Advances in QVA information at VAAC Buenos Aires

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Introduction

The QVA information is being developed at the Buenos Aires VAAC to meet the Initial Operational Capabilities (IOC), VAAC Best Practices and WMO VAAC modelers group agreements.

The implementation of QVA will change the way forecasters work today, the modeling strategy will change from deterministic to ensemble, with multiple solutions covering the uncertainty of the problem, the volume of information will increase significantly and new skills will be needed to communicate all this information to the end users.

Here we present the progress in the development of QVA information at VAAC Buenos Aires with a case study, current work and future developments.

Volcanic ash Transport and dispersion model

Model: FALL3D version 8.2 (Folch et al., 2022).
Meteorological fields: Global Forecasting System (NCEP-NOAA)
Grain Size distribution: range 4-10ϕ analogs from Mastin et al., (2009) and Costa et al. (2016)
Ensamble members: 20
Control run: control height (H_0) ; Profile shape (Suzuki-A_0) (Osores, 2020)
Perturbations: $H_0 \pm \Delta H$; Suzuki-$A_0 \pm \Delta A$ with ΔH and ΔA relative and absolute random perturbations from each PDF.
PDF: Uniforms

Workflow with QVA

VAAC forecaster's workflow will change with the inclusion of QVA information. The initial and complete VAA/VAG will continue during the IOC, and it will be necessary to ensure harmony between the QVA information and VAA/VAG. The limitations of numerical modelling will condition the provision of QVA information, and forecasters will need to be able to make decisions to issue the most reliable information.

