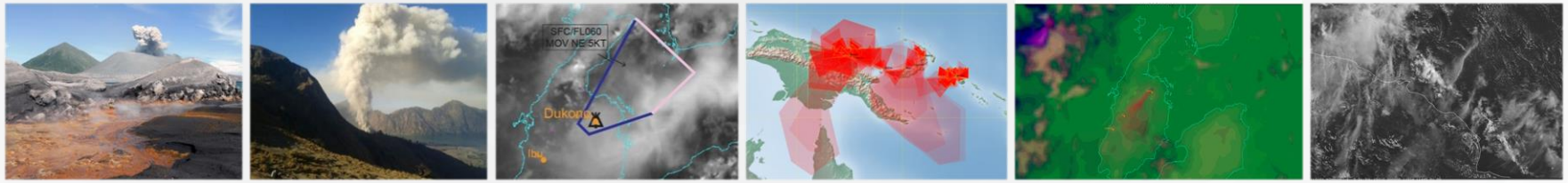
WMO VOLCANIC ASH ADVISORY CENTRE
BEST PRACTICE WORKSHOP 2017

DISCERNIBLE ASH AND VAA/VAG CONSISTENCY



VAAC DARWIN & VAAC TOKYO

Presented By: Dr Adele Crozier (VAAC Darwin Manager)

VAAC Darwin

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Discernible Ash| VAA/VAG Consistency

VW4-O-11 - Towards the development of VAAC Forecast Best Practice “guidance material” to be developed with “Discernible Ash Agreed Techniques” section.

Approach – Strength of Evidence Checklists

- Conventional “tick box” style checklist (e.g. VAAC Darwin web form)
- Graphical “pyramid” style checklist (e.g. VAAC Darwin/VAAC Tokyo concept)

Discernible Ash| VAA/VAG Consistency

- Overview of ‘tick-box’ style checklist
- Overview of ‘pyramid’ style checklist
- Case Study 1 – Dukono, Indonesia
- Case Study 2 – Manam, Papua New Guinea
- Review of the strengths of weakness of each approach discernible ash consistency application
- Group discussion

Overview| Tick box style checklist

Evidence Quality	Volcano: Dukono	
	Remote Sensing Evidence	
Weak	Anomalously rapid cloud development above a known volcano	☐
Weak	Convective development, that is asynchronous with the regional convective cycle, above a known volcano	☐
Moderate	Stationary, persistent (>1 hr) overshooting cloud top embedded within meteorological cloud above a known volcano	☐
Moderate	Hot spot at a known volcano	☐
Moderate	Anomalous lightning activity above a known volcano	☐
Weak	Low altitude SO2 signal with a back trajectory intersecting a known volcano	☐
Moderate	High altitude SO2 signal with a back trajectory intersecting a known volcano	☐
Strong	Grey or brown discolored clouds in true color imagery emmanating from a known volcano	☑
Strong	Cloud with a significant reverse absorption signal emmanating from a known volcano	☐
Strong	Anomalous linear or wedge shaped cloud emmanating from a known volcano	☑
Strong	Convective cloud like development in a stable air-mass above a known volcano	☐
	Airborne Evidence	
Weak	Pilot report of a sulfurous smell from a location downwind of a known volcano	☐
Weak	Pilot report of visible ash from a location downwind of a known volcano	☐
Moderate	Pilot report of a volcanic eruption from a known volcano	☐
Strong	Pilot report of identified volcanic ash airframe impacts	☐
	Ground Based Evidence	
Strong	Web-cam image of a buoyant non-white volcanic plume emanating from a known volcano	☐
Strong	State Volcano Observatory report of an ash generating eruption	☐
Weak	ASHTAM/NOTAM/SIGMET indicating an eruption at a known volcano	☐
Weak	Unofficial media report of an eruption from a known volcano	☐
Moderate	Official media report of an eruption from a known volcano	☐
Weak	Geophysical report indicating volcanic activity at a known volcano	☐
Moderate	Ground lidar observation of a significant aerosol cloud emanating from a known volcano	☐
Moderate	Ground radar observation of a plume emanating from a known volcano	☐
	Conceptual Evidence	
Weak	Volcano is currently on ACC Orange	☑
Moderate	Volcano is currently on ACC Red	☐
Strong	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	
	Submit (takes 20 seconds)	

- Remote sensing evidence
- Airborne evidence
- Ground based evidence
- Conceptual (situational) evidence
- Evidence quality (weak, moderate or strong)

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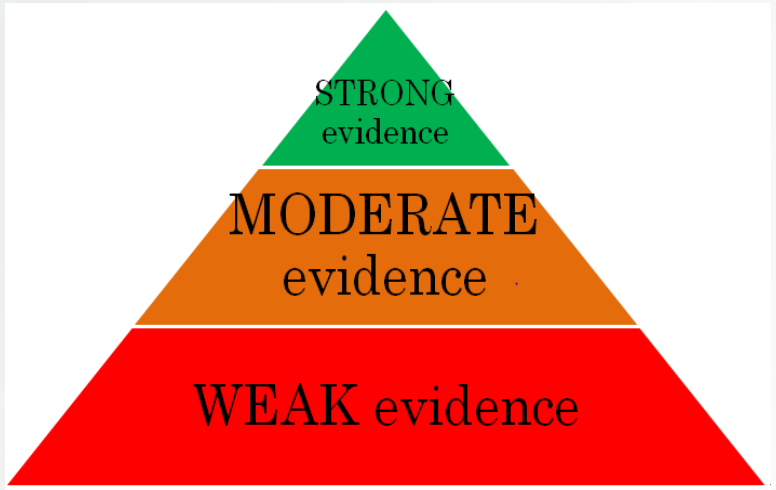
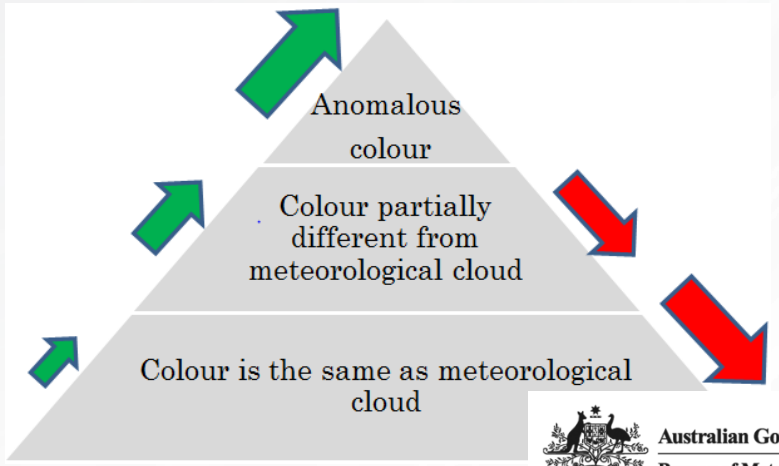
Overview| Pyramid style checklist

