



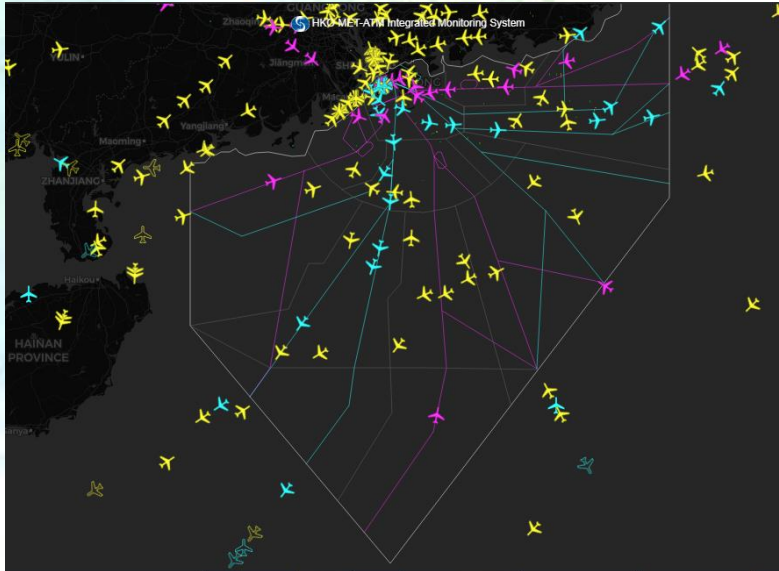
Application of NWP products on MET-ATM Integration

NWP MET-ATM products

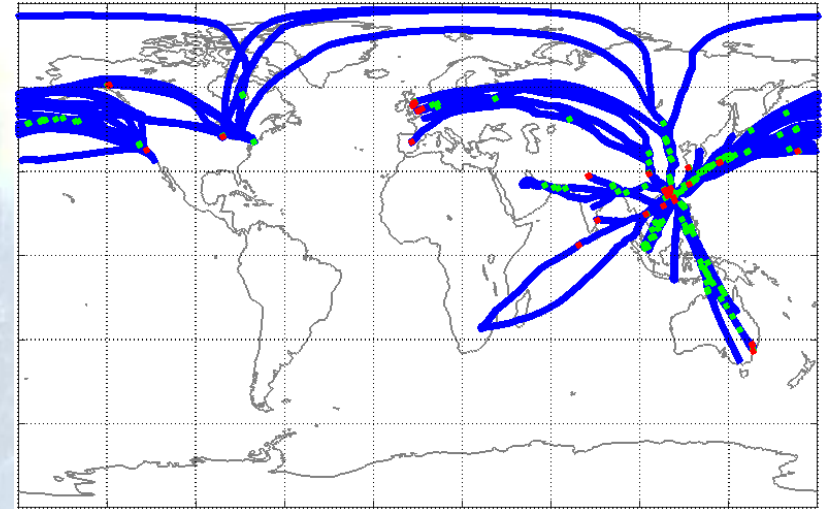
- **NWP forecast weather**
- **Derive impact to ATM from the NWP weather forecast**
- **Factors affecting the skills:**
 1. **Accuracy of the NWP weather forecast**
 2. **The correlation between the weather and the impact to ATM**
- **NWP can be regional or global, each has its own merit**

Global NWP MET-ATM products

**Pros: One single model that serves both ATM and airline
(seamless weather/weather impact forecast)**



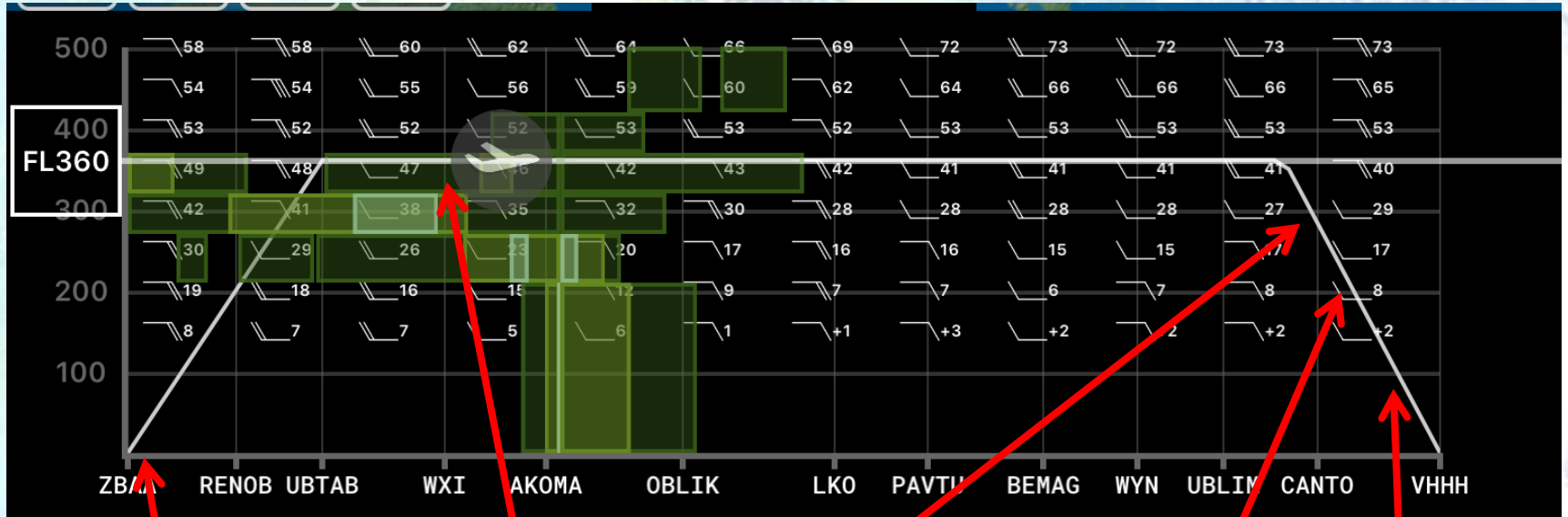
ATM perspective



Airlines perspective

**Cons: No control on temporal, horizontal and vertical
resolution, available forecast elements.**

Weather services at various phase



Take off forecast

Aerodrome weather
(cross wind,
convection, visibility)

En route weather
(turbulence,
convection, icing)

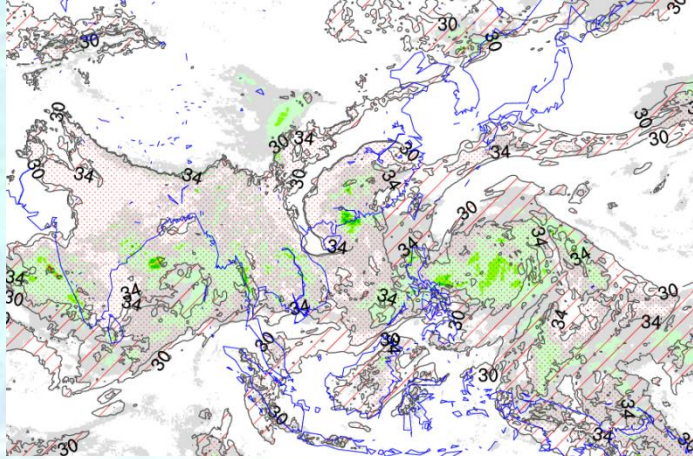
Weather at
holding point
(convection)

Low level
windshear

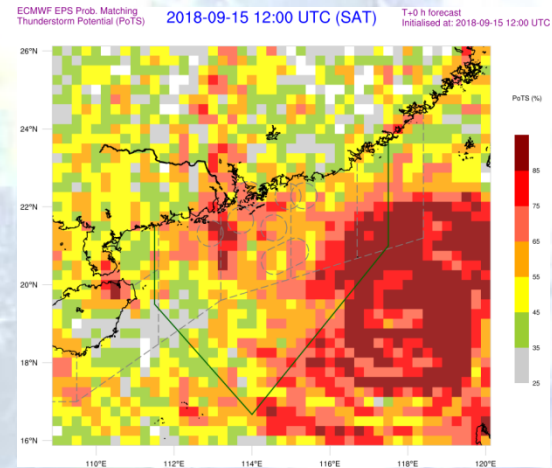
Convection forecast from global NWP

- Elements representing convection in NWP:

