MIDAPANPIRG MET SG/8

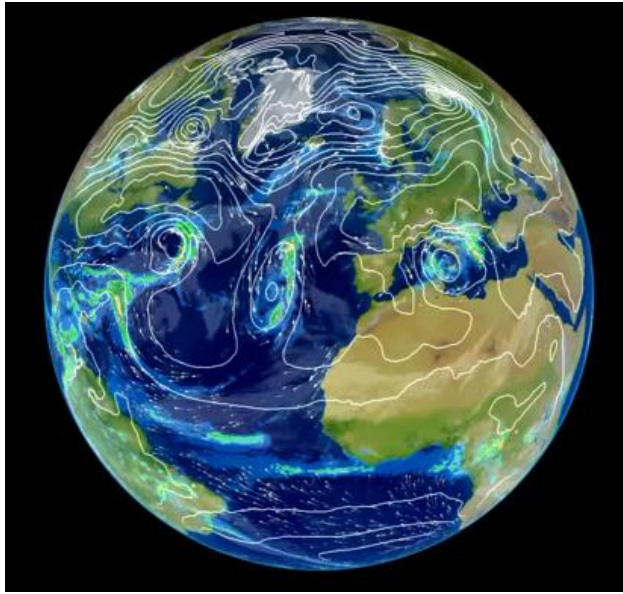
WAFS 10 year plan

Presented by WAFC London

Karen Shorey,
International Aviation and SADIS Manager, UK Met Office

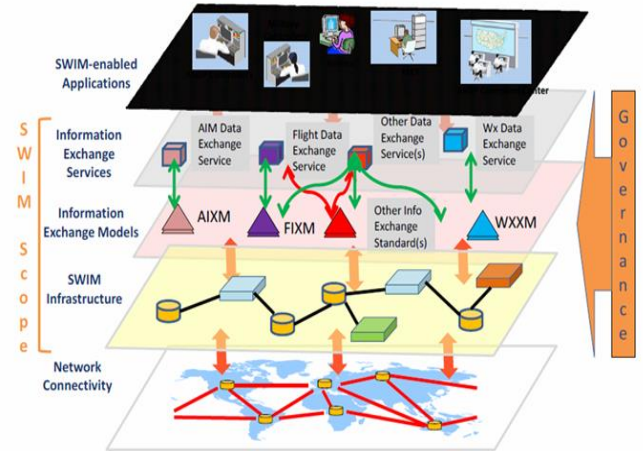
World Area Forecast System 10 Year Plan

- Developed in conjunction with the Met Panel Meteorological Operations Group (MOG)
- Devised and agreed by both WAFC London and WAFC Washington
- Will ensure WAFS is fit for the future of the aviation industry
- Will bring higher resolution data sets and new data delivery systems



Why develop WAFS?

- To meet the objectives of the Global Air Navigation Plan (GANP), delivered through Aviation System Block Upgrade (ASBU) methodology
  - Increased traffic and higher capacity airspace
  - Performance and trajectory based navigation
  - Environmental gains e.g. Continuous Climb/Descent Operations.
  - Air Traffic Flow Management (ATFM)
- Flight patterns and airline requirements are changing :
  - Very long haul flights such as Auckland to Qatar and Perth to London
  - Business jets flying at FL500
- To introduce scientific/modelling improvements