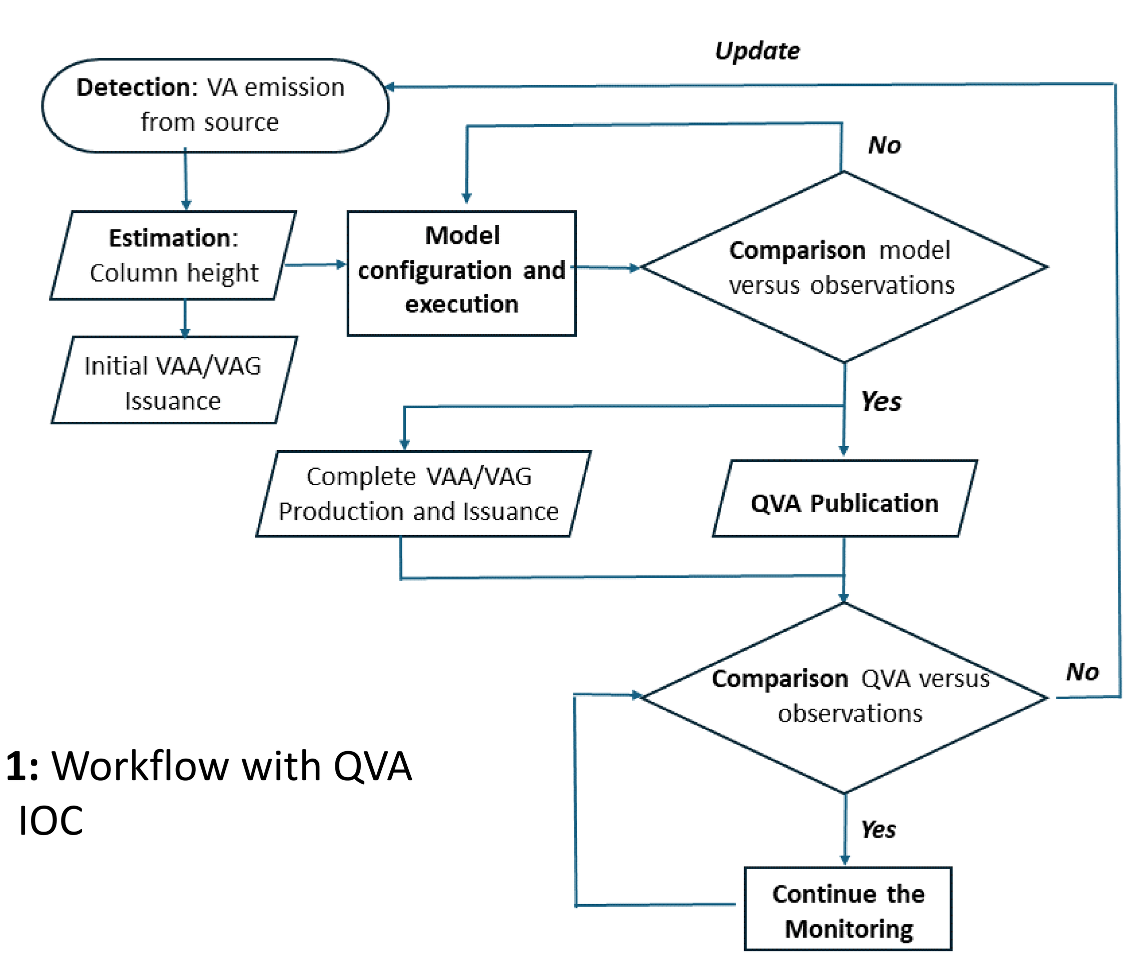

Figure 1: Workflow with QVA during IOC

Case study

Ubinas volcano, located in Perú, erupted on 19 July 2019, reaching eruptive column heights above 15 km.

QVA information was produced and updated every 6 hours using the best column heights estimations and the latest meteorological cycle.