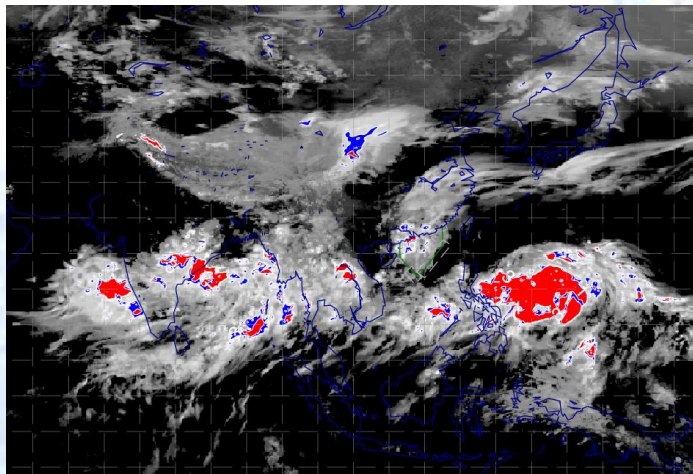
Rainfall + instability index



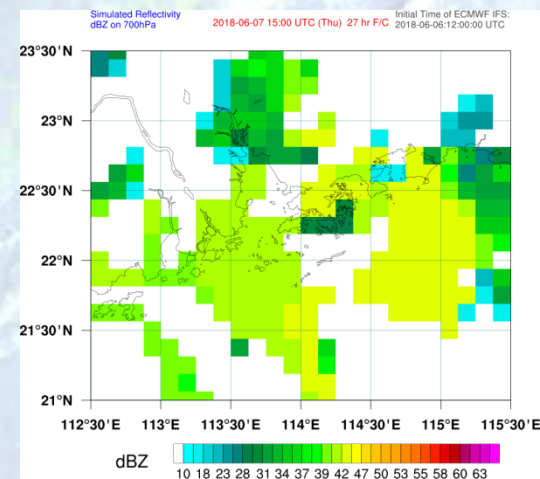
Lightning potential/probability



Forecast satellite

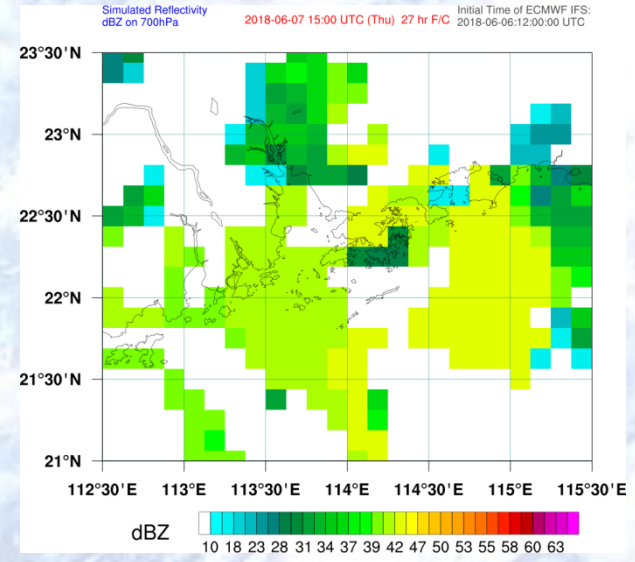
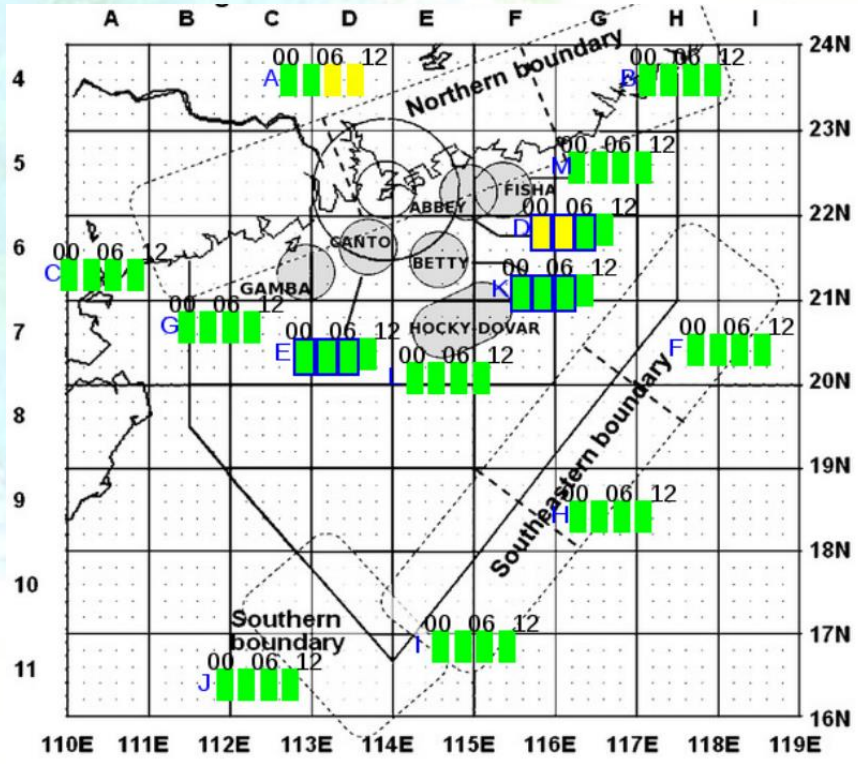


Forecast radar



Application of NWP convection products

- Extract the weather forecast for the holding points

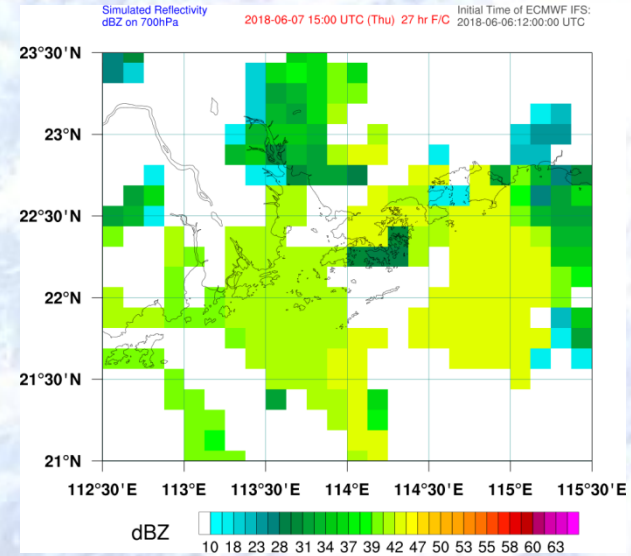
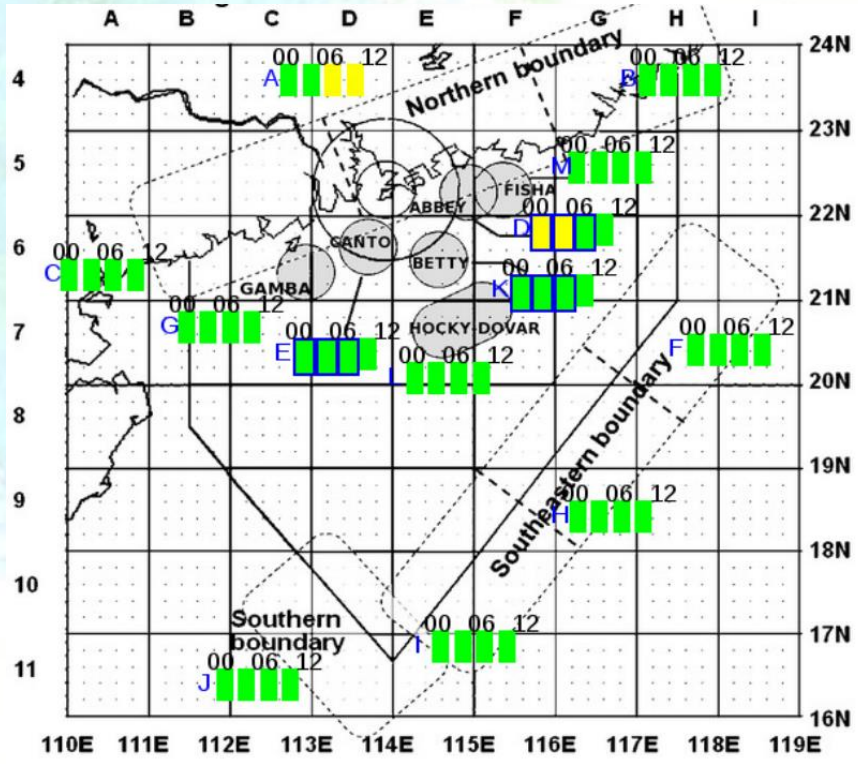