- Ground based evidence (e.g. VONA), airborne evidence (e.g. PIREP) trigger discernible ash detection procedures
- Pyramid levels: Triggers to start, Static and Loops, Loop and Model, Environment, Location – Issue VAA
- Situational (conceptual) evidence (e.g. aviation colour codes, SVO advice) or ground based evidence of high impact event may result in progressing straight to VAA issuance and follow up using remote sensing pyramid checklist.





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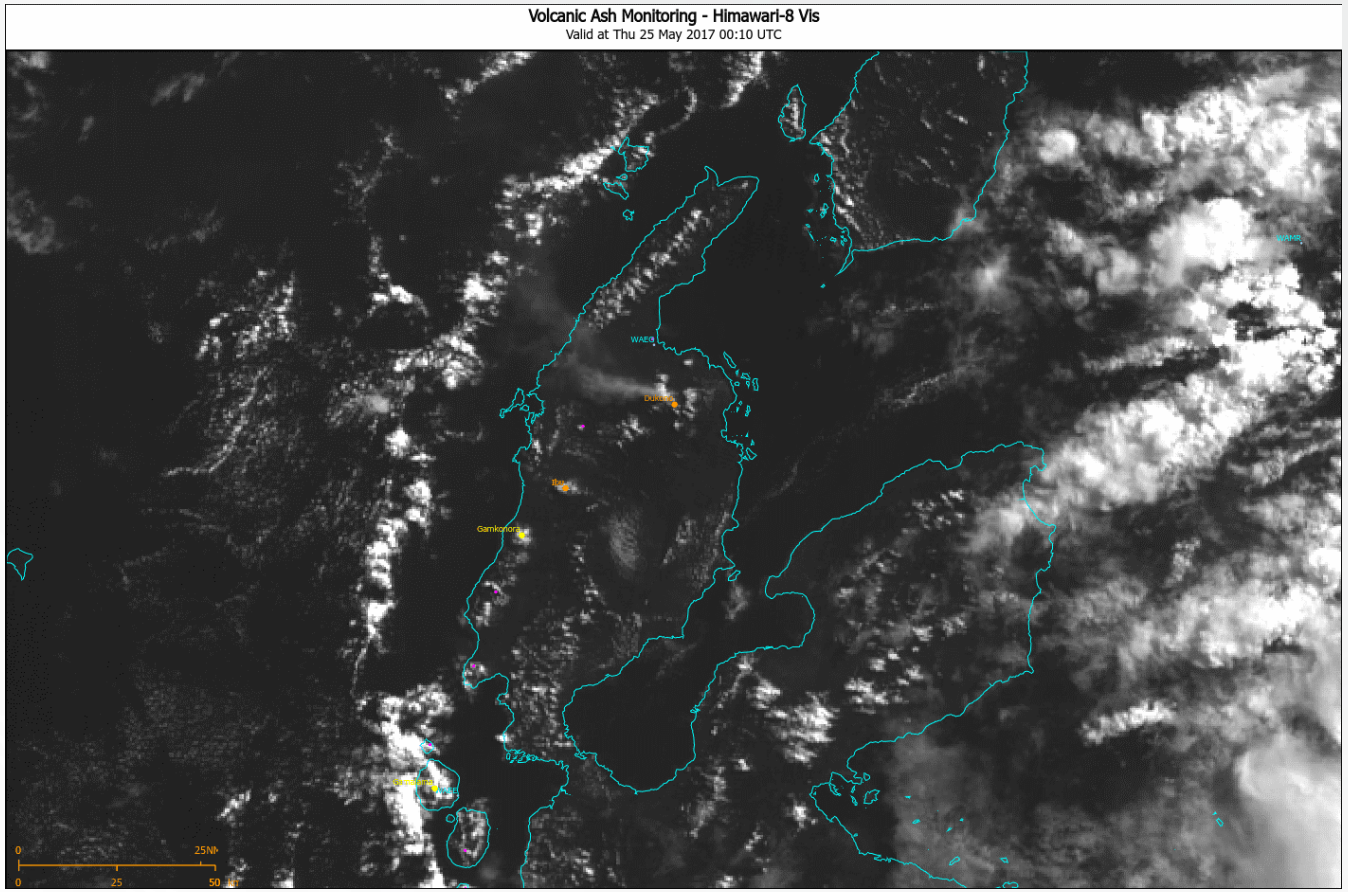
Case Study 1| Dukono, Indonesia



- 24 May 2017 (0010Z)
- VIS imagery
- Anomalous linear feature detected directly above a known volcano (Dukono)
- No VONA received

