

## Authors' Response to Tatjana Bolic, Referee #2, RC2 (02 Aug 2021):

In this authors' response, the text (normal style) answers point by point to the comment of the Referee #2 (text in bold). The text in blue corresponds to the authors' change in the manuscript.

### RC2 from Tatjana Bolic (Referee #2):

The paper describes the results of the EUNADICS AV project, which developed different natural hazards observation and notification products, with the goal to support aviation in the cases of airborne natural hazards. My expertise is in aviation, so I cannot judge the background scientific quality, even though it seems impressive to me - the number of different tools, observations and notifications.

I do have several comments, that would require minor text revisions:

1. In the abstract the authors say "All the ATM stakeholders (e.g. pilots, airlines and passengers) can access and benefit of these alert products through this free channel." I find this a bit strong as a statement. Any member of public can access these products, that is true, but it is unclear how they can benefit, as there is no explanation of the meaning of any of the products - one would need to be a scientist to understand what they are looking at. This is true even for graphical products where different colors are set for different concentrations (or similar), but there is no explanation what it means for layman - even for aviation stakeholder - what is red zone? Can I fly through it or not? If not, how far should I keep? All this to say that these products have great value for aviation, but they are still missing an important part which is the "translation" of its meaning for aviation stakeholders that are not meteorologists or atmospheric scientist (if this is a good term at all).

Thank you for this clarification and your advices. We totally agree with this and will do our best to apply this advice in the future. Hopefully this will help us to improve EUNADICS service. We have removed the term 'benefit' at the end of the abstract. The text is now the following:

All the ATM stakeholders (e.g., pilots, airlines and passengers) can access these alert products through this free channel.

2. In section 5 the authors say "EUNADICS is a SESAR (Single European Sky ATM Research; <https://www.sesarju.eu>) enabling project with regard to the definitions provided in the SESAR 2020 Programme Execution Framework, delivering SESAR Technological Solutions." I would strongly suggest to rephrase this sentence, as the project itself is not even connected to SESAR, and the products developed are not "enabling" in the sense that is used in SESAR (enabling in SESAR means a technology that is a necessary building block of an ATM infrastructure - in a sense that without it, there is no new ATM infrastructure. I would suggest to rephrase into "supporting" or similar wording. Thank you again for this clarification. The text has been modified:

EUNADICS is supporting SESAR (Single European Sky ATM Research; <https://www.sesarju.eu>). The development, verification and validation of products, and the EWS were designed with the goal of potential future deployment.

3. Next, the authors say: "EUNADICS pass maturity phase V2 with regard to the 7-phase concept as introduced by the European Operational Concept Validation Methodology (E-OCVM, 2010)..." E-OCVM presents guidance for V1-V3 of the 8 phases of ATM products life-cycle. However, I don't think that EUNADICS can claim V2 maturity level according to EOCVM, as human factors, safety, business, environmental and standards cases were not performed for any of the products. The point of the cases is to assess the impact of the solution on a wide set of matters in the ATM. These cases are requirements that need to be passed, in order for a solution/product to mature from V1 to V2 or from V2 to V3. The EUNADICS project could easily claim TRLs 2,3 or even 4, of the H2020 technology levels, but not V2 of EOCVM. mainly because the EOCVM requires the assessment of how the products can be implemented in ATM and what would the impact be, and that was not done (the various cases) in the project, nor was that the point of the project). Thank you again for this clarification. The following text:

EUNADICS passed maturity phase V2 with regard to the 7-phase concept as introduced by the European Operational Concept Validation Methodology (E-OCVM, 2010), which shows the feasibility of EUNADICS prototype service. EUNADICS EWS has developed a concept for starting V3 validation (i.e., pre-industrial development & integration). With regard to the alert products developed, a verification of requirements has been performed and a verification of EUNADICS EWS performance has been demonstrated (Fig. 27). A validation of the global concept of EUNADICS and its potential benefits, has also been demonstrated during the EUNADICS exercise (Hirtl et al., 2020a), showing the benefits in a limited framework.

has been replaced by:

EUNADICS passed the maturity phase V1, and we can now target the maturity phase V2 with regard to the 7-phase concept as introduced by the European Operational Concept Validation Methodology (E-OCVM, 2010). Tests with human factors, safety, business, environmental and standards cases are still required for EUNADICS products to reach the maturity phase V2 and show the feasibility of EUNADICS prototype service, according to E-OCVM. EUNADICS EWS has developed some work of validation of the alert products (TRL 4), as shown in Fig. 27. A validation of the global concept of EUNADICS and its potential benefits, has also been demonstrated during the EUNADICS exercise (Hirtl et al., 2020a), showing the benefits in a limited framework.

4. In line 925, what do you mean by "environment). EUNADICS EWS passes with success the performance verification."? As highlighted in comment 3., the environment is the one of E-OCVM, with tests of human factors, safety, business, environmental and standards cases. The following text (line 925-927):

EUNADICS consortium will now target an operationalisation of its activity, in the frame of SESAR H2020, with the objective of completing TRL 6 (demonstration in a relevant environment). EUNADICS EWS passes with success the performance verification.

has been changed to

EUNADICS consortium will now target an operationalisation of its activity with the objective of completing TRL 5 (validation in a relevant environment) and TRL 6 (demonstration in a relevant environment) in the framework of further SESAR developments. EUNADICS EWS passes with success the performance verification in a limited environment (TRL4).

5. **Finally, a suggestion to authors regarding the TRL levels of their products, in aviation setting. A product can be deemed operational in aviation if intended end-users can access the information, understand it and make decisions based on the understood information. If the presented information is not understandable by the end-user (e.g. pilot, air traffic controller), the product will not be used, even if it is completely accurate, and reliable. That is the reason for having various cases in the EOCVM methodology - to make new technology not only work, but to be understood. Some of the next steps, in my opinion should be identification of the end-users, and tailoring of the product for their use. If the end-users are only national meteorological providers, VAACs and similar, then the TRL of EUNADICS products is very high, and probably close to operational. But, if the products should be shared with other, non-scientific types of end-users, there is still a lot of work to reach high TRL levels, and that work is mainly on making the information understandable to these users.**

Thanks a lot for this advice we will definitely consider in the future activity of EUNADICS

With respect to TRL, section 4.6.1 has been modified:

In case of a future operationalisation of EUNADICS activity for TRL (Technology Readiness Levels; see H2020, Annex G of the General Annexes) of 5 and higher, i.e., system prototype validation and demonstration in operational environment, all the NRT observations will be visible on the EUNADICS data portal.

6. **Please review the paper for English proofing. It is overall of good quality, but there are typos and some non-English phrases that make reading slightly harder.** Done, see answer to RC1

We hope this document answers properly to the specific comments addressed by Tatjana Bolic, Referee #2. We are very grateful for this review and all the advices provided. We apply all them, and will do our best to improve the quality of our service in the future. We also improved the text of the manuscript to make the paper easier to read.

Thank you very much for this review. Best regards,

Hugues Brenot and co-authors