Simulated radar from global NWP

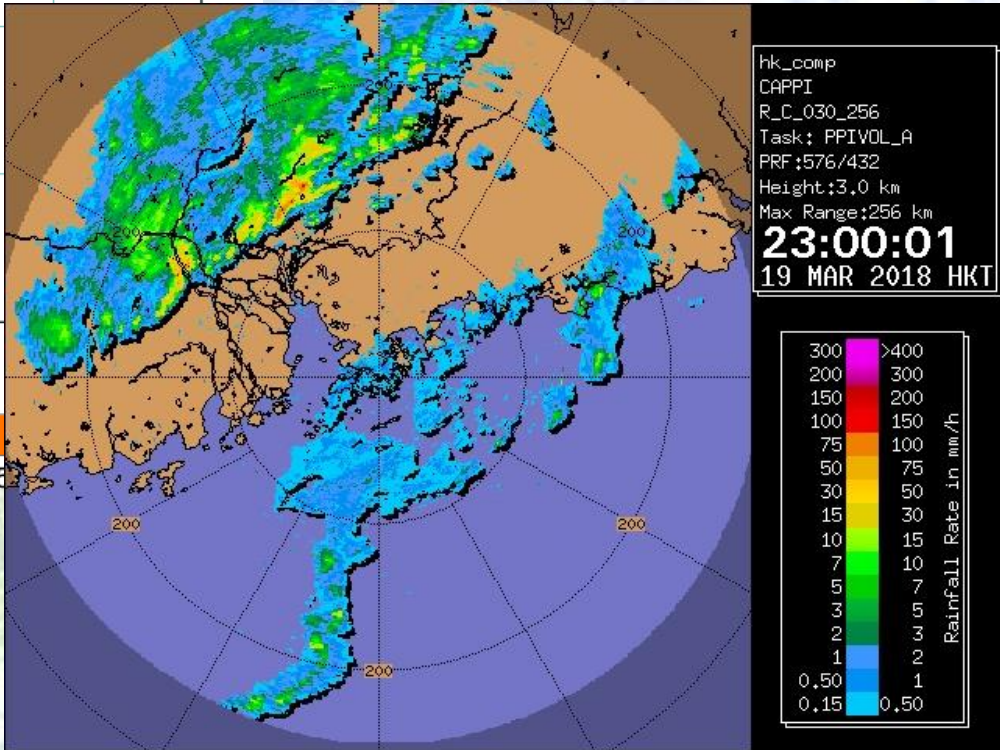
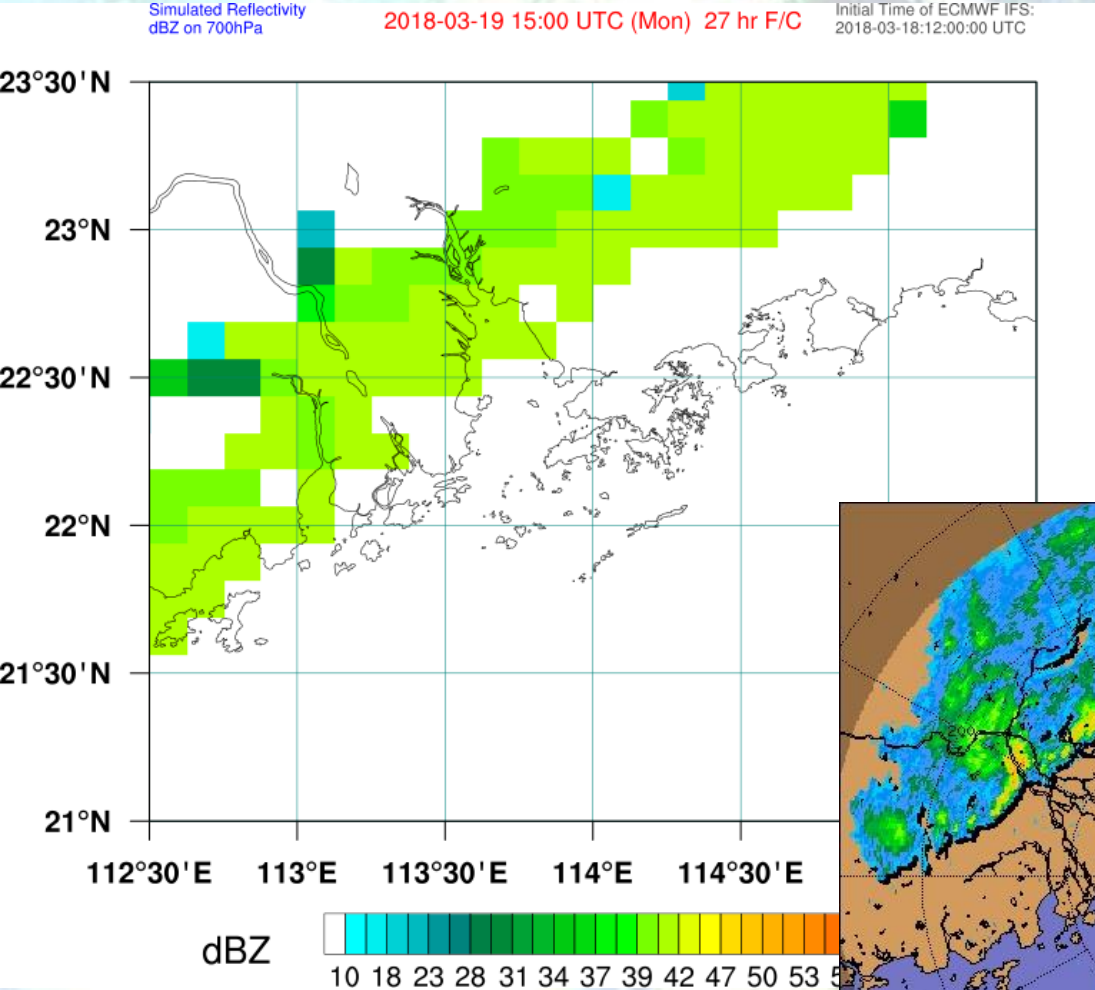
- **Why simulated radar? Because we usually verify convection with observation from radar. More “Apple-to-apple” comparison**
- **Reflectivity computed from hydrometeor content in the updraft/downdraft**
- **Stand-alone local implementation of convective parameterization scheme of ECMWF IFS Cy43r3**
- **Account for entrainment, detrainment, freezing, melting, condensation, evaporation, etc**
- **Some diurnal effect accounted due to ingestion of surface heat flux and boundary layer height**
- **Updraft/downdraft equation solved numerically by implicit scheme**