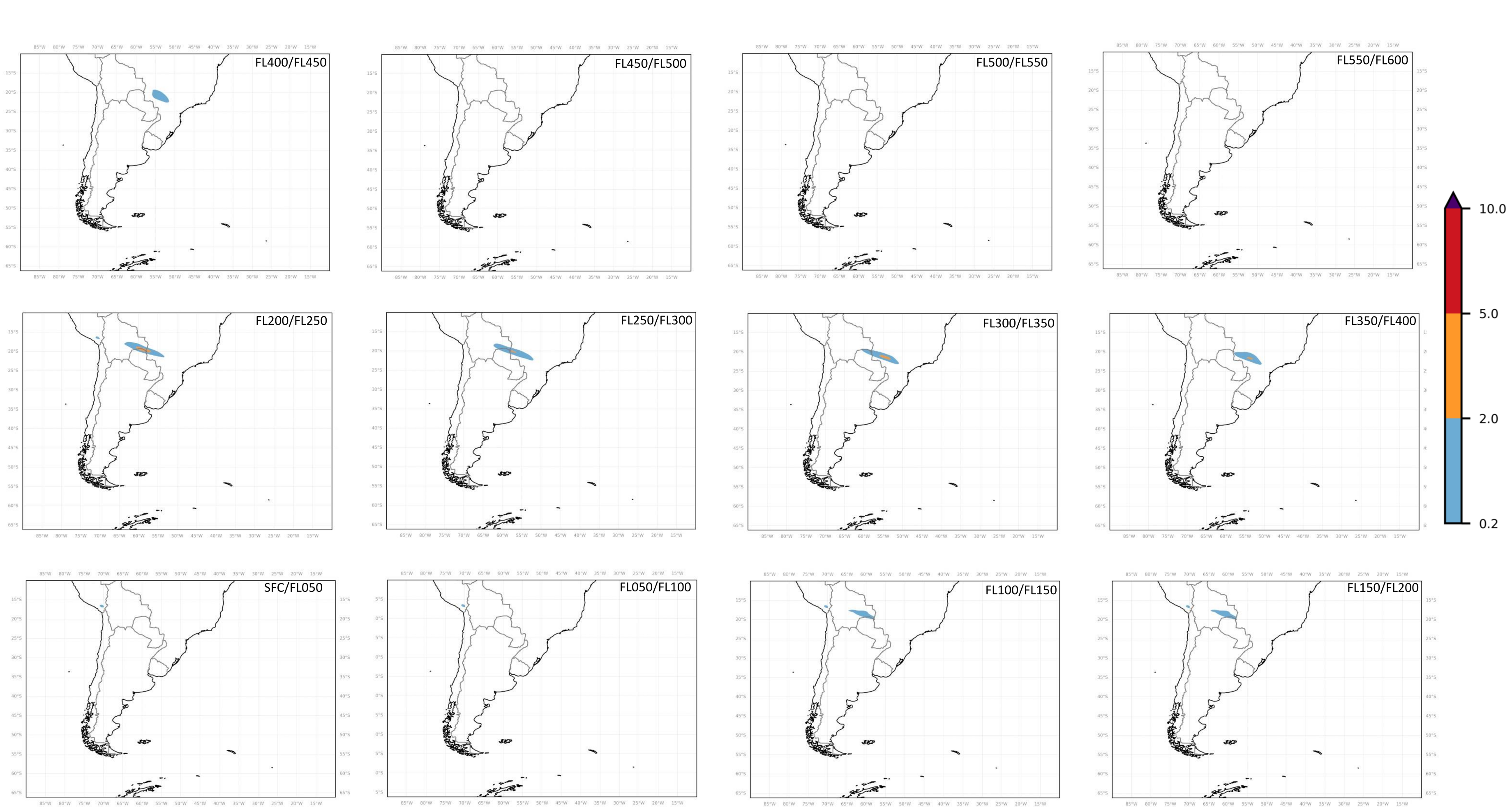

Figure 2: Ash concentration mg m^{-3} (deterministic) valid for 20 July at 6:00 UTC.

Case study (cont.)

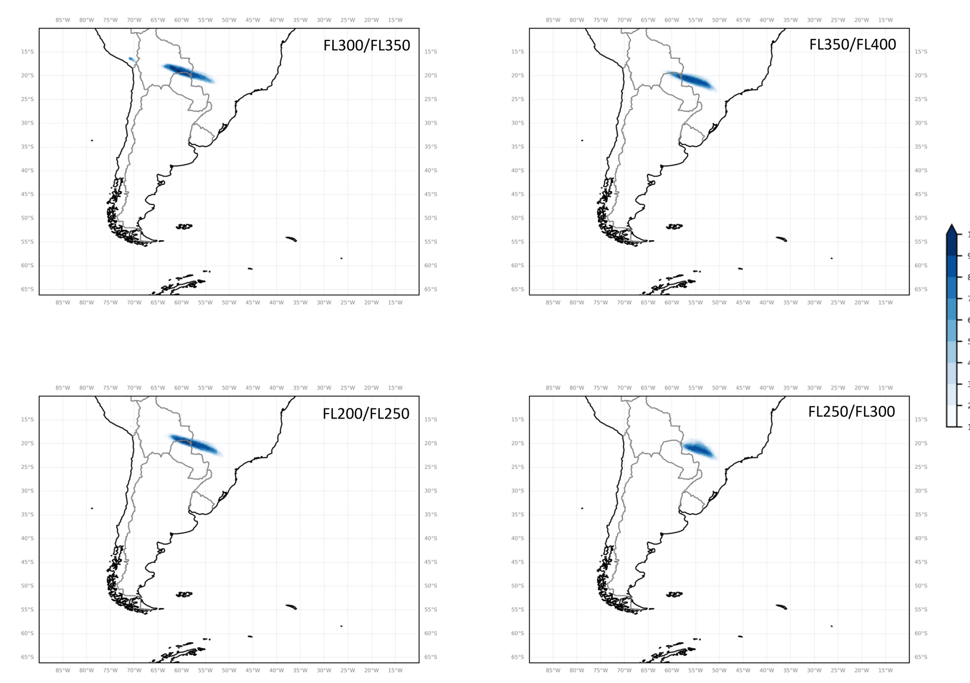

Figure 3: Probability of exceeding 0.2 mg m^{-3} valid for 20 July at 6:00 UTC.