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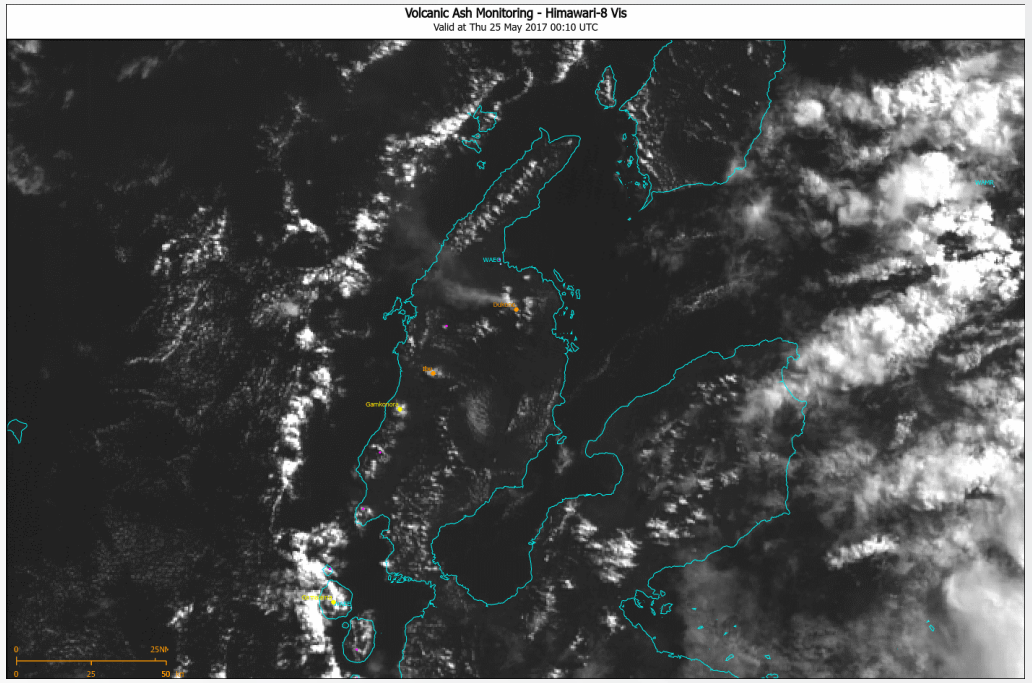
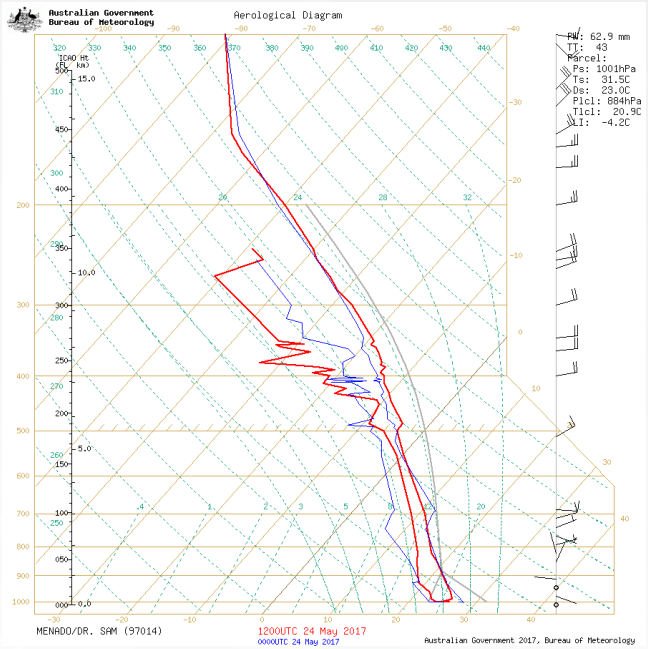