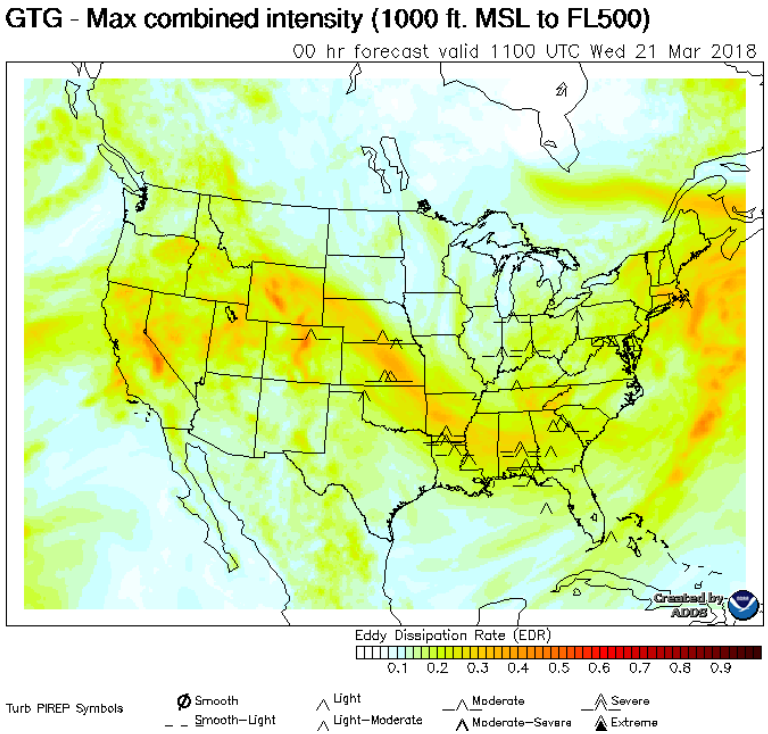

What is on the horizon for WAFS…….

Advancements in Meteorological Science

- Upgrades to the hazard algorithms

Turbulence

- NOW: Turbulence Potential
- November 2020: Turbulence Severity
  - Will use the Graphical Turbulence Guidance (GTG) product developed by NOAA/NCAR
  - Provides output in units of Eddy Dissipation Rate (EDR), which is an aircraft independent measure of turbulence.
  - GTG can forecast Clear Air Turbulence and Mountain Wave Turbulence.

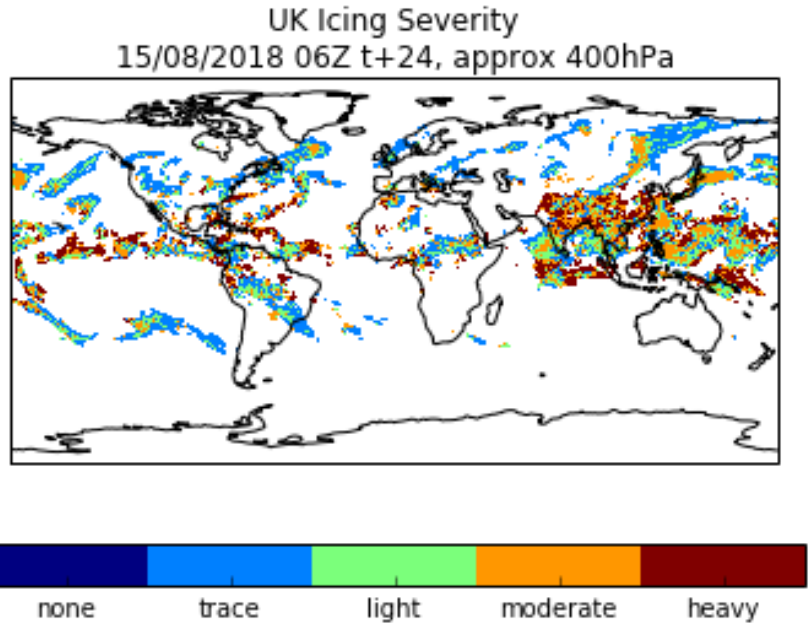


Advancements in Meteorological Science

- Upgrades to the hazard algorithms

Icing

- NOW: Icing Potential
- Nov 2020: Icing Severity
  - More physically realistic as it takes into account a wider range of meteorological conditions conducive to icing
  - Will give a categorical measure of icing