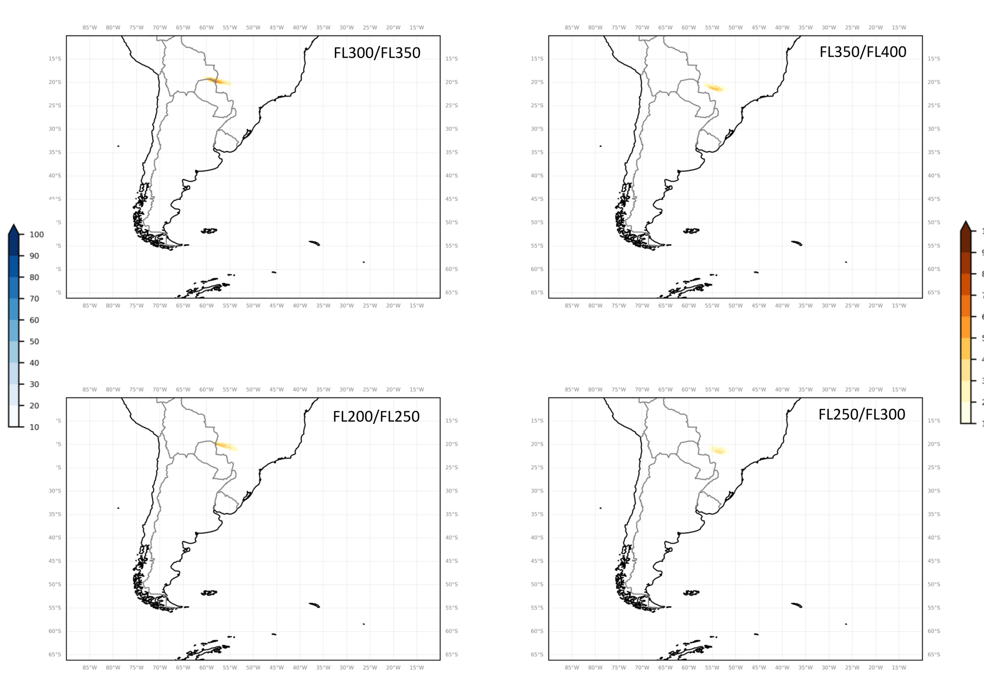

Figure 4: Probability of exceeding 2 mg m^{-3} valid for 20 July at 6:00 UTC.

Ash concentration probability of exceedance above 2 mg m-2 constrained the area with possible higher concentrations of VA.

The quality of QVA information, combined with the information from the OEM about the susceptibility of the engines as well as the operator's Safety Risk Assesment will help stakeholders to operate in airspaces contaminated with volcanic ash.

Ash mass load evaluation

The lower limit of discernible ash from satellite data is approximately 0.1 - 0.2 g m-2. It was considered to evaluate the same ash mass loading threshold obtained by the model (see Fig. 4) This is one of the main pieces of information that the forecaster will analyze to determine the performance of QVA information as well as ash mass load estimations from VOLCAT.