Sufficient remote sensing and conceptual evidence to issue a VAA



Evidence Quality	Volcano: Dukono	
Remote Sensing Evidence		
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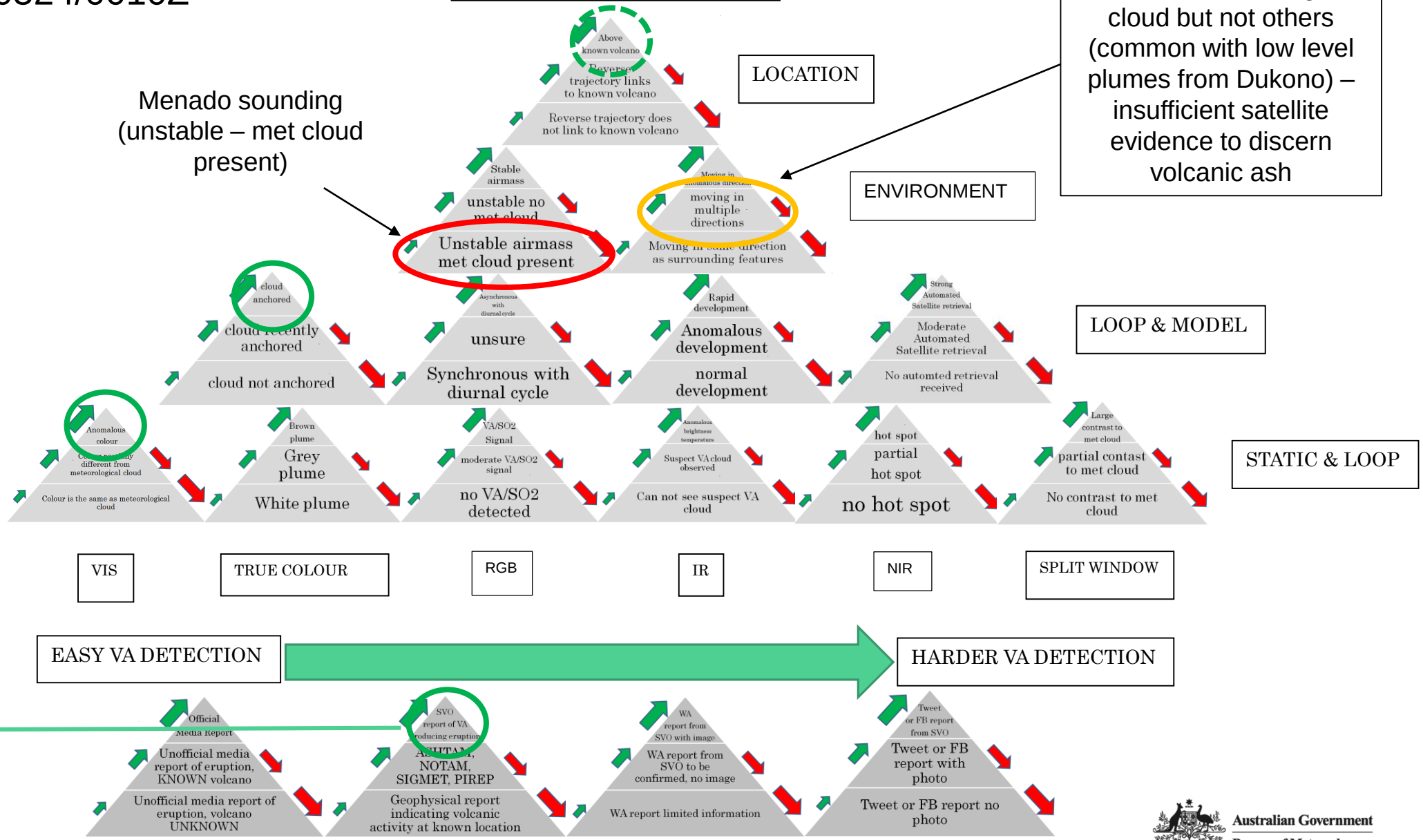
Strength of Evidence	Sufficient	
Sufficient	The balance of evidence suggests that an ash producing eruption has occurred	
Insufficient	Insufficient evidence to suggest that an ash producing eruption has occurred	
Submit (takes 20 seconds)		

20170524/0010Z

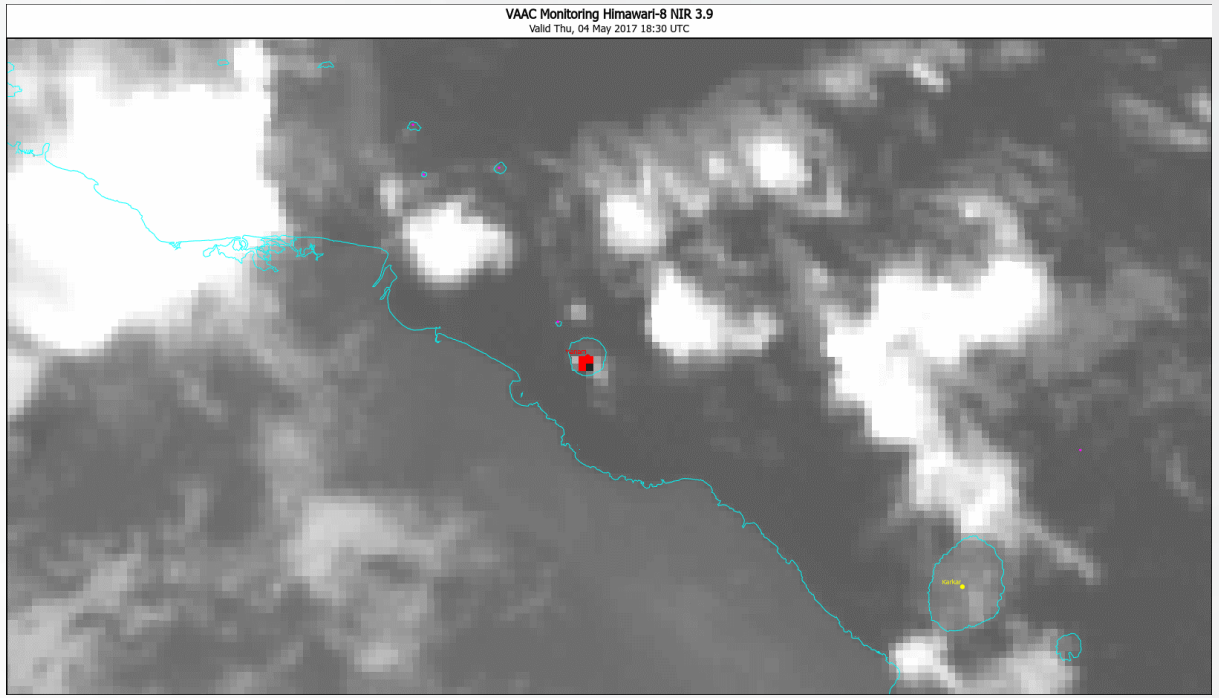
ISSUE VAA, Strength of evidence says VA is discerned