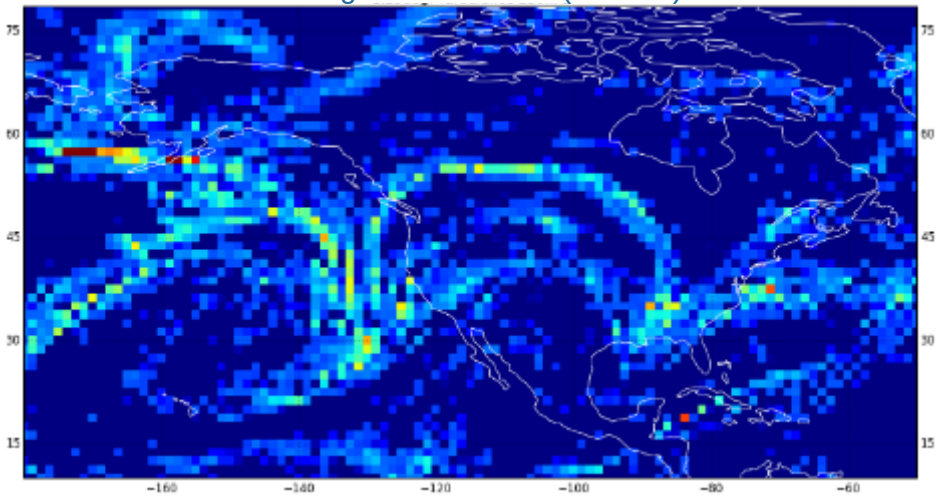
Improvements in the WAFC data sets

Improved Horizontal Resolution

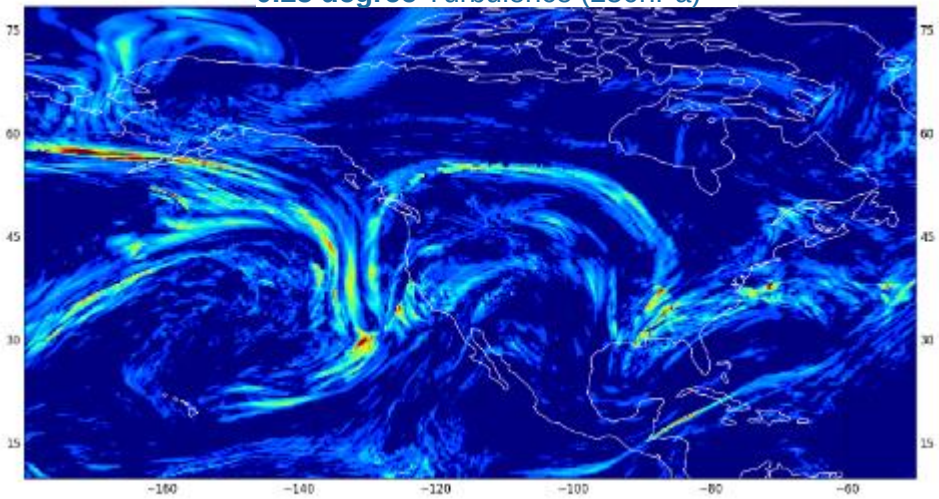
- The WAFCs currently run global models with 10-13 km (approx. 0.12 degree) resolution. Data is then “thinned” to create the 1.25 degree resolution WAFC data sets.
- 0.25 degree resolution has been shown to be a good compromise between resolving features and limiting file size
- What does it mean:
  - 1.25 degree equates to approx. 9 minutes flying time
  - 0.25 degree equates to about 1.75 minutes flying time

Resolution increase to 0.25°

1.25 degree Turbulence (250hPa)

