User Requirements for En-route Hazardous Weather Information

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• Weather is a major contributing factor to aviation accidents
• IATA classifies weather as an “environmental threat” that induces pilot’s error
• Weather is the second biggest threat to flight safety after aircraft malfunction

24 July 2014
Air Algerie 5017

28 December 2014
AirAsia 8501

1 June 2009
Air France 447

24 July 2014
Air Algerie 5017

28 December 2014
AirAsia 8501

July 2014
SA Airways 286

SEV CAT
En-route Hazardous Weather

- Tropical cyclone
- Significant convection
- Turbulence
- Airframe icing
- High Ice Water Content (HIWC)
- Mountain wave
- Sand/duststorm
- Volcanic ash
- Radiation
Existing Information Service

- **SIGMET**
  - Text-based $\rightarrow$ not easy to interpret automatically
  - FIR-based $\rightarrow$
    - For region with small FIRs, one weather phenomenon might involve a number of SIGMETs
    - Discontinuity across FIR boundaries
    - Different local practice adopted in SIGMET issuance
  - Unavailability of SIGMET
Example of SIGMET issues
Who/what to trust?

- Range of differences in intensity, coverage, forecast position, development and timings

State A: TOP FL350
MOV E 25KT

State B: TOP FL450 STNR
But when we take out the satellite image...
What pilots get

How misleading to the big picture these SIGMETs could be
Near-term solution

- SIGMET Coordination to address consistency issue
  - WMO Pilot Project on SIGMET Coordination (Indonesia, Malaysia and Singapore)
  - METAAlliance SIGMET Coordination Project
  - Russian Federation SIGMET Coordination Project (Russia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan)
  - Balcans (Bosnia-Herzegovina, Croatia, Serbia and Slovenia)
  - DACH (Germany Austria and Switzerland)
  - NAMCON (Denmark, Estonia, Finland, Iceland, Latvia and Norway)
Participating MWOs

- Kuala Lumpur FIR
- Singapore FIR
- Kota Kinabalu FIR
- Jakarta FIR
- Ujung Pandang FIR
Monitoring and Coordination tool (HK)
Web-based Monitoring tool (HK)
Monitoring and Coordination tool (Japan)

Products

- Download TS area information file (SATAID format)
- Copy the information to the web tool
- Analyze convective clouds and draw TS area on SATAID referring to downloaded TS area information

Tools

- Compile SIGMET message
Europe - METAlliance

- Eight member states share national tools
- Harmonize forecaster’s handbooks and SIGMET thresholds
- Realtime web portal for common situation awareness
Future En-route Hazardous Information

- Paradigm shift
- Harmonized, phenomenon-based
- Aligned and integrated into the future ATM system as part of the Global Air Navigation Plan (GANP)
- In line with Aviation System Block Upgrades (ASBU) methodology and timeline
- Integrated in the SWIM environment for further processing by automatic decision support tools
Pilot’s expectation

- With widespread deployment of EFB, pilots’ wish for 3D view may soon materialize
Significant Convection - Detailed requirement

Observation and Nowcast
Note: The requirements should be based upon information needed to support realistic operational decisions.
The figure is Himawari-8 satellite picture with significant convection marked in red. Overlaid on top are the lightning in the past 10 minutes. The grid is 1 deg x 1 deg.

1. What is the timeliness requirement for observations?
   [Note: calculated from the time when data is available, e.g. pilot report - from time when report received from ATC. This is the maximum allowed time for analysis and preparation, observation should of course be made available soon.]
   - < 5 mins
   - < 10 mins
   - < 15 mins
   - < 20 mins
   - Other (please specify)

2. Do you need hazardous information relating to towing CU?
   - Yes
   - No

3. How many levels should the intensity of significant convection be expressed in?
   - 1
   - 2
   - 3
   - 4
   - More than 4
   - No requirement

4. How should significant convection intensity be expressed?
   - Isolated, scattered, occasional, frequent ...
   - Radar reflectivity [Note: over the areas not covered by radar, it would be derived from satellite]
   - Impact-based in scale of 1, 2, 3, ...
   - Other (please specify)