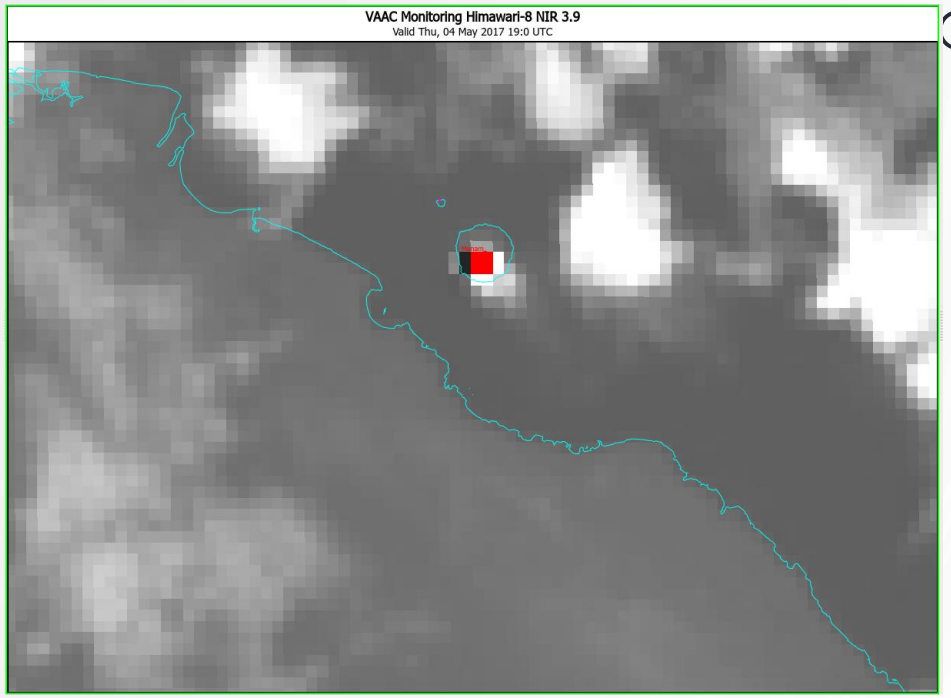
Moving in same direction as some surrounding met cloud but not others (common with low level plumes from Dukono) – insufficient satellite evidence to discern volcanic ash

Menado sounding (unstable – met cloud present)



Case Study 2| Manam, PNG





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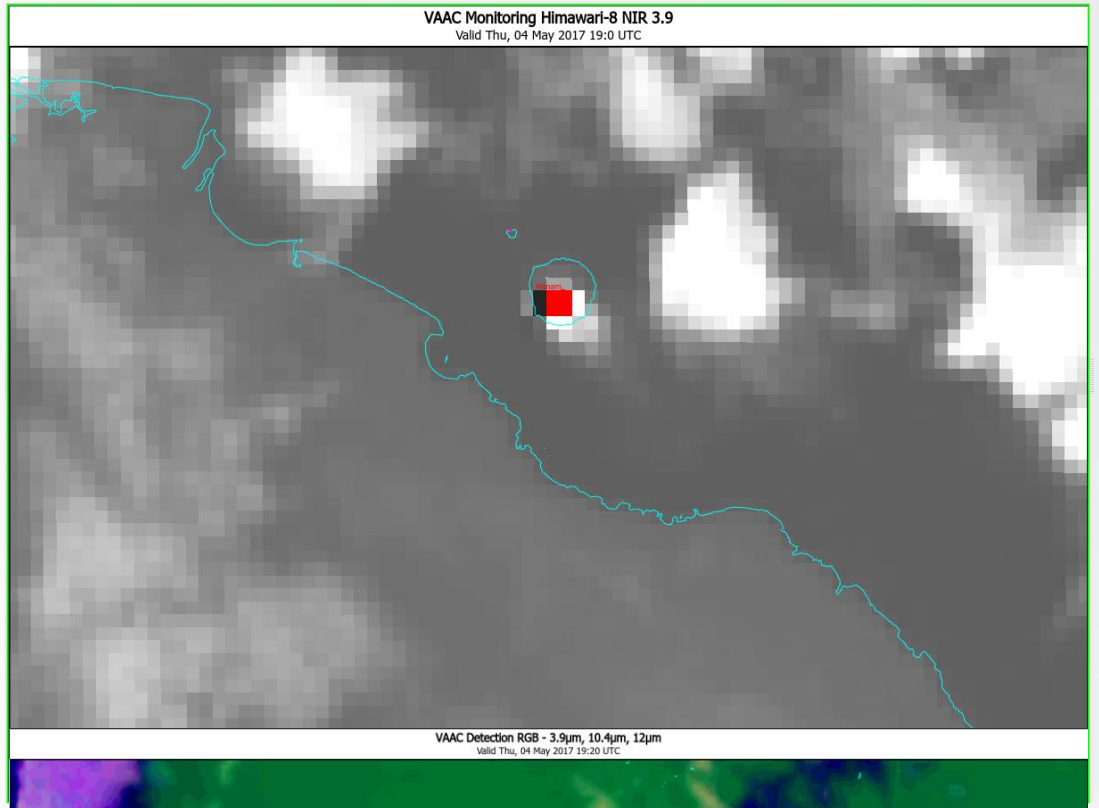

