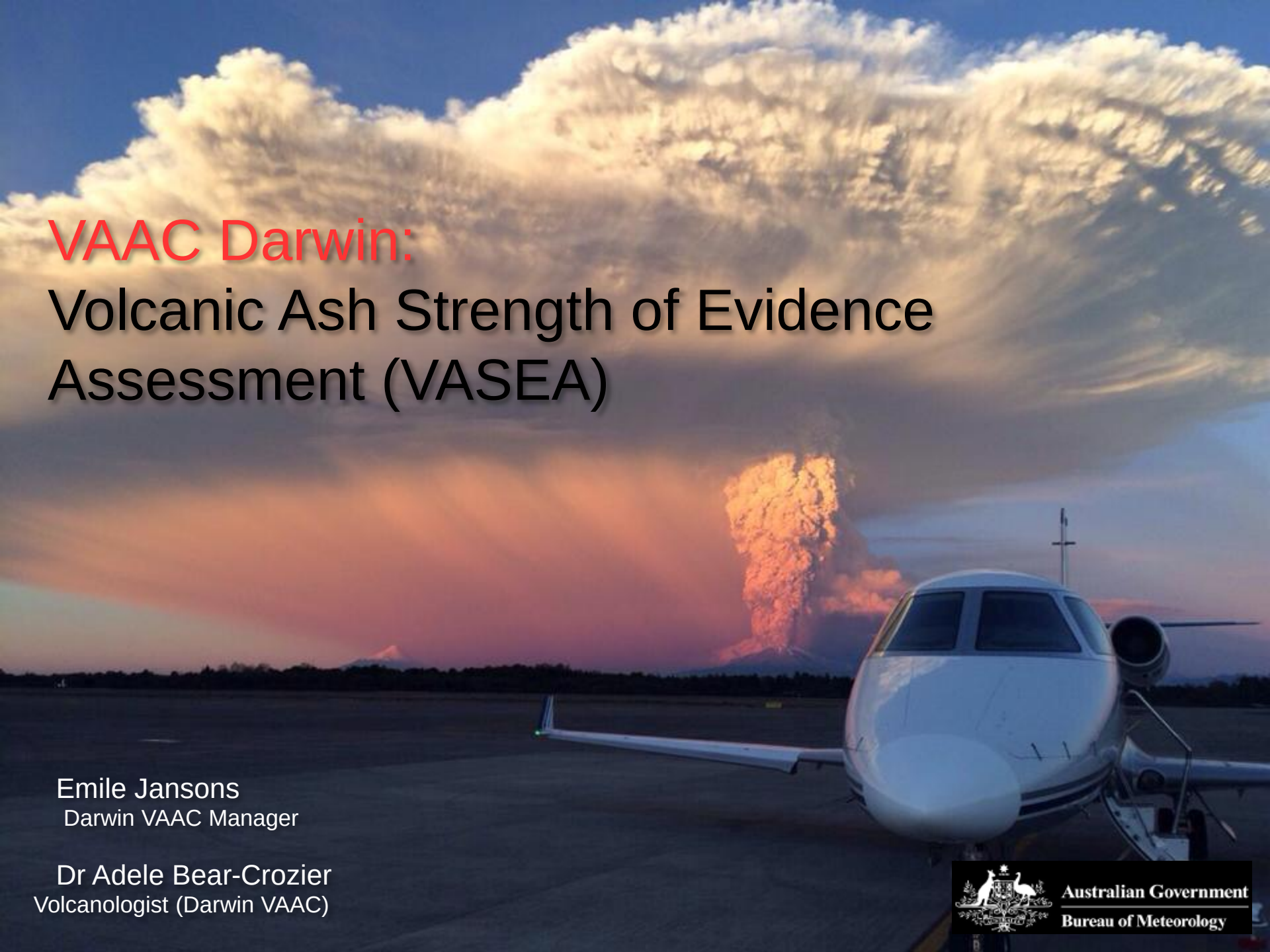


VAAC Darwin:
Volcanic Ash Strength of Evidence Assessment (VASEA)