Application of NWP convection products

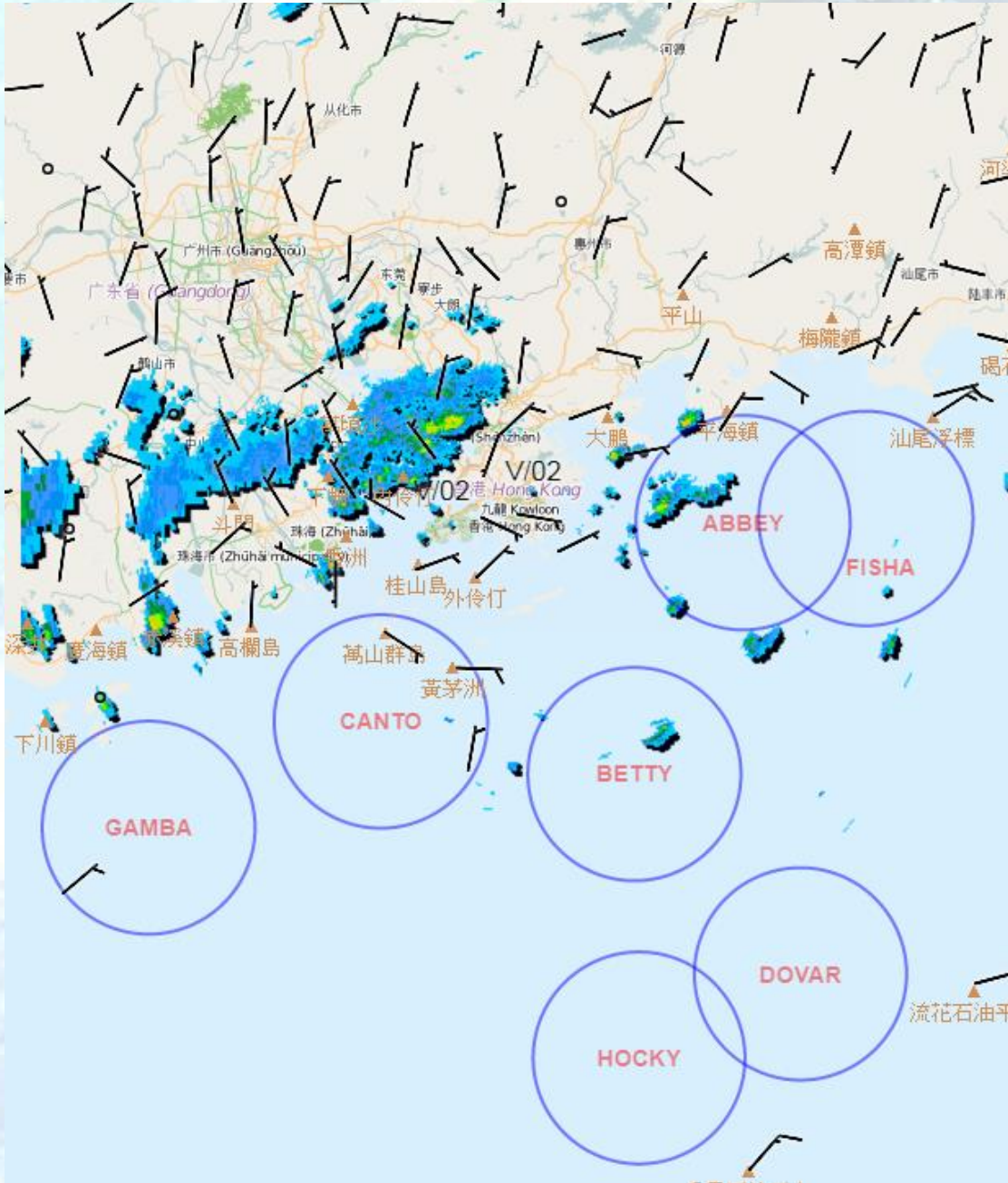
- Extract the weather forecast for the holding points



Some case



Performance

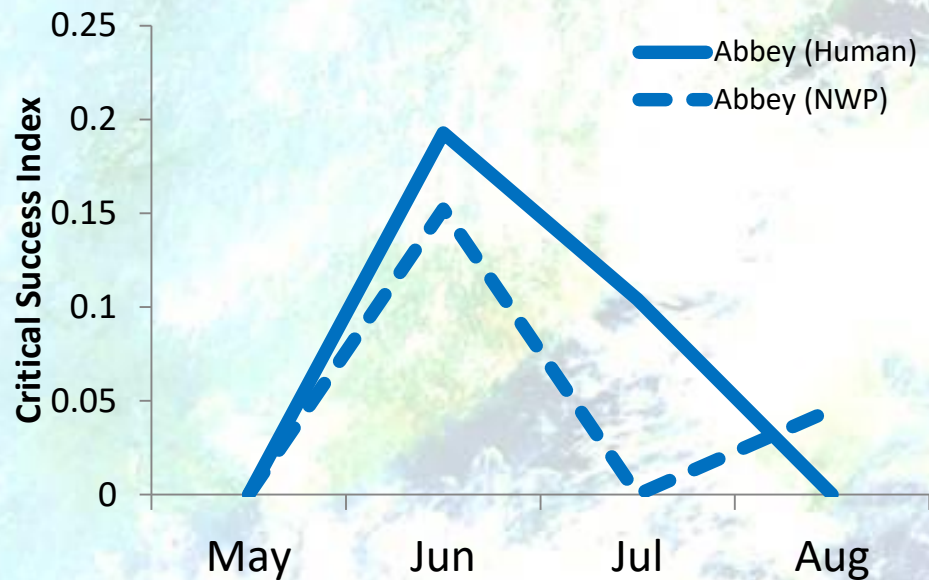


Model: Simulated reflectivity from ECMWF (≥ 33 dBZ) at holding points
Forecast frequency: 3hrly
Forecast element: convection
12 hrs from forecast time

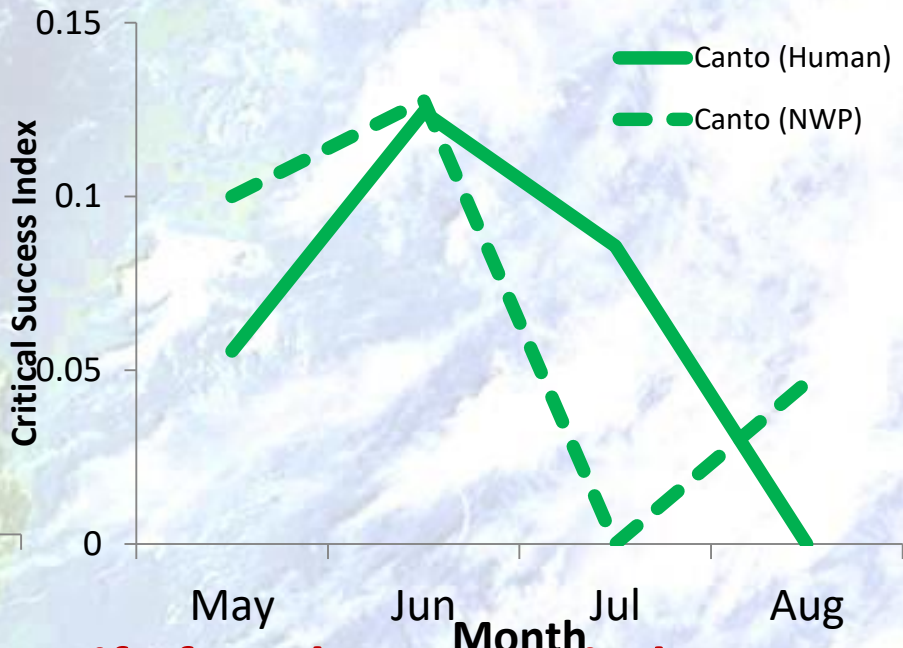
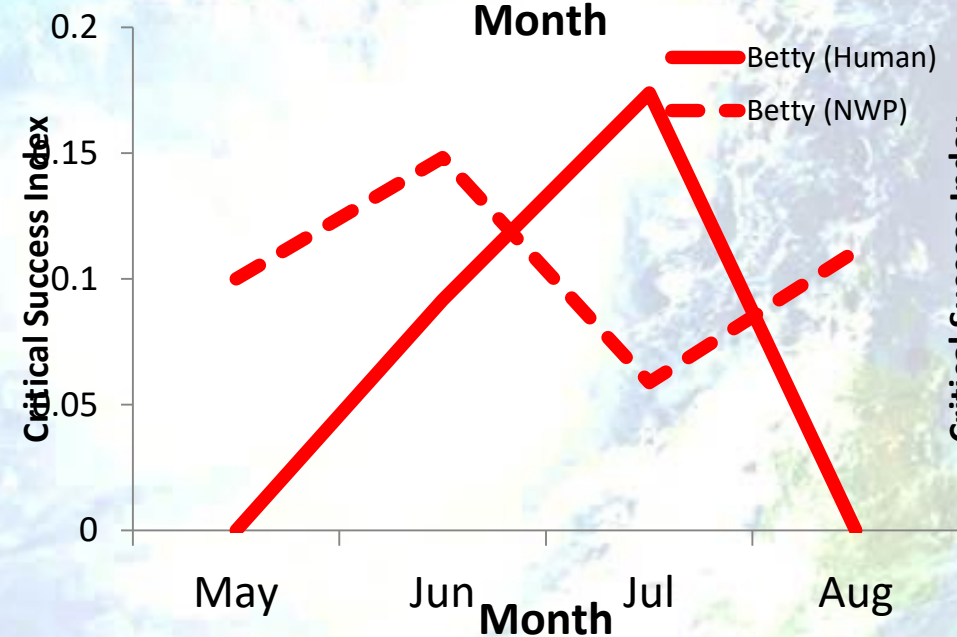
Assume 12 hours delay from initial time to data available (i.e. 24+ hours forecast from NWP)