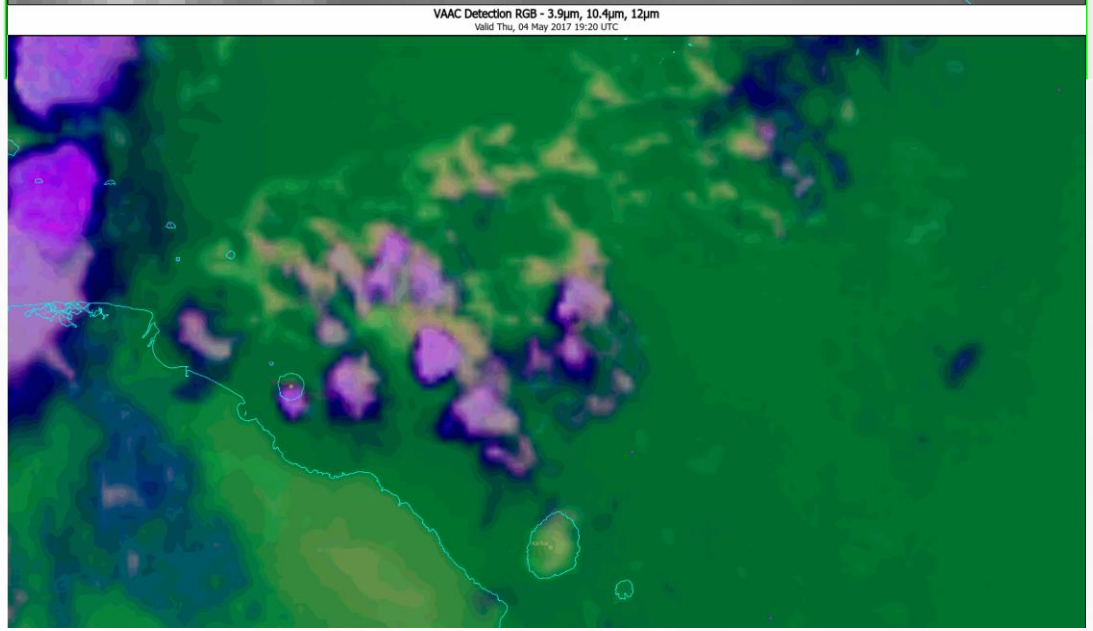

Evidence Quality	Volcano Manam	
Remote Sensing Evidence		
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Strong	SVO advice that an eruption from the volcano is immanent	☐
Strength of Evidence	Insufficient ⇕	
Sufficient	The balance of evidence suggests that an ash producing eruption has occurred	
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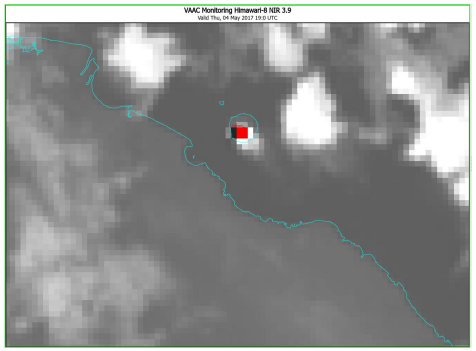
20170504/ 1900 – 2000Z

ISSUE VAA, Strength of evidence says VA is discerned



ACCESS-R model sounding (unstable – met cloud present)

Strongly resembling appearance and movement of nearby thunderstorms – not enough satellite evidence to discern volcanic ash

20170504/ 2000 – 2100Z

ISSUE VAA, Strength of evidence says VA is discerned

Brown plume (dashed) – ash discernible at FL100

ACCESS-R model sounding (unstable – met cloud present)