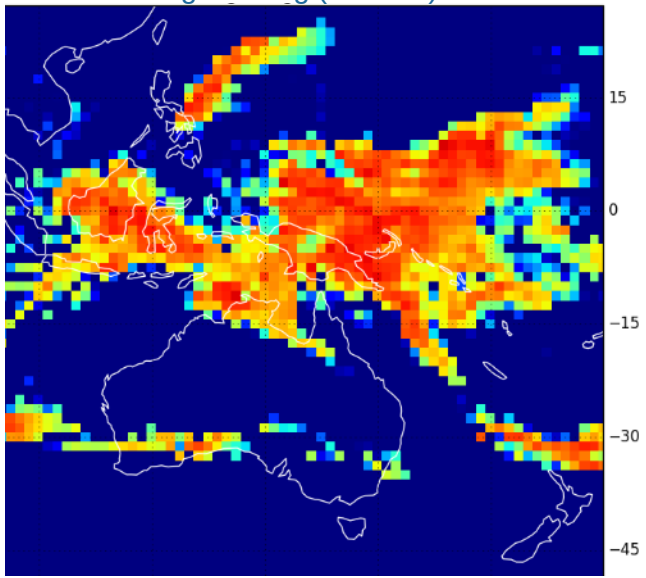


0.25 degree Turbulence (250hPa)

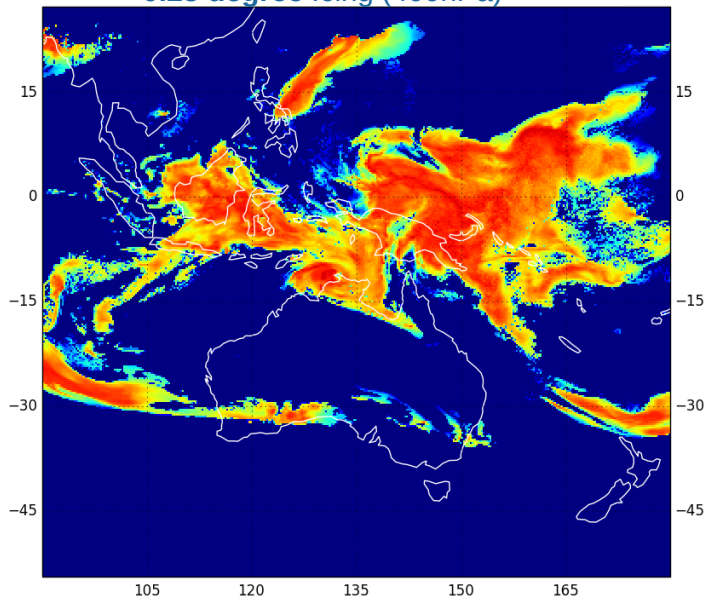


Resolution increase to 0.25°

1.25 degree Icing (400hPa)

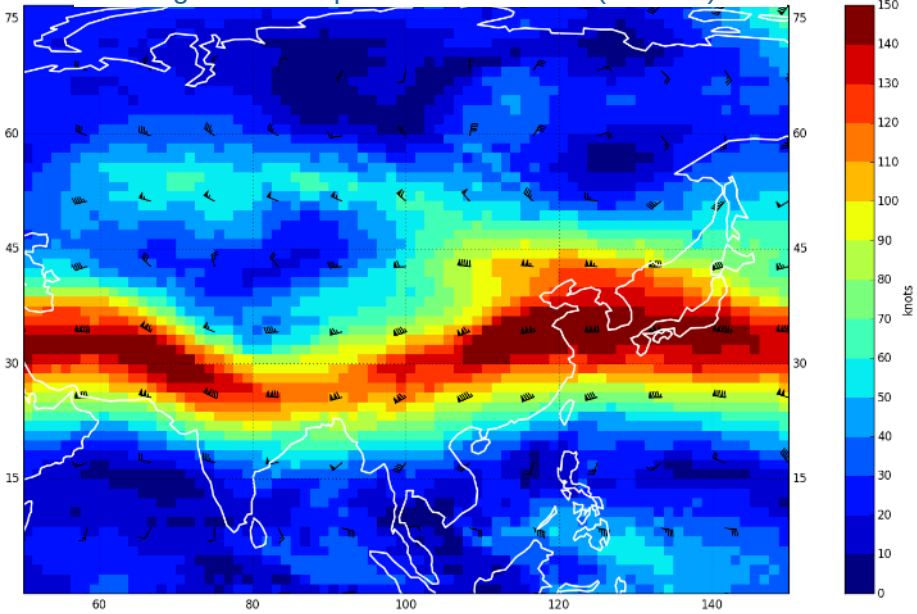


0.25 degree Icing (400hPa)

