelle, Esther Calvo Fernández, and Manuel Waltert

Reviewers: Raúl Sáez, Ryota Mori, Xavier Olive

Editor: Xavier Olive

1. Original paper

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2. Review - round 1

2.1 Reviewer 1

In this paper, the authors present an analysis of go-around occurrences in several major European airports, characterizing them in terms of several factors such as fuel consumption. Furthermore, the most remarkable contribution of this paper is the analysis of how these go arounds affect subsequent arrival traffic in terms of time spent in the arrival sequencing and metering area (referred to as ASMA time by the authors).

The contribution is valuable, but I have some remarks that I would like the authors to address:

a) I would like to ask the authors to review the manuscript specifically for English usage, grammar, and overall linguistic coherence. I found the paper hard to follow while reading some of the sections. I highlight some of the issues encountered below (note the list is not exhaustive): - Line 32 to 68: this is such a long paragraph. I recommend the authors to divide it into shorter paragraphs. Several ideas are introduced, so it should be easy to divide the text into 5-6 paragraphs to improve readability. Actually, this is something I noticed throughout the paper, many times the paragraphs are too long, which makes hard to follow what is written. - Line 71: it should be "traffic arriving AT an airport", the preposition is missing. - Line 108: one comma should be removed - Line 116 and 117: first the authors consider metadata is singular and then plural. Both are gramatically correct, but I recommend the authors to be consistent and use one form or the other. - Line 150 and 151: "the actual duration OF a flight between", the preposition is missing

b) In my opinion, the main and most remarkable contribution of this paper is the analysis of the effects that go arounds have in subsequent flights. This is mainly shown in Figure 9, and explained in Section 3.2. However, I think this analysis is rather short and does not provide enough details regarding the go arounds impact on the arrival traffic.

I would like to see a more comprehensive analysis of the plots presented in Figure 9. Furthermore, I think it would be important to link what is presented in the previous sections (e.g., Figures 4, 5, 6,

etc) with the behavior observed in Figure 9.

I do not expect the authors to provide an exhaustive analysis (actually, this could be included in a future publication); however, I would appreciate having at least some preliminary analysis. For instance, from all the airports considered in this work, maybe there is one with a higher number of heavy aircraft go arounds. If that is the case, does that affect what it is observed in Figure 9? This is just an idea, but similar analysis could be done with the market segment or the go around rate per airport.

Probably the authors already have this information, so what I am missing in the paper is this link from the characterisation of the go arounds and their effect on the ASMA times of subsequent flights.

c) In line 146, the authors mention that they consider a mass of 60 tones for the A320. Could the authors present this mass as a percentage of maximum landing weight (MLW) as well? As not all the readers might be familiar with the masses of the A320, I think it might be better to present this value as a percentage of MLW rather than the value in tones (both could be kept though).

d) The authors mention in lines 270-273 that the results presented in this paper might be affectd by the fact that some of the data used for their work was from the COVID19 period. I would like to see more details about how this issue could affect the results.

Actually, why do not the authors use data from 2022 to 2023 and repeat the analysis? This might lead to more realistic results. I am afraid that the results could change quite significantly... Take for instance the go around rate per airport. During the COVID19 period, there was way less traffic. Therefore, it is easy to conclude that the go around rate must have been lower as well.

2.2   Reviewer 2

This paper analyzes the go-around occurrences and their impact at 20 major European airports. The go-around rate depends on various factors, such as airport and aircraft types. The more interesting result is found in Fig. 9; the impact of a single GA differs among the airport. I feel that such an analysis is new, and the interesting result is obtained. On the other hand, some details are difficult to understand due to the lack of the description. Therefore, I recommend to accept this paper after minor revision. Please see minor comments below.

line132: Please provide the reference of the Clopper-Pearson interval method.

line 147: Please provide specific parameters to be used for the estimation of fuel consumption. 3D trajectory data (Latitude, longitude, baro altitude) only? Anything else?