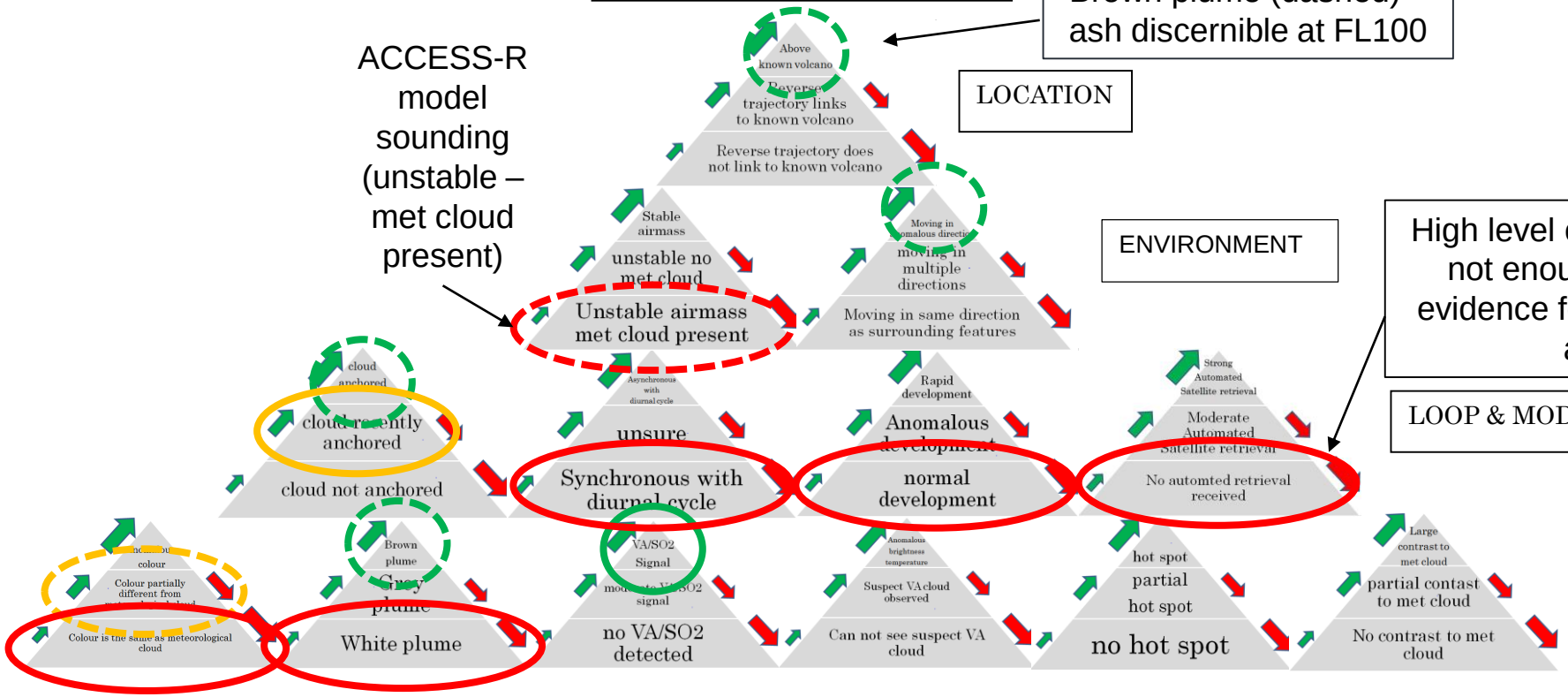
LOCATION

ENVIRONMENT

High level cloud (solid) – not enough satellite evidence for discernible ash

LOOP & MODEL

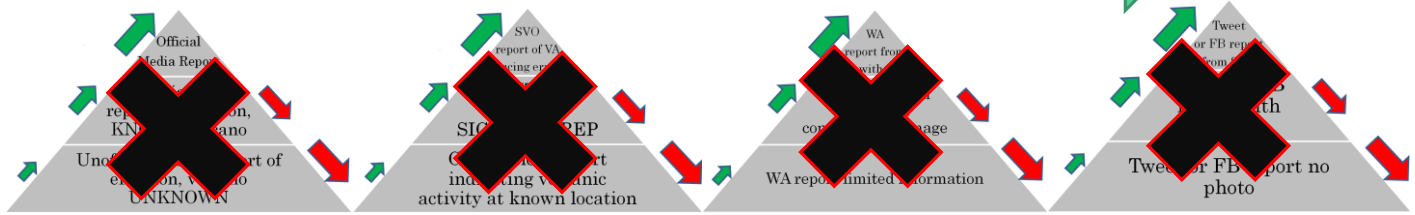
STATIC & LOOP



START HERE

VIS | TRUE COLOUR | RGB | IR | NIR | SPLIT WINDOW

EASY VA DETECTION → HARDER VA DETECTION

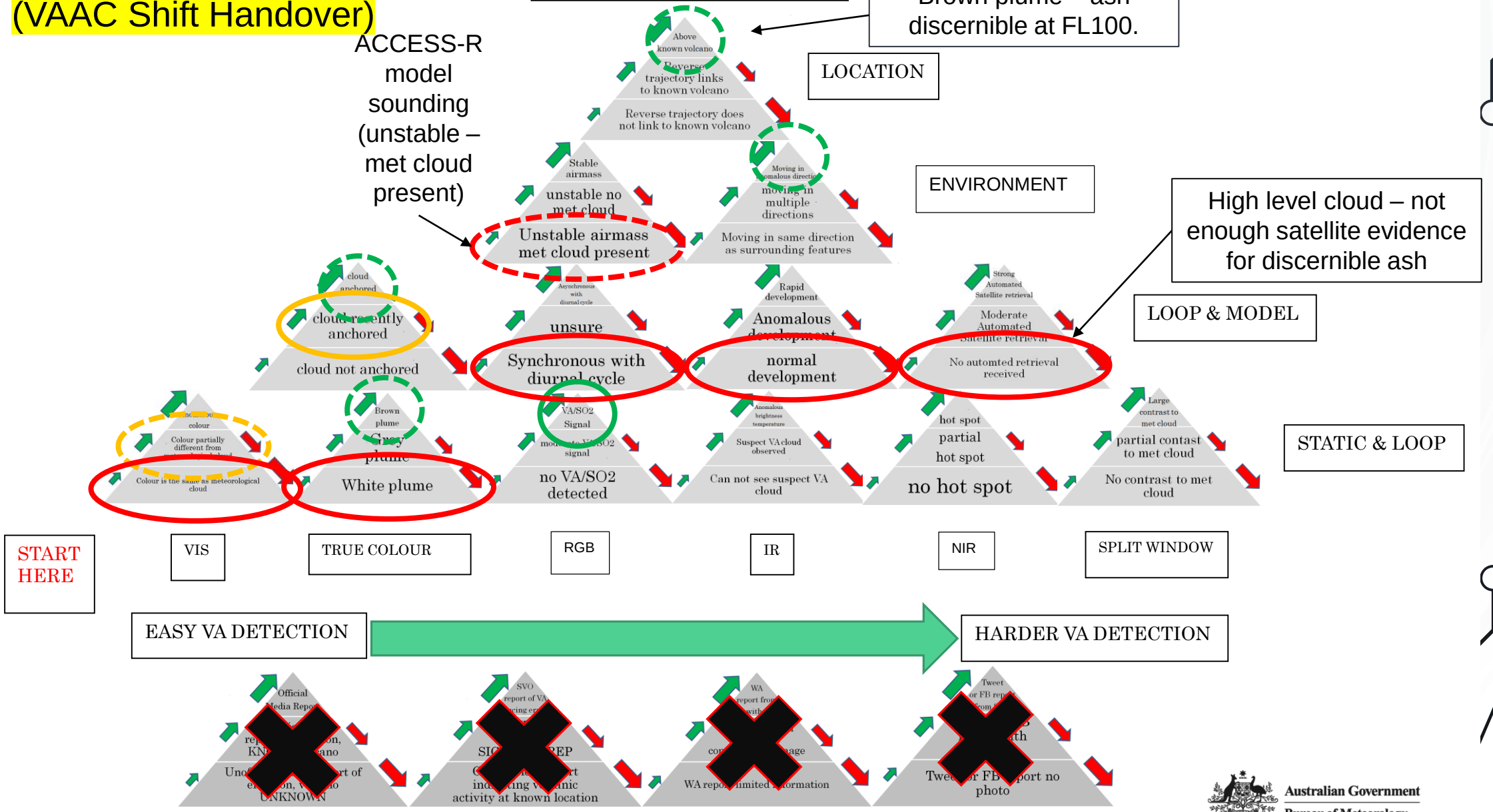


20170504/ 2100 – 2200Z
(VAAC Shift Handover)

ISSUE VAA, Strength of evidence says VA is discerned

Brown plume – ash discernible at FL100.