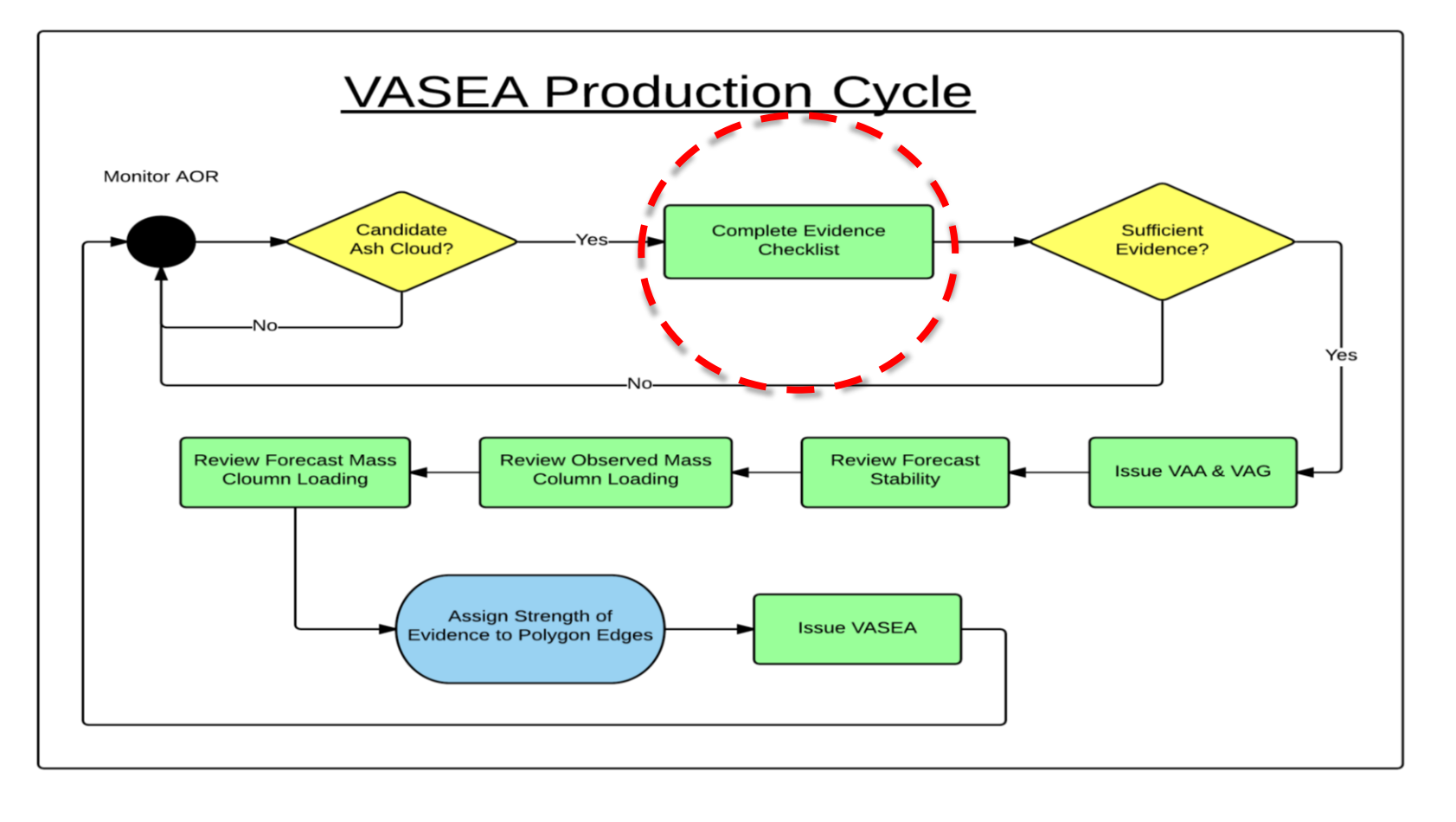
Emile Jansons
Darwin VAAC Manager

Dr Adele Bear-Crozier
Volcanologist (Darwin VAAC)

Australian Government
Bureau of Meteorology

Risk Assessment Support Products

Forecaster's assessment of the strength of evidence



Risk Assessment Support Products

Volcano	Raung
Remote Sensing Evidence	
Anomalously rapid cloud development above a known volcano	☐
Convective development, that is asynchronous with the regional convective cycle, above a known volcano	☐
Stationary, persistent (>1 hr) overshooting cloud top embedded within meteorological cloud above a known volcano	☐
Hot spot at a known volcano	☒
Anomalous lightning activity above a known volcano	☐
Low altitude SO2 signal with a back trajectory intersecting a known volcano	☐
High altitude SO2 signal with a back trajectory intersecting a known volcano	☐
Grey or brown discolored clouds in true color imagery emmanating from a known volcano	☒
Cloud with a significant reverse absorption signal emmanating from a known volcano	☒
Anomalous linear or wedge shaped cloud emmanating from a known volcano	☒
Convective cloud like development in a stable air-mass above a known volcano	☐

- Remote Sensing Evidence

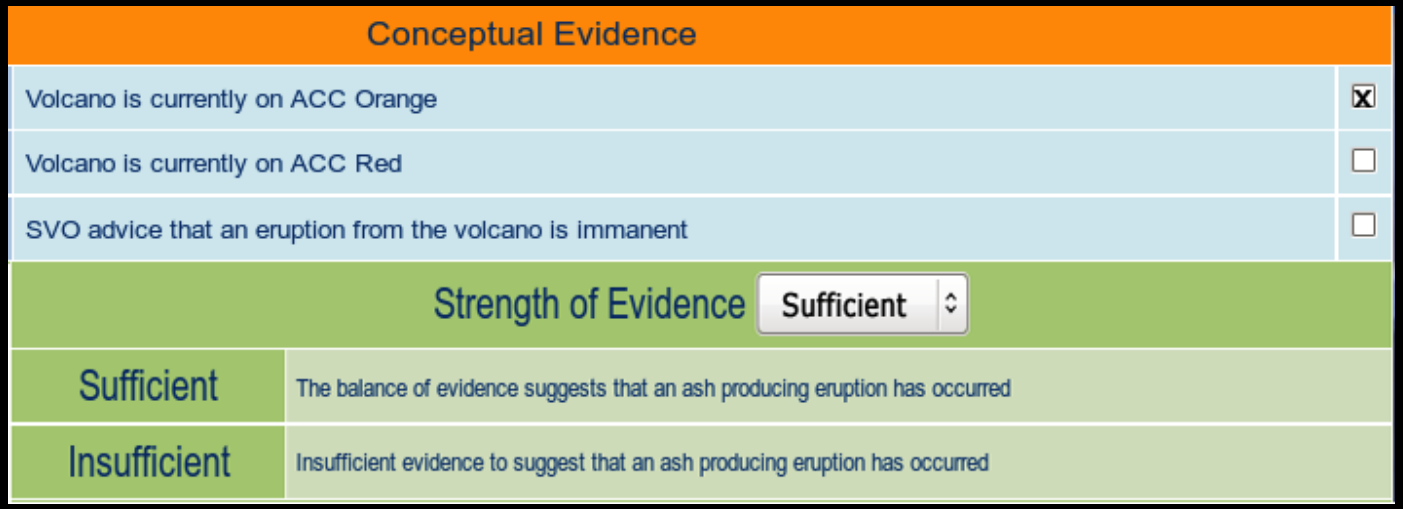
- Evidence Checklist completed for each candidate ash cloud
- Checklists link to the VAAC operational logbook and are available on the VAAC's webpage

Risk Assessment Support Products

Airborne Evidence	
Pilot report of a sulfurous smell from a location downwind of a known volcano	☒
Pilot report of visible ash from a location downwind of a known volcano	☒
Pilot report of a volcanic eruption from a known volcano	☒
Pilot report of identified volcanic ash airframe impacts	☐
Ground Based Evidence	
Web-cam image of a buoyant non-white volcanic plume emanating from a known volcano	☐
State Volcano Observatory report of an ash generating eruption	☒
ASHTAM/NOTAM/SIGMET indicating an eruption at a known volcano	☒
Unofficial media report of an eruption from a known volcano	☒
Official media report of an eruption from a known volcano	☒
Geophysical report indicating volcanic activity at a known volcano	☐
Ground lidar observation of a significant aerosol cloud emanating from a known volcano	☐
Ground radar observation of a plume emanating from a known volcano	☐