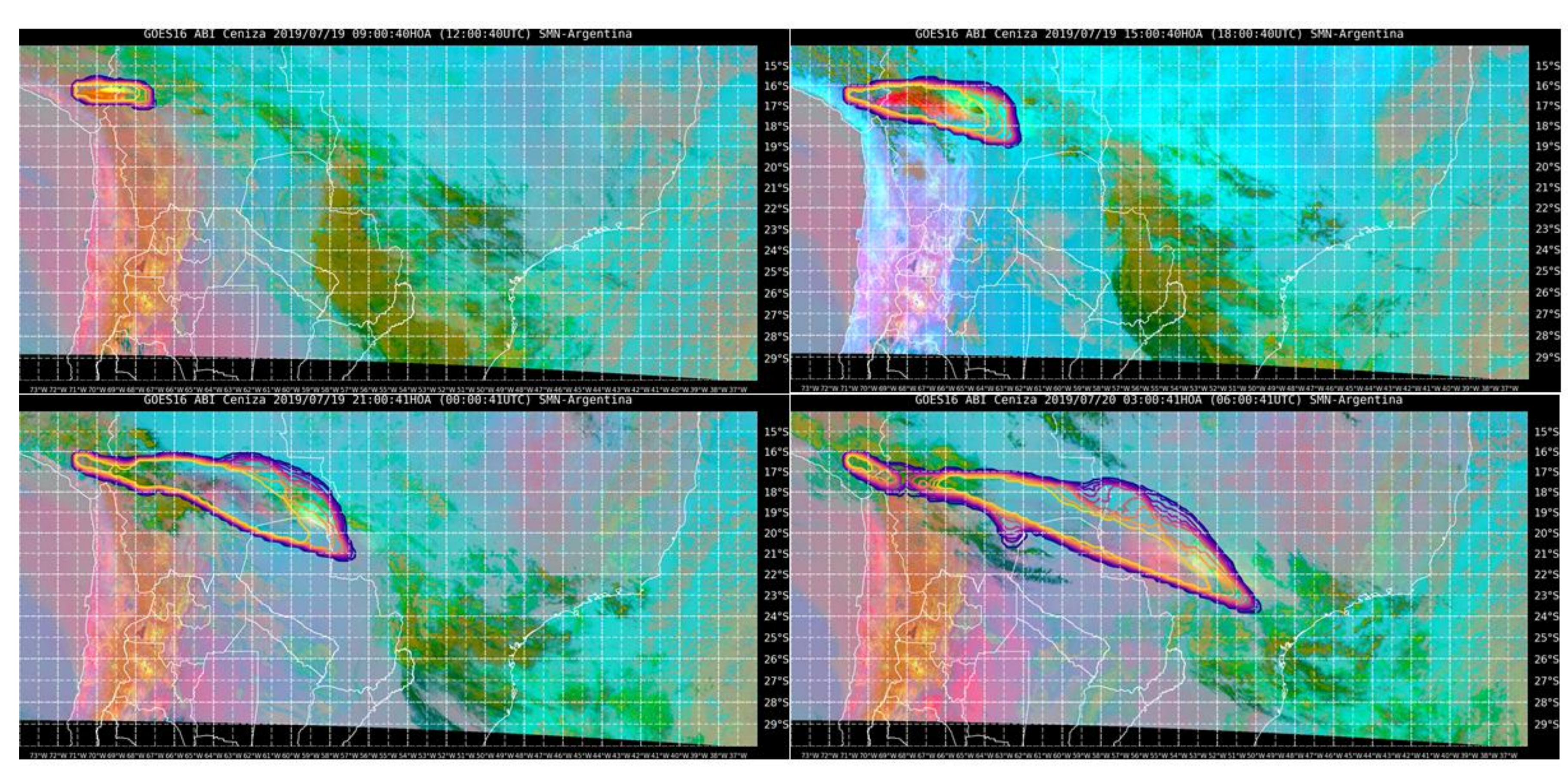

Figure 5: Ash RGB from GOES-16 satellite data (shaded) and probability of exceeding 0.2 g m^{-2} of ash mass load (contours, blue 10% and yellow 100%).

Work in progress and next steps

- Continue working on the development of the final technical characteristics of the IOC
- Update the model to include GEFS in the uncertainty, test and final implementation.
- Forecasters training on QVA operation and exercises.
- Develop new communication skills in the forecasters to address queries on QVA results.
- Keep working on model verification against satellite ash mass loading from VOLCAT and improve model results objectively.
- Implement the decisions agreed to in the Best Practices group, the AG-VSA advisory group, and the VAAC modellers group to improve the QVA process.
- Progress in science to implement more complex data fusion techniques using near real-time data to improve QVA, incorporate remobilization ensemble of deposited material, and improve the representation of complex cases (small plumes in complex topography).
- Work with stakeholders to understand the QVA information.

References

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