Only verify for Abbey, Betty and Canto

Performance

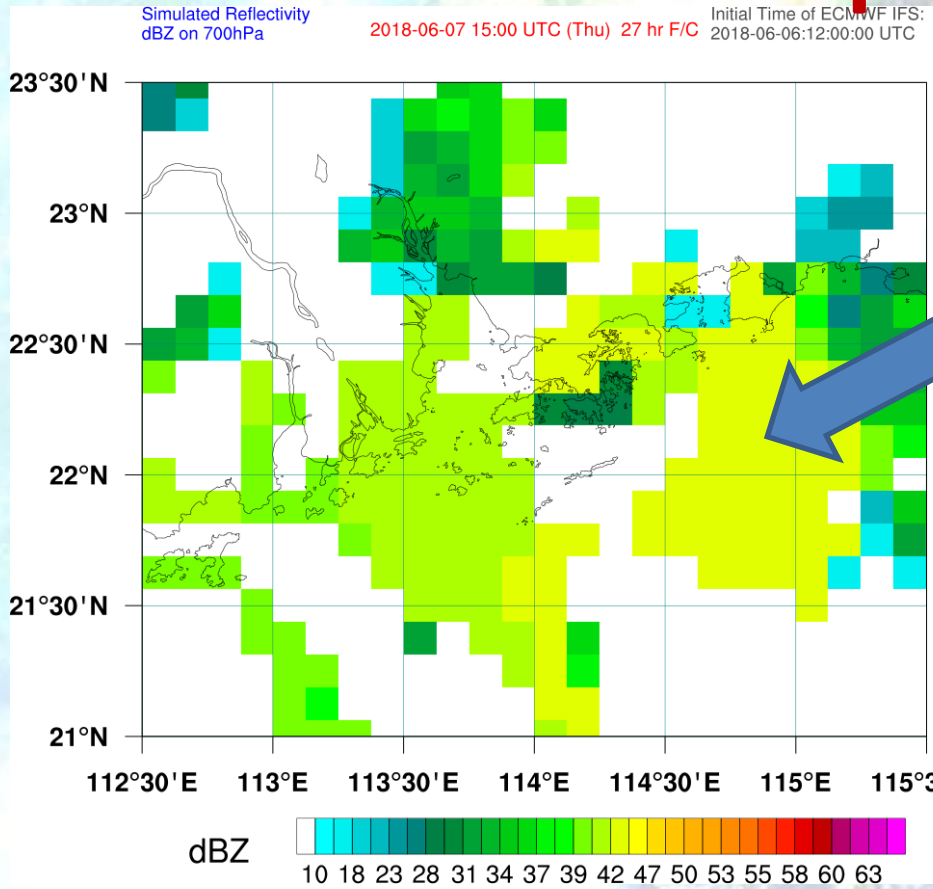


Human 12 hours forecast VS NWP 24-33 hours forecast

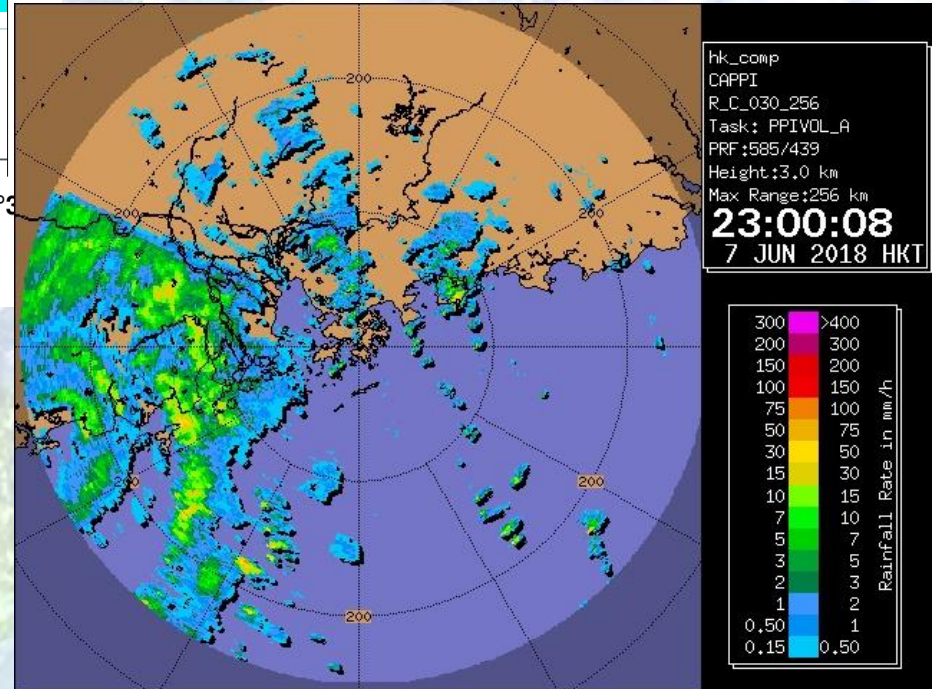


Some values for blending. Need to verify for a longer period

Example cases



Over-forecast the reflectivity here



Performance depends on weather system. Better for larger systems like TC. Blend with nowcasting to improve short term skills

Visibility forecast from global NWP

Flights to Hong Kong International Airport diverted to Macau and Shenzhen as heavy fog causes delays

Affected aircraft include at least seven operated by Cathay Pacific and three by Hong Kong Airlines

PUBLISHED : Friday, 16 March, 2018, 10:16am

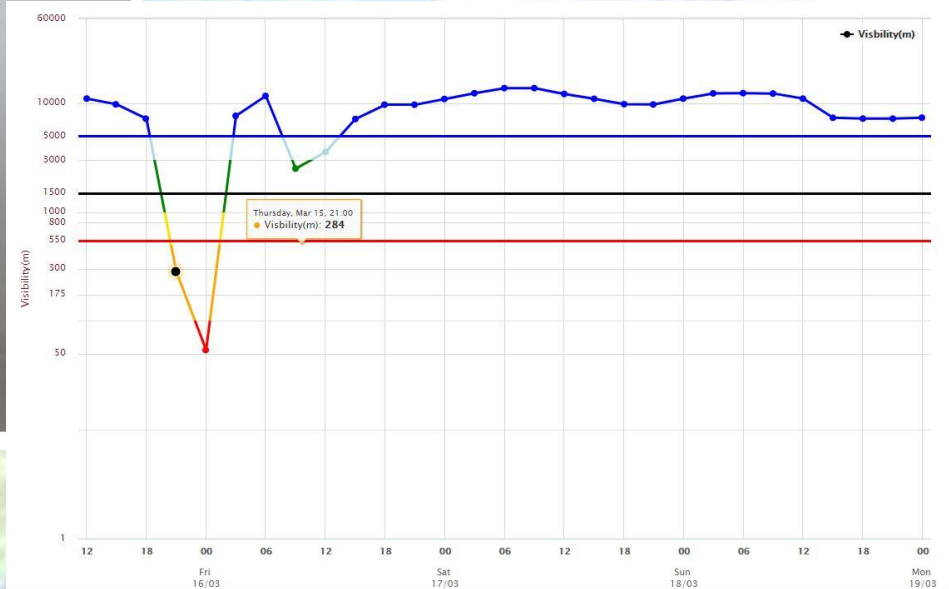
UPDATED : Friday, 16 March, 2018, 3:24pm