- Airborne Evidence
- Ground Based Evidence

Risk Assessment Support Products



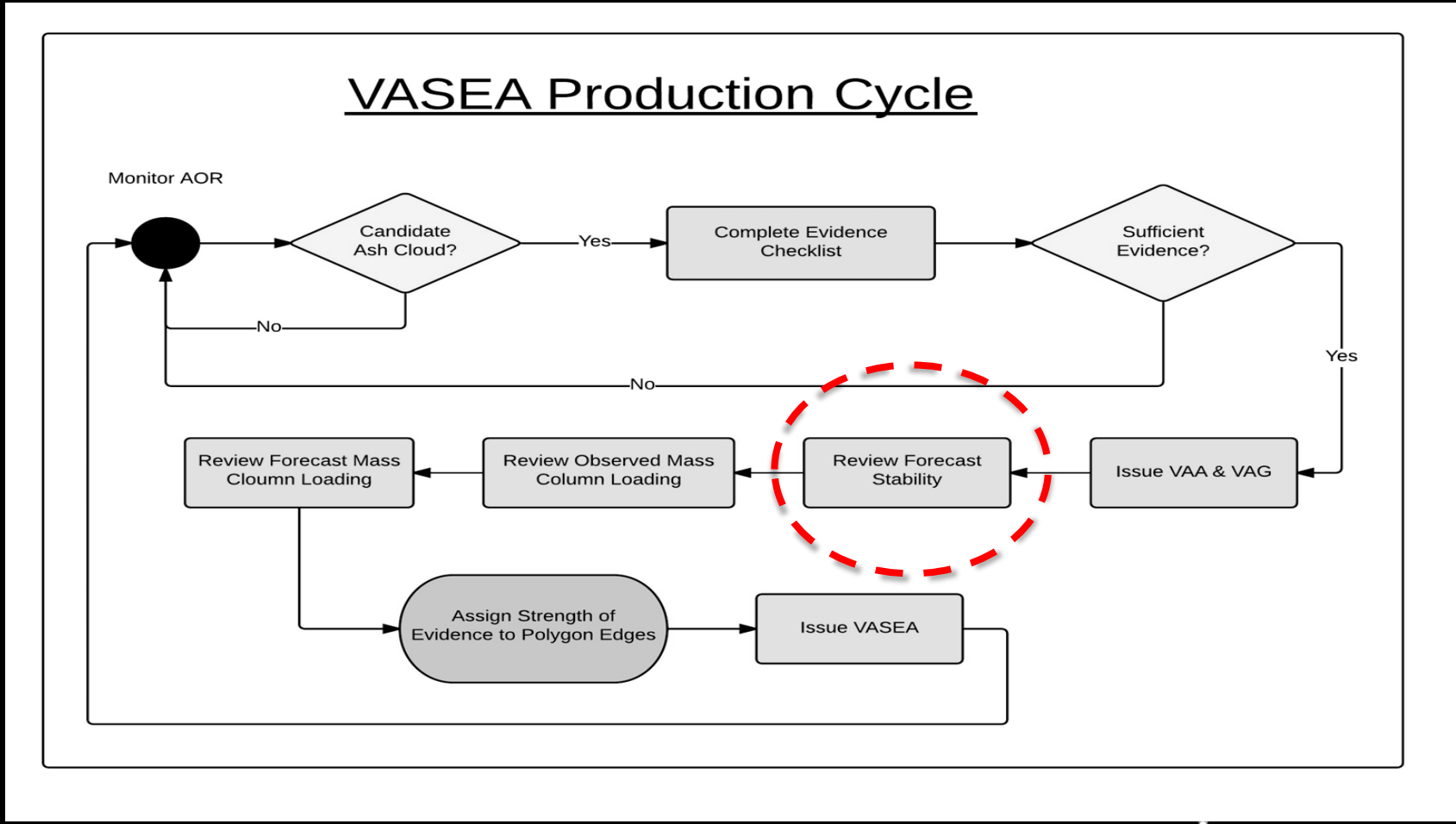
Conceptual Evidence	
Volcano is currently on ACC Orange	☒
Volcano is currently on ACC Red	☐
SVO advice that an eruption from the volcano is immanent	☐
Strength of Evidence: Sufficient	
Sufficient	The balance of evidence suggests that an ash producing eruption has occurred
Insufficient	Insufficient evidence to suggest that an ash producing eruption has occurred