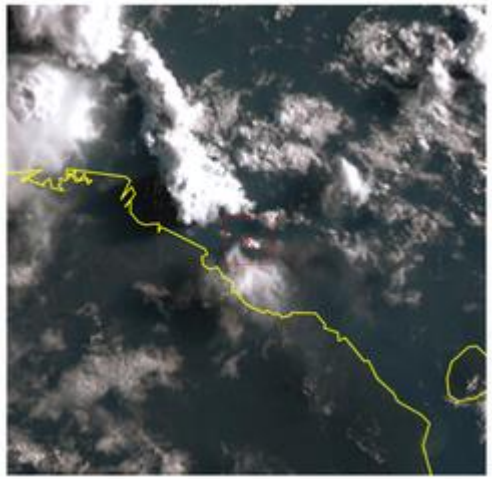
ACCESS-R model sounding (unstable – met cloud present)



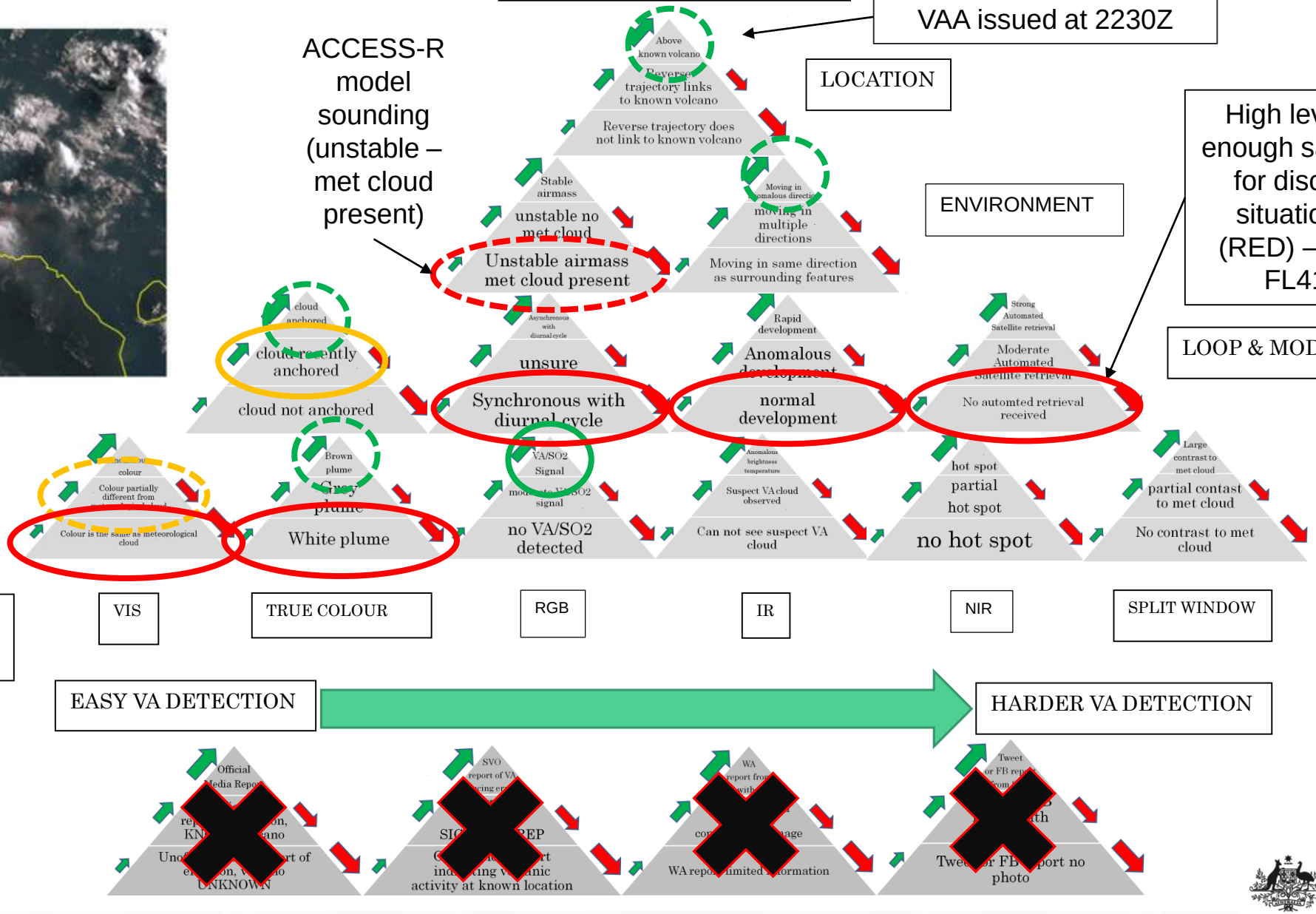
20170504/ 2200 – 2300Z

ISSUE VAA, Strength of evidence says VA is discerned

Brown plume – ash discernible at FL100 – VAA issued at 2230Z



ACCESS-R model sounding (unstable – met cloud present)



High level cloud – not enough satellite evidence for discernible ash – situational evidence (RED) – VAA issued to FL410 at 2250.

Discernible Ash| VAA/VAG Consistency

Checklist Type	Strengths	Weaknesses
Tick-box style checklist	Takes into account multiple sources of evidence including remote sensing, ground, airborne and conceptual (situational; i.e. aviation colour code)	How many weak, moderate and strong ticks constitutes sufficient evidence?
Pyramid style checklist	Graphical “Climbing the pyramids” scheme easy to follow and the forecaster can clearly see the pathway of evidence.	Strong emphasis on remote sensing evidence over the other types of evidence needed to discern volcanic ash – work in progress.
		Does not capture environment for low level plumes effectively – e.g. low level plumes commonly moving in the same direction as surrounding met cloud – according to environment pyramid there would never be enough evidence using this approach to issue a VAA if this was the case – incorporate situational (conceptual) evidence e.g. colour code).