COMMENT:

1



A case early this year. Low vis situation well captured

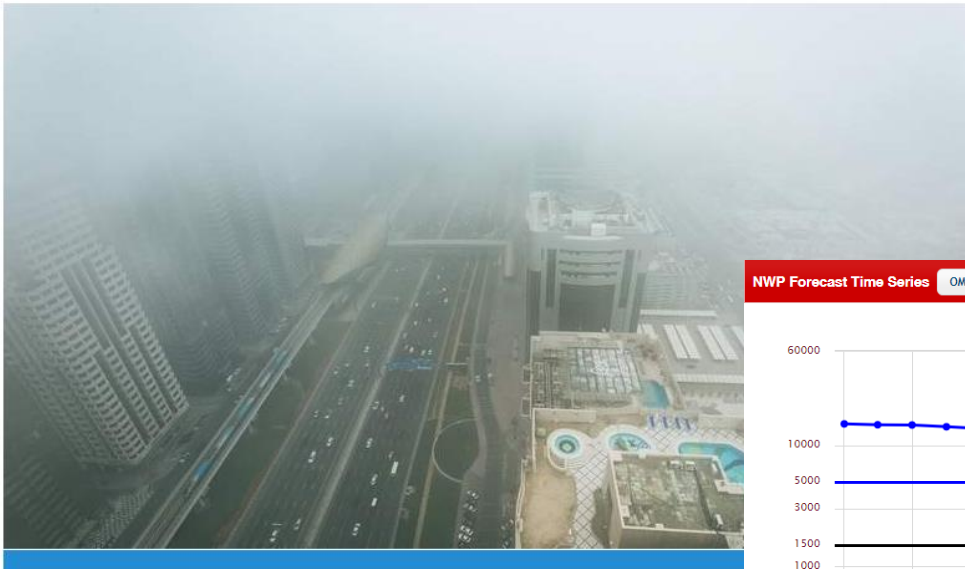


Visibility forecast from global NWP

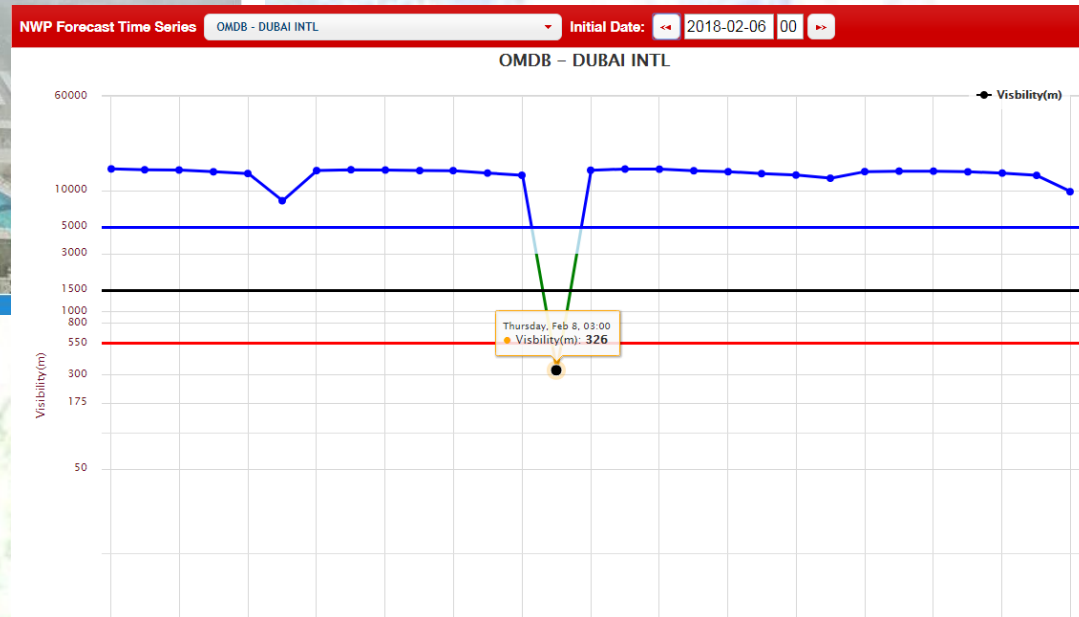
HOME > NATION > DUBAI

Flights delayed as dense fog takes over UAE

Staff Report/Dubai
Filed on February 8, 2018

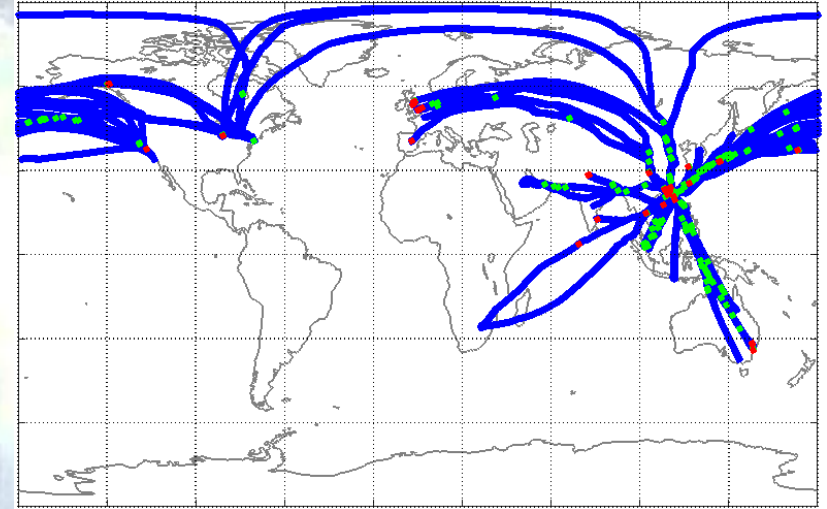
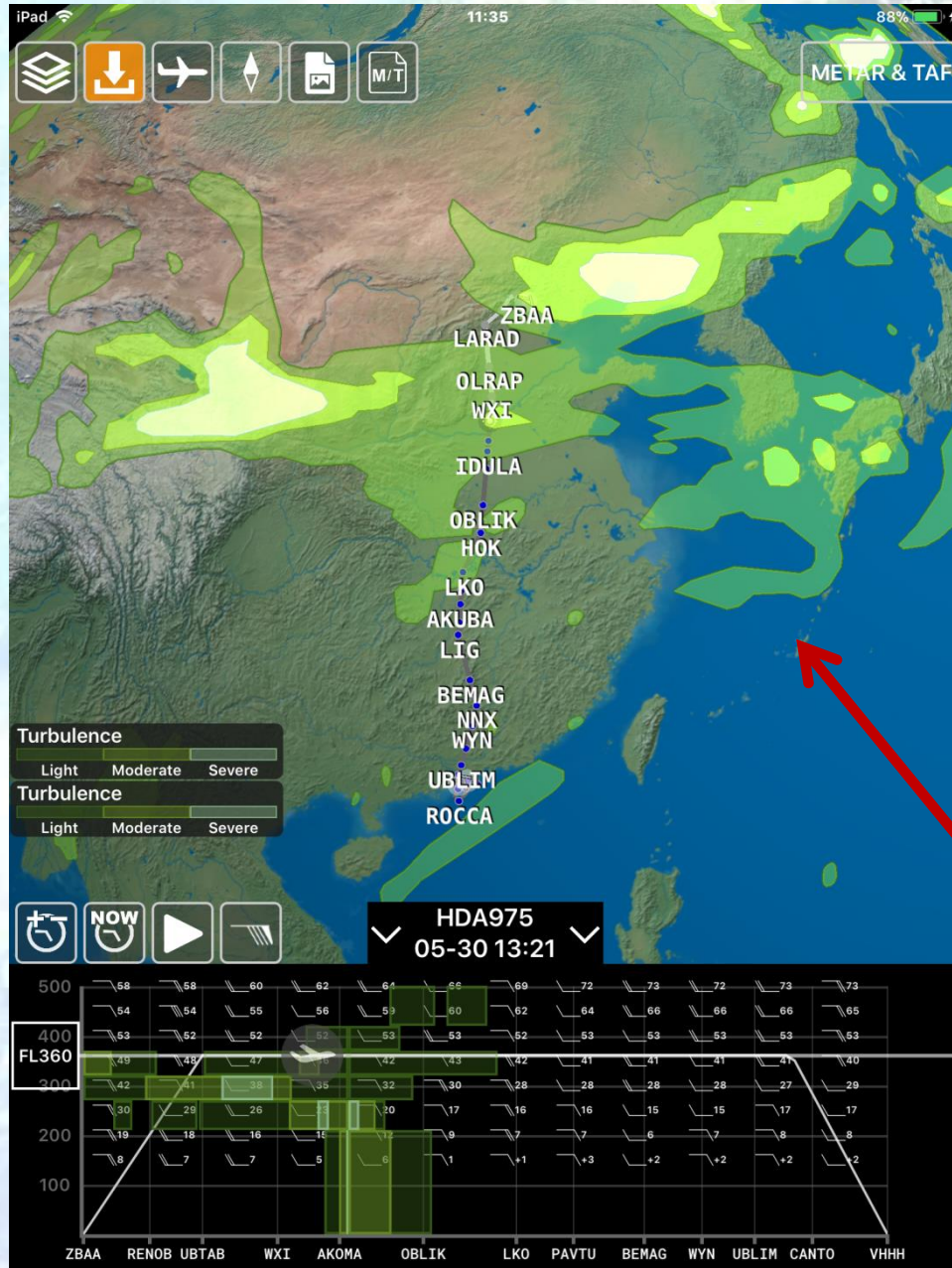