- Conceptual Evidence

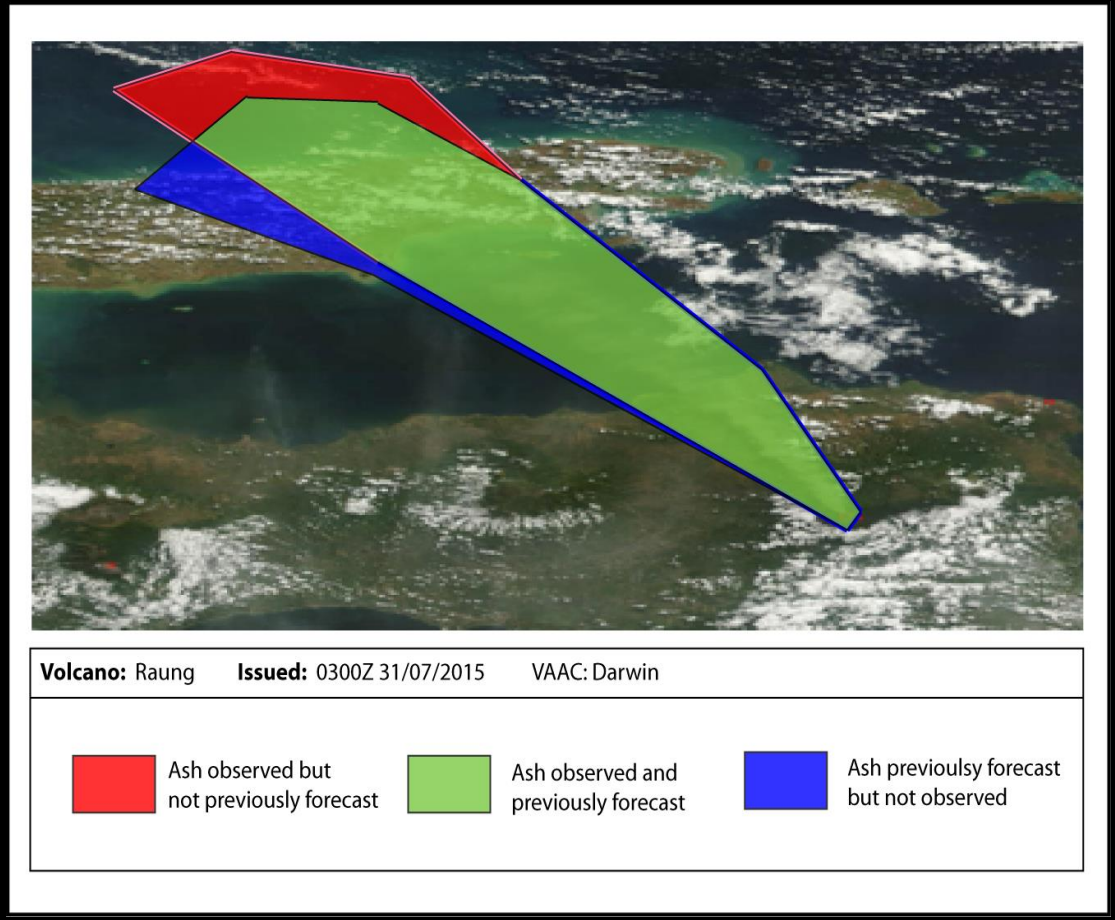
- Forecaster evaluates whether an advisory is required
- Checklist is a formal record of the decision making process
- Checklist submission triggers archiving of satellite imagery