Line 169-180: In my understanding, the authors calculate the ASMA time for each go around (i.e., total 20196 GAs). Each red line in Fig. 9 shows the median of ASMA time for all GAs in each airport? Is it correct? If so, please clearly state such a fact. If not, explain what the authors did in more detail.

Line 182-186: It is difficult to understand. I think "10 times" correspond to the blue lines in Fig. 9, and the number of ASMA time calculation is 10*GAs in each airport. Is it correct? Please explain in more detail both 2.4.2 and 3.2.

2.3   Reviewer 3

Dear authors, please find below my recommendations to improve the quality of the paper:

I recommend removing the "towards" from the title. What you performed is an actual analysis. Maybe it is not as advanced as you may have expected, but the "towards" does not make much sense here;

line 32: I recommend creating a proper bibliography section that you could detail a bit more. All your bibliography is in one paragraph now, which may be hard to read;

line 43: Please avoid bulk citing papers. Explain the specificities of each approach;

figure 1: That plot was great on a slide, but it is hard to read on paper. I recommend replacing it by a regular Table, including also the name or city of the airport;

line 94: python => Python;

Table 1: why is the ILS column a list and not a string if you are talking about the first landing approach;

Figure 3.a): I recommend highlighting the runways, and maybe consider adding one or two trajectories entering from each cluster;

Figure 4, 5 and 6: why not plotting a box plot in the same style as Figure 8;

Figure 7: I recommend changing the colormap, the yellow part of the trajectory is hard to read; also please add a unit on the colorscale (m? ft?);

line 269: It would be interesting to show examples of flights that are not detected as GoA if you claim there are;

I don't recommend adding the data to a GitHub repository. You may want to consider putting the data on a Figshare or Zenodo repository and download it to the data/ folder if it is empty. When you do so, please make sure that the archive file is not in the history of the git (otherwise it doesn't make sense...).

Last, a more open "correlation/causality" question. How do you ensure that the delay in ASMA timings is really the impact of a previous GoA? Not that the current conditions (meteo + congestion) are prone to GoA (incl. the one you detected) and further disruptions like the one you measure? I believe this deserves a word in your conclusion section.

3. Response - round 1

This appendix contains all comments raised by all reviewers. As such, all comments were copied verbatim and are formatted in blue font. For all comments and suggestions provided by the reviewers, a corresponding response has been provided. To improve the readability of this document, our comments are indicated with an → sign. Furthermore, whenever possible, we added the changed or corrected passages of the manuscript. To this end, these passages are marked both in bold italic as well as in red font.

3.1 Response to Reviewer 1

a) I would like to ask the authors to review the manuscript specifically for English usage, grammar, and overall linguistic coherence. I found the paper hard to follow while reading some of the sections.

I highlight some of the issues encountered below (note the list is not exhaustive):

- Line 32 to 68: this is such a long paragraph. I recommend the authors to divide it into shorter paragraphs. Several ideas are introduced, so it should be easy to divide the text into 5-6 paragraphs to improve readability. Actually, this is something I noticed throughout the paper, many times the paragraphs are too long, which makes hard to follow what is written.

- Line 71: it should be "traffic arriving AT an airport", the preposition is missing.

- Line 108: one comma should be removed

- Line 116 and 117: first the authors consider metadata is singular and then plural. Both are gramatically correct, but I recommend the authors to be consistent and use one form or the other.

- Line 150 and 151: "the actual duration OF a flight between", the preposition is missing

→ We agree with the reviewer, we therefore have split the long paragraph concerning literature review into multiple ones. We have also corrected the highlighted typos.

b) In my opinion, the main and most remarkable contribution of this paper is the analysis of the effects that go arounds have in subsequent flights. This is mainly shown in Figure 9, and explained in Section 3.2. However, I think this analysis is rather short and does not provide enough details regarding the go arounds impact on the arrival traffic. I do not expect the authors to provide an exhaustive analysis (actually, this could be included in a future publication); however, I would appreciate having at least some preliminary analysis. For instance, from all the airports considered in this work, maybe there is one with a higher number of heavy aircraft go arounds. If that is the case, does that affect what it is observed in Figure 9? This is just an idea, but similar analysis could be done with the market segment or the go around rate per airport.