5. If your answer to the above question is impact-based, please elaborate how you would define impact.

6. For oceanic air space, what would be the minimum size of the convection you want to know?
   [Note: For very fine shapes, you may run into information overload. So the requirement should be based on ease of deviation from the significant convection.]
   - 50 km x 50 km
   - 100 km x 100 km
   - 150 km x 150 km
   - 200 km x 200 km
   - Other (please specify)

7. For oceanic air space, what would be the minimum separation distance between two convective systems which will not bring impact to your operation?
   [Note: For very fine shapes, you may run into information overload. So the requirement should be based on ease of deviation from the significant convection.]
   - 50 km
   - 100 km
   - 150 km
   - 200 km
   - > 200 km
   - Other (please specify)
• Observed hazard - updated as required
• Immediate Forecast (30 mins) – updated every 30 mins or as required
• Near term forecast (3 hrs) – updated hourly or as required
• Medium Forecast (12 hours) – updated every 3 hours or as required
• Long term forecast (24 hrs) – updated every 6 hours or as required
• Extended forecast (TC) – updated every 6 hours or as required
Initial user requirement - spatial

- Highly granular, as small as 0.25 deg x 0.25 for significant convection!
• Questions we should be asking the users
• Assessment of the service level based on science & technology
• Develop a roadmap in meeting the user requirements in future
• Being undertaken by a workstream under ICAO METP
Suggestions?

Thank you
8. For continental en-route airspace, what would be the minimum size of the convection you want to know? [Note: for very fine shapes, you may run into information overload. So the requirement should be based on ease of deviation from the significant convection.]
   - 50 km x 50 km
   - 100 km x 100 km
   - 150 km x 150 km
   - 200 km x 200 km
   - Other (please specify)

9. For continental en-route airspace, what would be the minimum separation distance between two convective systems which will not bring impact to your operation, i.e., you may consider to go between them?
   - 50 km
   - 100 km
   - 150 km
   - 200 km
   - > 200 km
   - Other (please specify)

10. Should the severity of the convection over continental en-route airspace be based on the number of accumulated lightning or lightning density (e.g., number of accumulated lightning strikes or lightning strike density)
    - Yes
    - No

11. If your answer to Q10 is YES, what should be the minimum criteria?
    - Less than 5 lightnings in the past 10 minutes
    - 5-10 lightnings in the past 10 minutes
    - 10-15 lightnings in the past 10 minutes
    - More than 15 lightnings in the past 10 minutes
    - Other (please specify)

12. If your answer to Q10 is NO, what should be the basis of the criteria?

13. Should the severity of the convection over oceanic en-route airspace be based on the number of accumulated lightning or lightning density (e.g., number of accumulated lightning strikes or lightning strike density)
    - Yes
    - No

14. If your answer to Q13 is YES, what should be the minimum criteria?
    - Less than 5 lightnings in the past 10 minutes
    - 5-10 lightnings in the past 10 minutes
    - 10-15 lightnings in the past 10 minutes
    - More than 15 lightnings in the past 10 minutes
    - Other (please specify)

15. If your answer to Q13 is NO, what should be the basis of the criteria?

16. If your answer to the above question is YES, what cloud top information do you require?
    - The maximum cloud top of the area
    - The 90th percentile of the cloud top of the area, i.e., half of cloud top is higher than this height and the other half lower than this height
    - The 75th percentile of the cloud top of the area, i.e., half of cloud top is higher than this height and the other half lower than this height
    - The 50th percentile of the cloud top of the area, i.e., half of cloud top is higher than this height and the other half lower than this height
    - The average cloud top of the area, i.e., the mean
    - The most frequent occurring cloud top of the area, i.e., the mode
    - Other (please specify)

17. Do you require cloud top information?
    - Yes
    - No

18. Do you require cloud base information?
    - Yes
    - No

19. Your organization, name and post title, please.
    
    Organization
    Name
    Post title

   [Submit button]