Risk Assessment Support Products

Forecaster's assessment of the strength of evidence



Risk Assessment Support Products

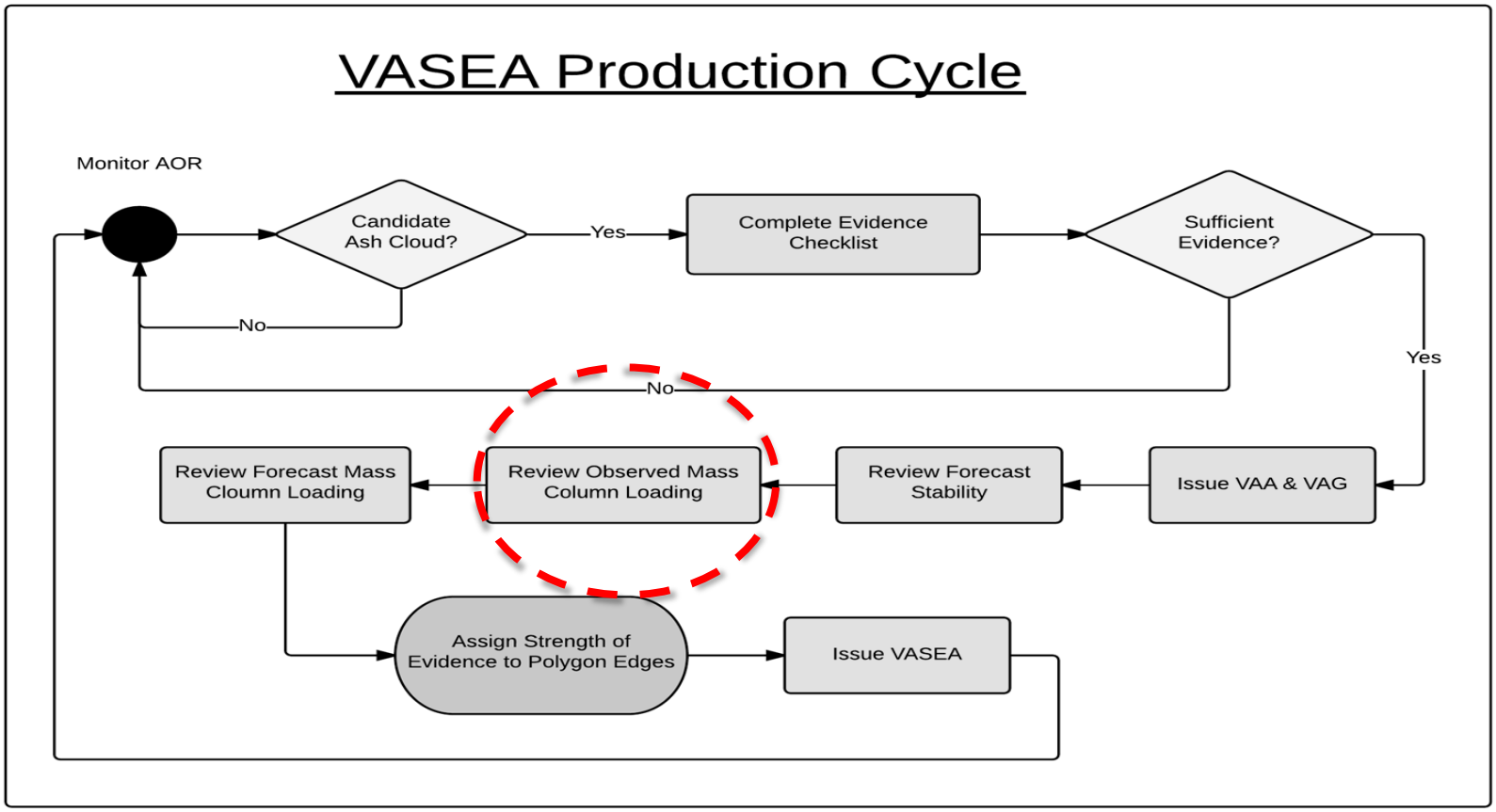


Forecast Stability Product

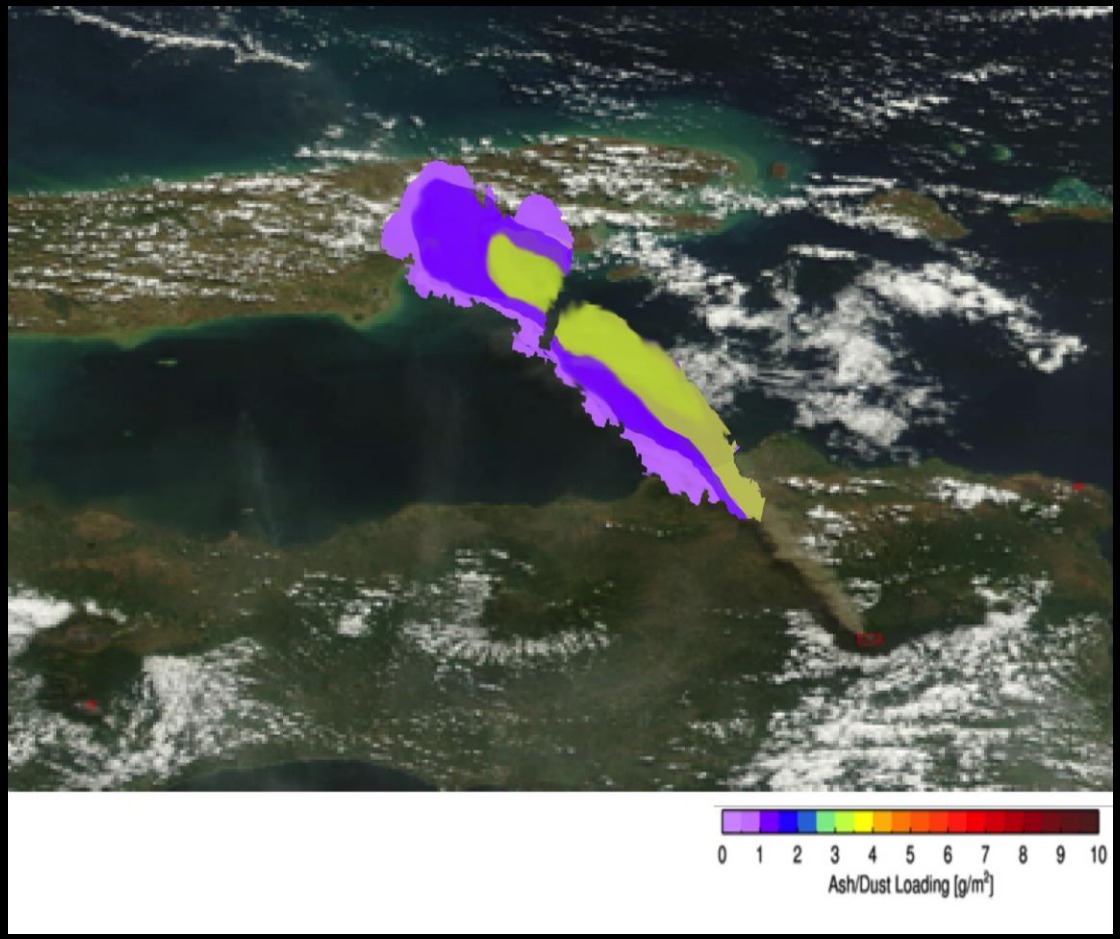
- Comparison of previous VAA T+6 with current T+0
- Uses interpolation for non-routine issue times
- Highlights areas of change