Probably the authors already have this information, so what I am missing in the paper is this link from the characterisation of the go arounds and their effect on the ASMA times of subsequent flights.

→ We have slightly extended the section 3.2 to present a bit more analysis. What you are suggesting concerning the characterization of GoA and their effect on the ASMA times is indeed very interesting but does not fit the scope of this research. In our opinion, this would require a considerable amount of work that would perfectly fit another study.

For instance, at airports such as Milan Malpensa and Dublin, the GoAID peaks at approximately 100 seconds. This indicates that, on average, landings occurring between 10 and 20 minutes after a GoA spend an additional 100 seconds in the ASMA cylinder compared to those before the GoA. Conversely, at some airports, the GoAID is consistently lower, remaining below 50 secondsthroughout the hour-long observation period. Notably, Madrid Barajas Airport is the least affected, with a maximum GoAID of 21 seconds.

c) In line 146, the authors mention that they consider a mass of 60 tones for the A320. Could the authors present this mass as a percentage of maximum landing weight (MLW) as well? As not all the readers might be familiar with the masses of the A320, I think it might be better to present this value as a percentage of MLW rather than the value in tones (both could be kept though).

→ Very good point, the percentage of the maximum landing weight has been added to the paper.

d) The authors mention in lines 270-273 that the results presented in this paper might be affectd by the fact that some of the data used for their work was from the COVID19 period. I would like to see more details about how this issue could affect the results. Actually, why do not the authors use data from 2022 to 2023 and repeat the analysis? This might lead to more realistic results. I am afraid that the results could change quite significantly... Take for instance the go around rate per airport. During the COVID19 period, there was way less traffic. Therefore, it is easy to conclude that the go around rate must have been lower as well.

→ Indeed, we have begun analyzing trends and seasonality in Go-Around rates, but no significant impact from COVID-19 was evident. In fact, the trend indicated an increase in Go-Around rates during the COVID years. However, we chose not to include this in the paper as we needed to focus on a more limited scope for our study.

3.2   Response to Reviewer 2

I recommend removing the "towards" from the title. What you performed is an actual analysis. Maybe it is not as advanced as you may have expected, but the "towards" does not make much sense here.

→ **The title has been changed to Analysing the impact of Go-Around Occurrences at Large European Airports.**

line 32: I recommend creating a proper bibliography section that you could detail a bit more. All your bibliography is in one paragraph now, which may be hard to read;

→ **Instead of adding a bibliography section we did split the long paragraph into multiple ones. We hope that it makes it easier to read.**

line 43: Please avoid bulk citing papers. Explain the specificities of each approach;

→ **We have decreased the number of citations. We believe that detailing all the differences wouldn't add significant value to our work. However, we consider it important to maintain a number of references for readers who wish to explore them further. figure 1: That plot was great on a slide, but it is hard to read on paper. I recommend replacing it by a regular Table, including also the name or city of the airport;→ This is a very valid point; we have replaced it with a table.**

line 94: python to Python;

→ **Thank you for the correction, it is now fixed.**

Table 1: why is the ILS column a list and not a string if you are talking about the first landing approach;

→ **Thank you for identifying the issue, it is indeed a mistake. We have updated the description to : Designation of runways on which the aircraft performed its landing attempts.**

Figure 3.a): I recommend highlighting the runways, and maybe consider adding one or two trajectories entering from each cluster;

→ **Thank you for the suggestion, we have added 10 trajectories per cluster, and it makes it much better.**

Figure 4, 5 and 6: why not plotting a box plot in the same style as Figure 8;

→ **This is unfortunately not possible since we are plotting point statistics and not distributions. The bar indicated the 95% confidence interval and not any quartile.**

Figure 7: I recommend changing the colormap, the yellow part of the trajectory is hard to read; also please add a unit on the colorscale (m? ft?);

→ **The color scale has been changed to something with more contrast. The units of the color bar have also been added.**

line 269: It would be interesting to show examples of flights that are not detected as GoA if you claim there are;

→ **We believe this could be included in the notebook, but we are not certain it would enhance the value of the paper.**

I don't recommend adding the data to a GitHub repository. You may want to consider putting the data on a Figshare or Zenodo repository and download it to the data/ folder if it is empty. When

you do so, please make sure that the archive file is not in the history of the git (otherwise it doesn't make sense...).