Another case early this year in Dubai



Consistently forecast in subsequent runs

Global NWP data for EFB

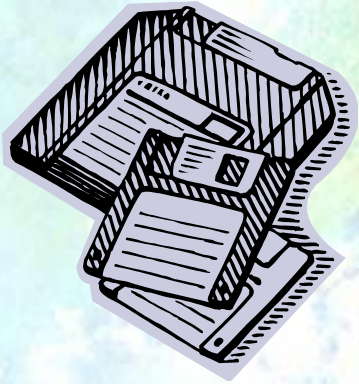


Global model is needed to cover all of the flight routes

Turbulence forecast

Global NWP data for EFB

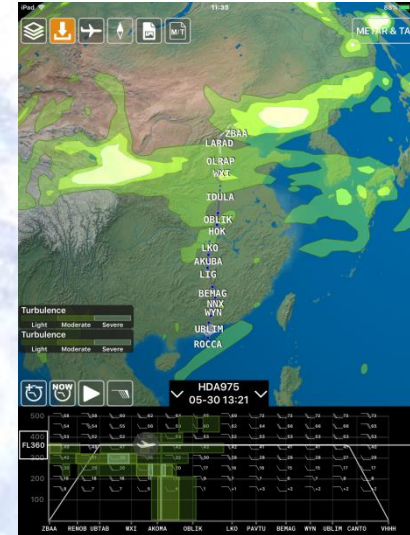
Processing flow:



NWP forecast



Post-processing



Display

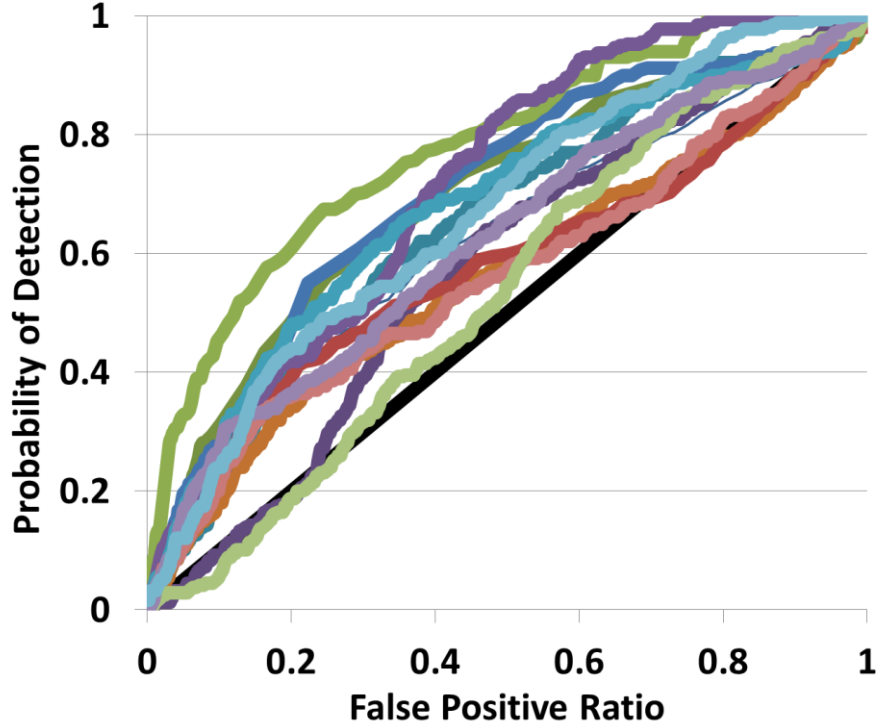
Same as usual NWP products.

Devils in the details! Subtle issues.

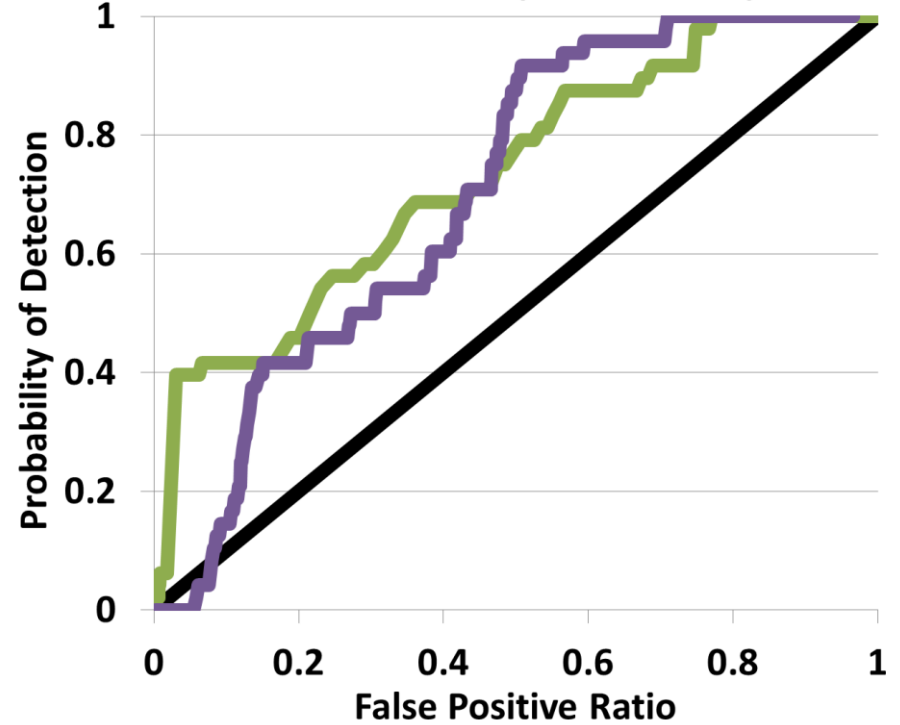
- Pole
- Periodic boundary
- Large grid size (resolution @0.125° 2880 x 1441 x vertical levels)

Verifications

ROC for EDR > 0.1 (fcst hr: 24-33)



ROC for EDR > 0.4 (fcst hr: 24-33)



Grid-based verification against QAR data

QAR records both “events” and “non-events”

QAR data needs serious QC!