Risk Assessment Support Products

Forecaster's assessment of the strength of evidence



Risk Assessment Support Products

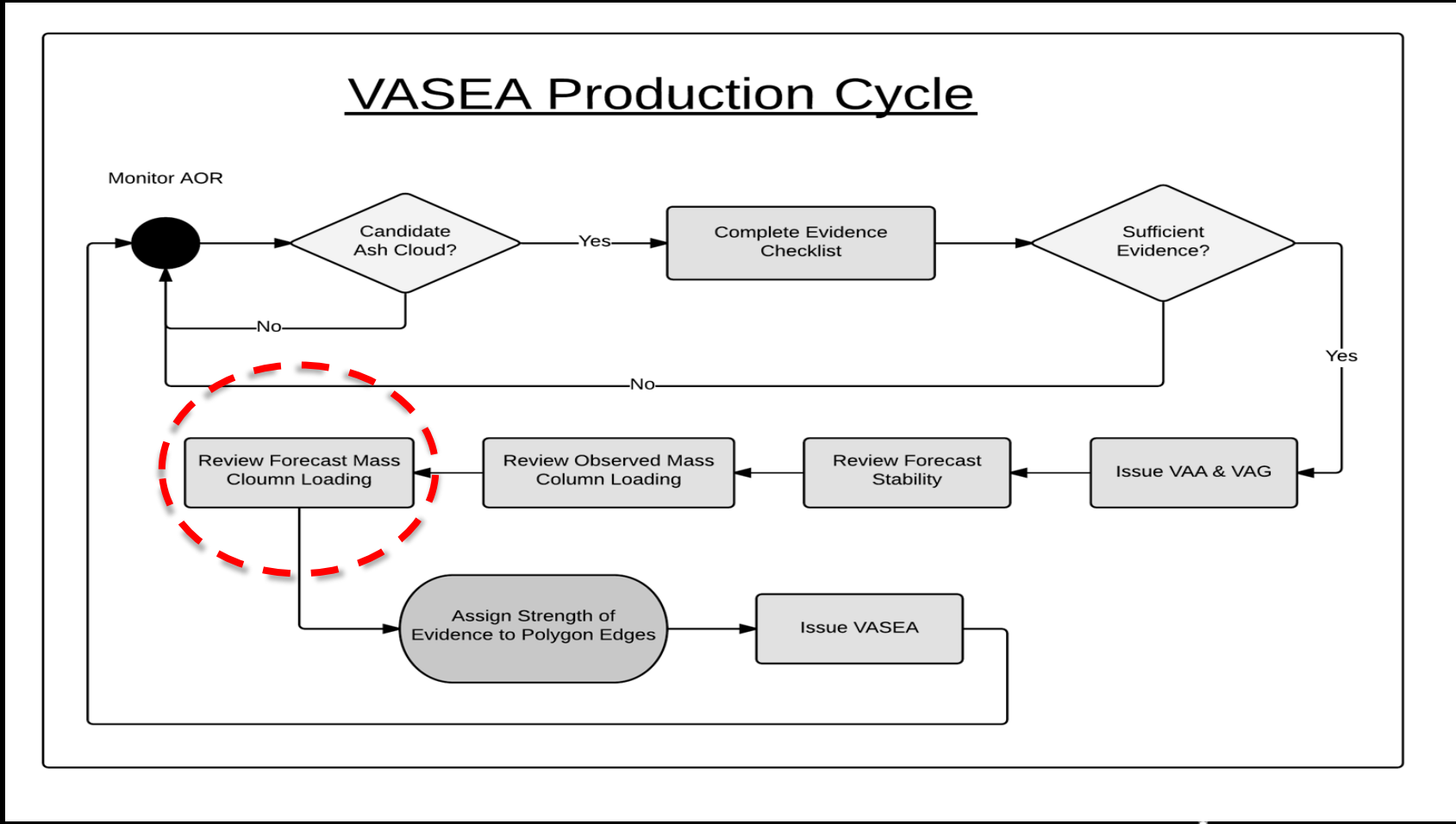


Observed ash column mass loading

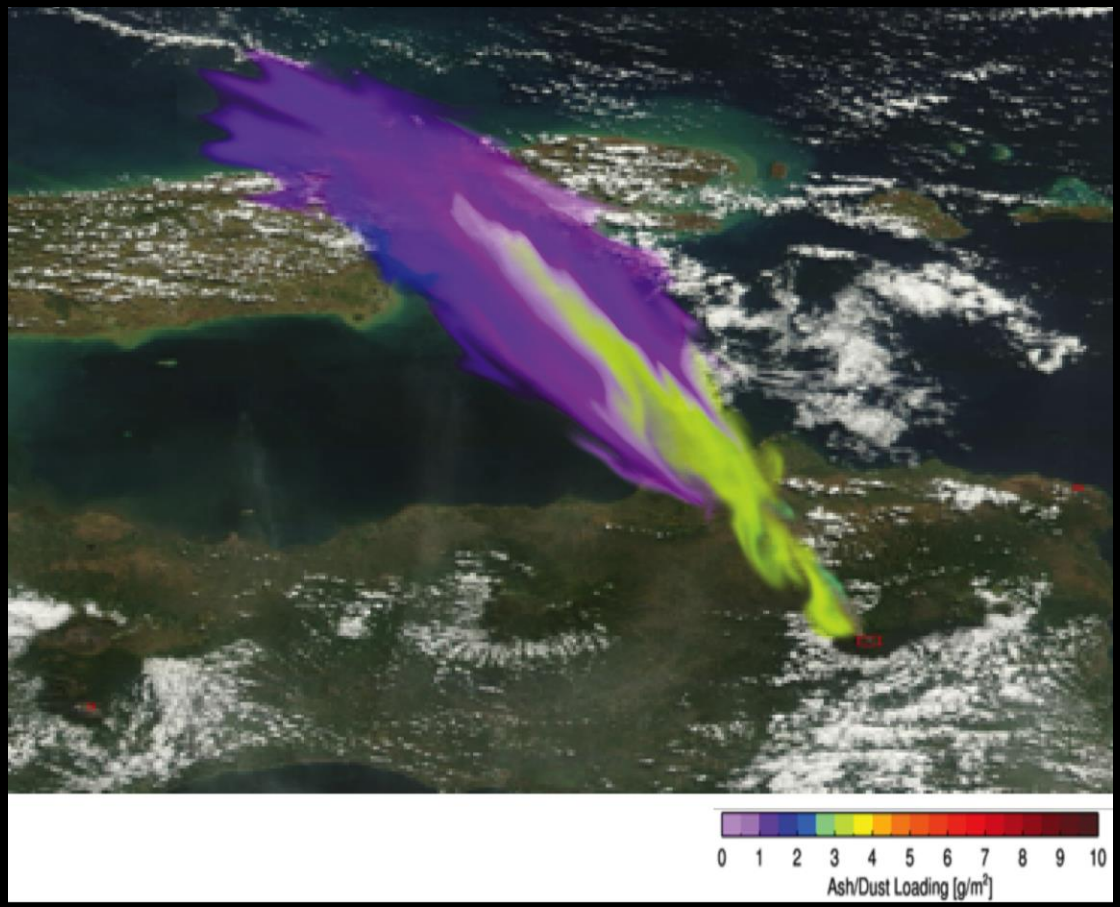
- Review Quantitative Observations

Risk Assessment Support Products

Forecaster's assessment of the strength of evidence



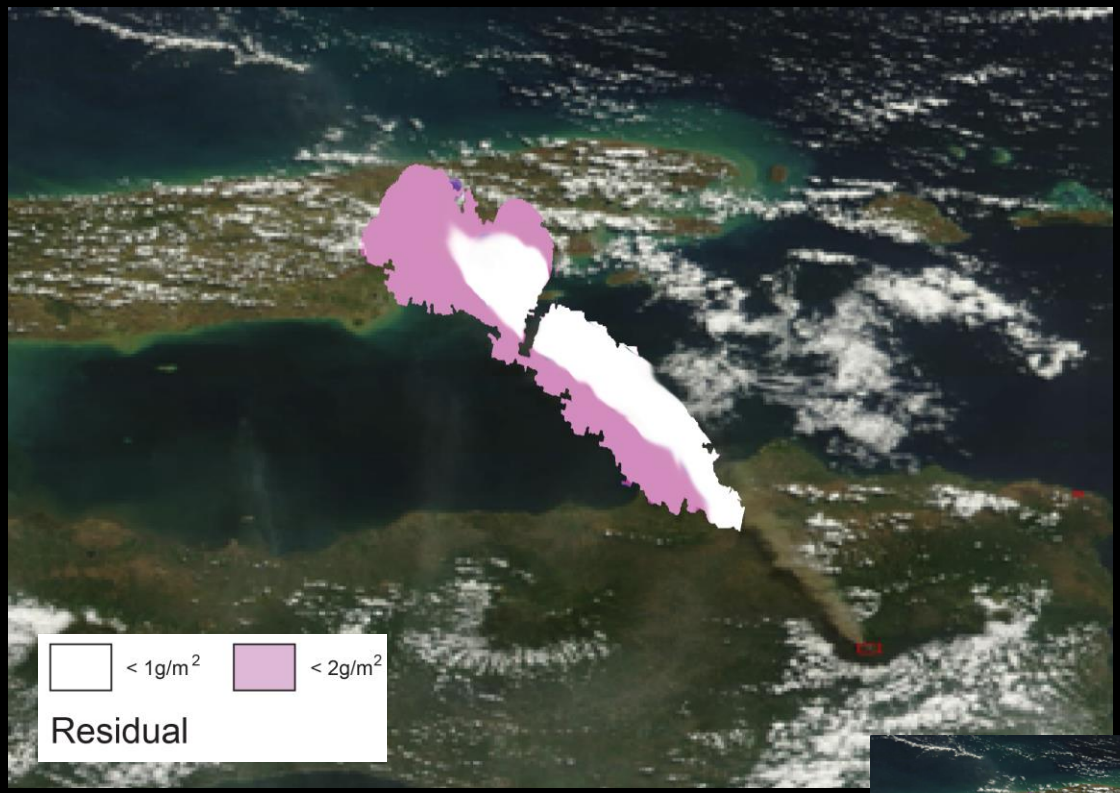
Risk Assessment Support Products



Modeled ash column mass loading

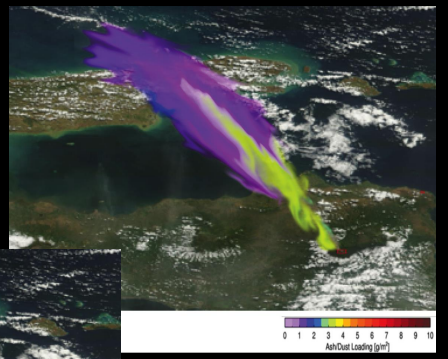