→ The dataset has been moved to Zenodo, the code git will be updated very soon.

Last, a more open "correlation/causality" question. How do you ensure that the delay in ASMA timings is really the impact of a previous GoA? Not that the current conditions (meteo + congestion) are prone to GoA (incl. the one you detected) and further disruptions like the one you measure? I believe this deserves a word in your conclusion section.

→ The idea with comparing 20 minutes before and some time after the GoA is to compare with timings in similar weather / congestions situations. It's true that weather phenomena can be very punctual and therefore be different before and after the GoA. This is also one of the reason why weuse the median instead of the mean to perform our statistics. To be sure, we would need to have an indicator of "low" congestion and "good" weather and then redo the analysis. While not impossible this could be done for a further study.

3.3   Response to Reviewer 3

1. line132: Please provide the reference of the Clopper-Pearson interval method.

→ A reference to the Clopper-Pearson interval method has been added.

2. line 147: Please provide specific parameters to be used for the estimation of fuel consumption. 3D trajectory data (Latitude, longitude, baro altitude) only? Anything else?

→ Thank you for this comment, we have added more information in the text: using actual flight trajectory data (namely the altitude, the vertical rate and the speed)

3. Line 169-180: In my understanding, the authors calculate the ASMA time for each go around (i.e., total 20196 GAs). Each red line in Fig. 9 shows the median of ASMA time for all GAs in each airport? Is it correct? If so, please clearly state such a fact. If not, explain what the authors did in more detail.

→ This is true that the explanation was a bit confusing. We have completely rephrased it and hopefully improved it:

To assess the impact of GoA on landings at an airport, we compared the additional ASMA times before and after a GoA. Our methodology, applied to every GoA occurrence, starts with the following steps:

1) Baseline – Pre GoA Additional ASMA Time: We established a baseline by computing the median additional ASMA time for landings within the 20-minute interval preceding a GoA.

2) Post-GoA Additional ASMA Time: We calculated the median additional ASMA times for successive 10-minute intervals following the GoA, ranging from [0, 10min], [1, 11min], up to [50, 60min].

3) Go-Around Arrival Induced Delay: The Go-Around Arrival Induced Delay (GoAID) for each 10min window was determined by subtracting the pre-GoA median from the respective post- GoA median additional ASMA times.

After calculating the GoAID for each time window of every GoA occurrence, we aggregated these values at an airport level. This entailed determining the median GoAID for each interval across all GoA occurrences at the airport. For example, the median GoAID for the [0, 10min] period provides insight into the typical delay experienced during this interval following a GoA at that airport.

4. Line 182-186: It is difficult to understand. I think "10 times" correspond to the blue lines in Fig. 9, and the number of ASMA time calculation is 10*GAs in each airport. Is it correct? Please explain in more detail both 2.4.2 and 3.2.

→ Thank you very much for pointing this out. Indeed, it was not clear in the original text. We propose the following modification:

To verify whether the GoAID times are directly related to GoA events, we employed a control group approach. Specifically, we applied our analysis methodology to landing sequences that have not been affected by any GoA occurrence. To create these control groups, we randomly selected time periods at each airport during which no GoA occurrences were observed. Ten control groups for each airport were created. This comparative analysis between GoA and non-GoA periods allowed us to discern whether there exists a significant difference in GoAID times. If the GoAID times exhibit notable distinctions during GoA periods as opposed to non-GoA periods, it strongly suggests that GoAs have a discernible impact on landing delays.