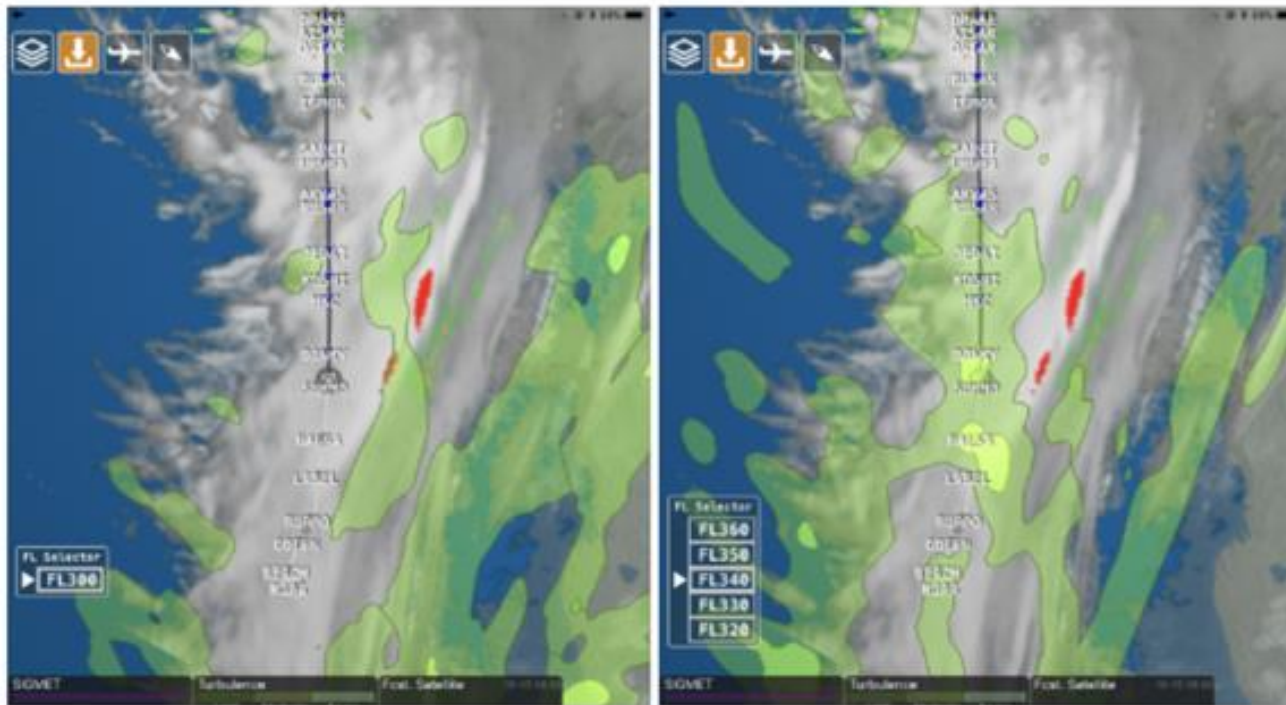
More devils in further details!

Some data can be saved by QC. Some have to be throw away

Verifications

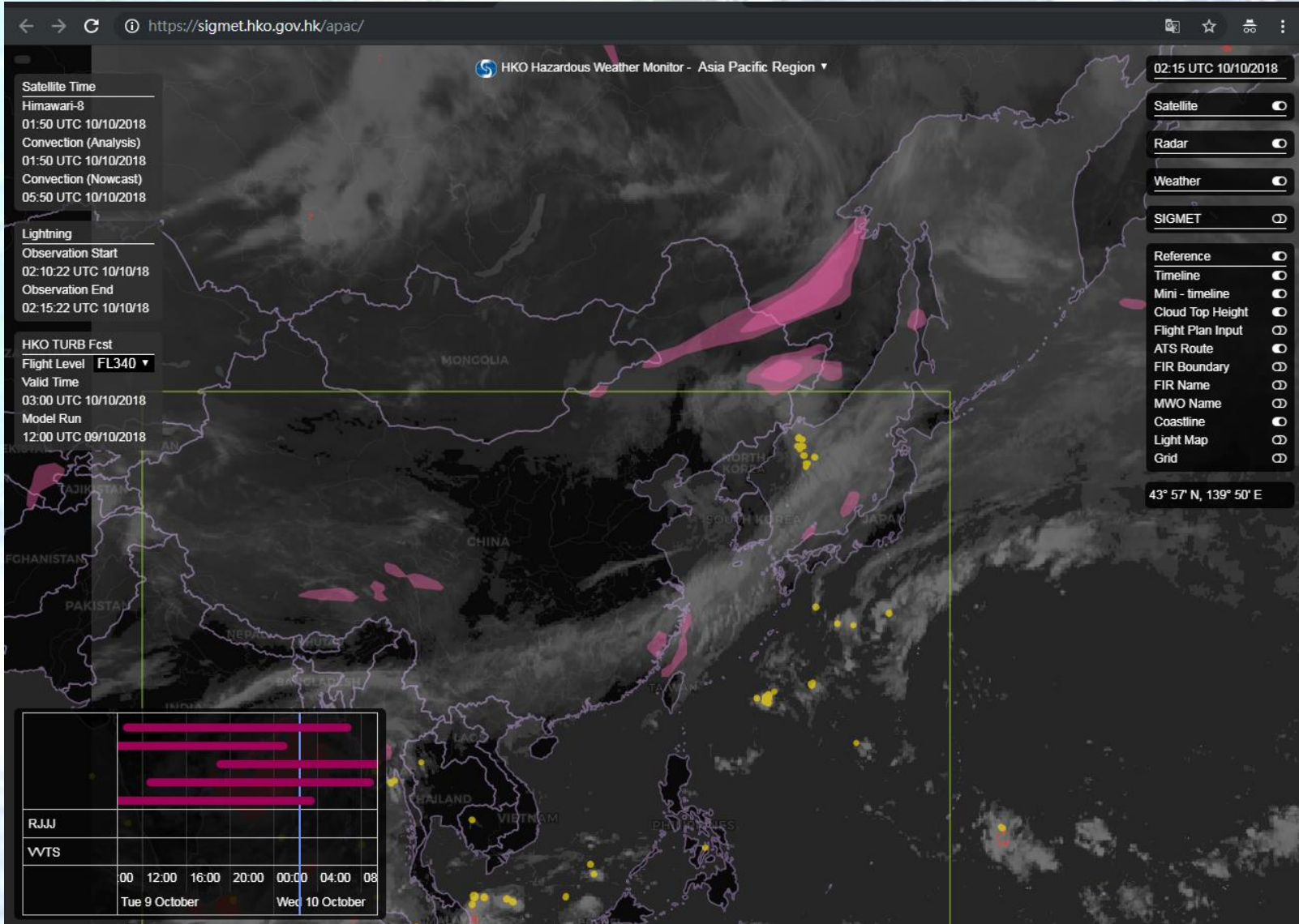
Follow - 2017 at 7:35 AM - Edited

CX [redacted] cruising at CFP level of FL340, encountered moderate turbulence - service stopped and cabin crew seated. FL320 was blocked by CI103, so descended to FL300, where it was smooth. When I had time to consult the app it showed an impressive correlation with the real world, which is more than could be said for the WAFC London chart! We also used the app to decide when to climb back up to FL340 and that worked like a charm too.



Collecting user feedback from social media

Available on SIGMET monitor page



<https://sigmet.hko.gov.hk/apac/>

An aerial photograph of a coastline, showing a narrow strip of green land between a dark blue sea and a lighter blue bay. The land is covered in dense vegetation. The water shows some white foam or rapids in the central channel.

This is just outlines.

Feel free to contact me for details.

An aerial photograph of a dense forest with a winding path. The path is a mix of brown and grey, suggesting it might be a dirt or stone path. The surrounding trees are lush green, and the overall scene is captured from a high angle, looking down on the forest floor.

Thank you