- Review Quantitative Forecasts
- Ensemble of meteorological and volcanological members

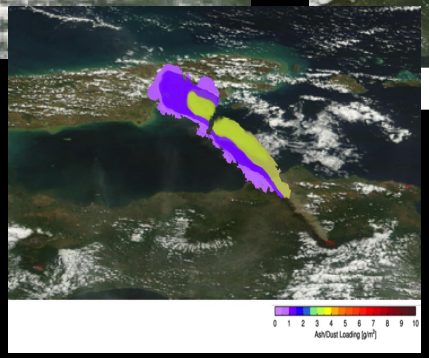
Risk Assessment Support Products



Residual ash column mass loading

- Quantitative comparison of modeled and observed spatial distribution
- Best fit ensemble member
- Awareness of product limitations is essential





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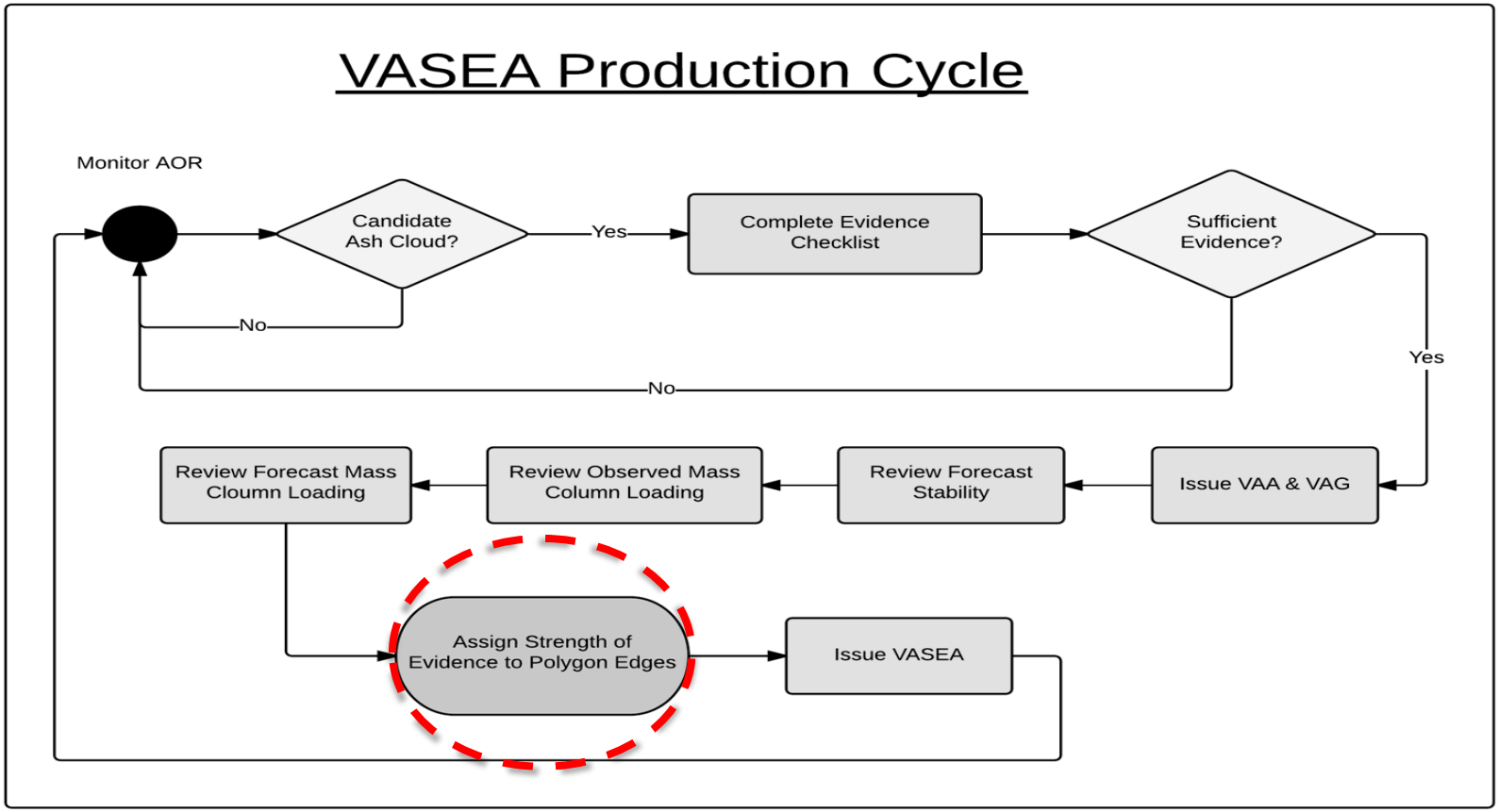
Risk Assessment Support Products

Forecaster's assessment of the strength of evidence



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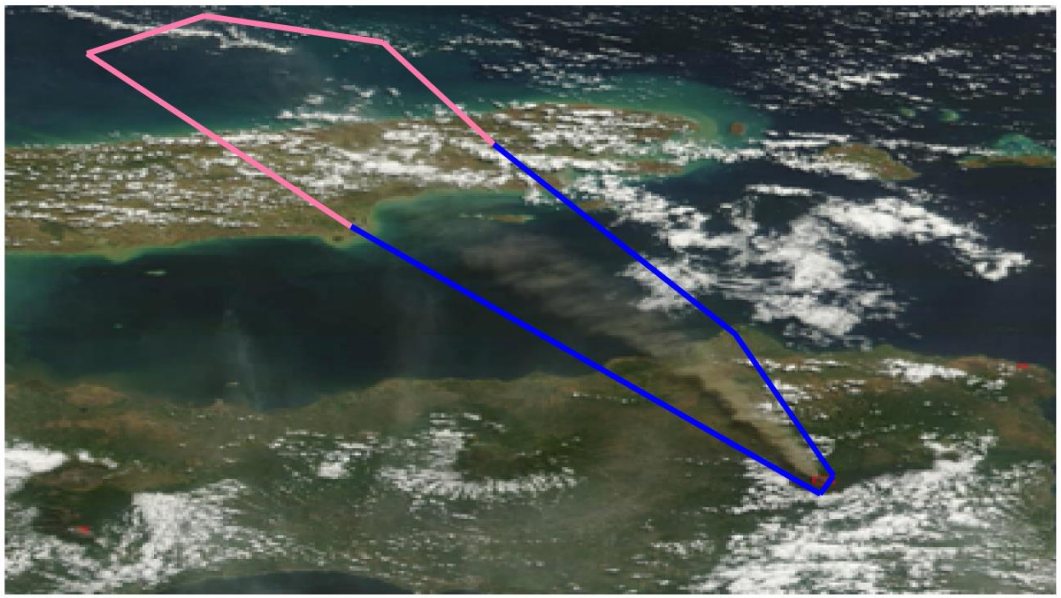
Risk Assessment Support Products

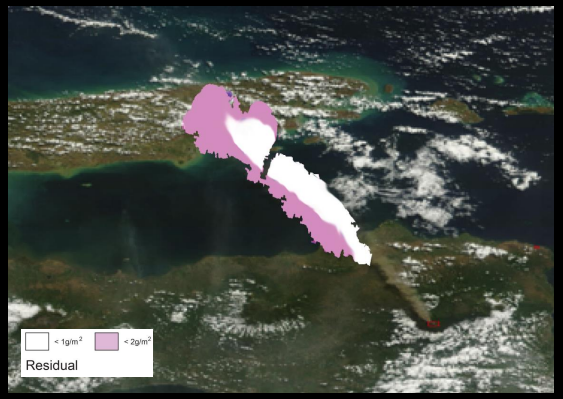


Volcano: Raung **Issued:** 0300Z 31/07/2015 VAAC: Darwin High Uncertainty Low Uncertainty

Notes:
A sustained, low intensity eruption is continuing at the volcano Raung. Ash is continuing to be erupted to a maximum height of 17 000 ft and prevailing winds are expected to remain southeasterly for the next 24 hours.
The ash boundary is clearly discernible in visible imagery extending to 45 nm northwest; however uncertainty increases beyond 45 nm as the plume becomes more diffuse. Ash is not currently discernible beyond 60 nm from the volcano.

- VAG T+0 polygon edges colour coded as high/low spatial uncertainty

- Allows product users to understand the overall body of evidence



Forecaster's assessment of the strength of evidence

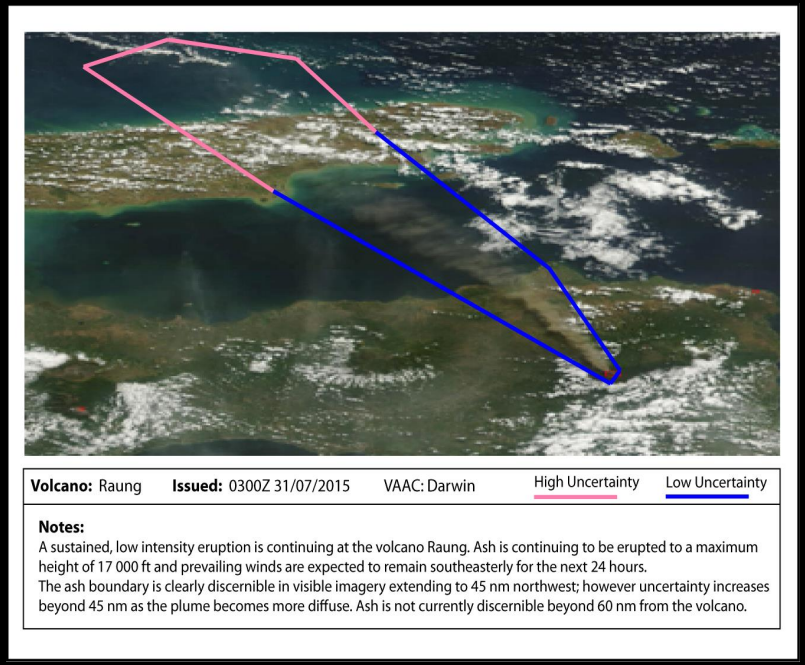
Risk Assessment Support Products

Strengths of the VASEA

Robust:
Relies on multiple, independent lines of evidence

Transparent:
The primary information utilized in the decision making process is made available to the user

Objective:
Based on quantitative observations and verification



Efficient:
Based on existing VAAC processes; most output products can be automated

Flexible:
Can be adapted to the available evidence and ensures the expert evaluation of the VAAC forecaster is central to the process