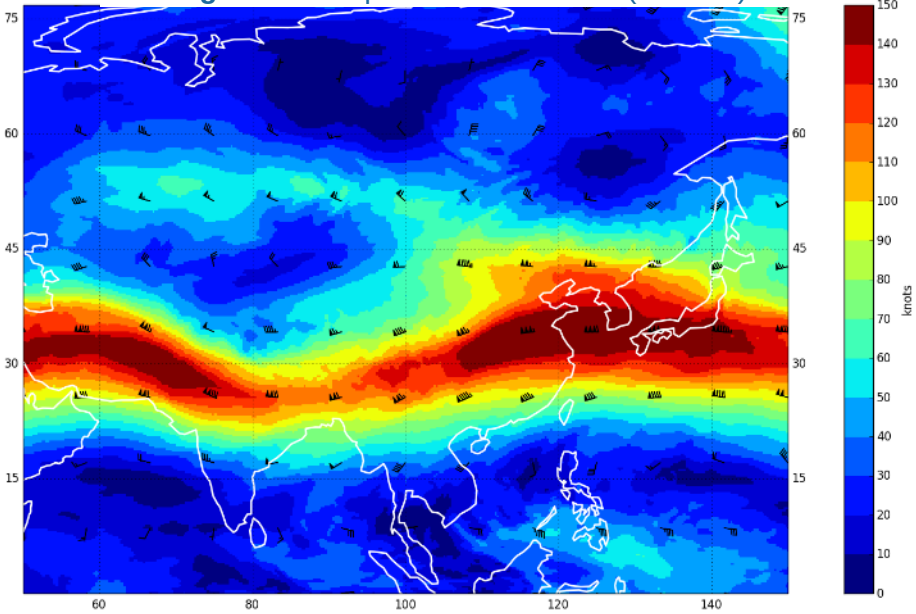


Resolution increase to 0.25°

1.25 degree Wind Speed and Direction (200hPa)



0.25 degree Wind Speed and Direction (200hPa)



Improvements in the WAFC data sets

Improved Vertical Resolution

- Data at 1000ft intervals

Flight Level	Geopotential Altitude (FT)	ICAO Standard Atmosphere pressure level (hPa)	Wind	Temp	Turbulence Severity	Icing Severity	Humidity
FL050	5000	843.1	X	X		X	X
FL060	6000	812.0	X	X		X	X
FL070	7000	781.9	X	X		X	X
FL080	8000	752.6	X	X		X	X
FL090	9000	724.3	X	X		X	X
FL100	10000	696.8	X	X	X	X	X
FL110	11000	670.2	X	X	X	X	X
FL120	12000	644.4	X	X	X	X	X
FL130	13000	619.4	X	X	X	X	X
FL140	14000	595.2	X	X	X	X	X
FL150	15000	571.8	X	X	X	X	X
FL160	16000	549.2	X	X	X	X	X
FL170	17000	527.2	X	X	X	X	X
FL180	18000	506.0	X	X	X	X	X
FL190	19000	485.5	X	X	X	X	
FL200	20000	465.6	X	X	X	X	
FL210	21000	446.5	X	X	X	X	
FL220	22000	427.9	X	X	X	X	
FL230	23000	410.0	X	X	X	X	
FL240	24000	392.7	X	X	X	X	
FL250	25000	376.0	X	X	X	X	
FL260	26000	359.9	X	X	X	X	
FL270	27000	344.3	X	X	X	X	
FL280	28000	329.3	X	X	X	X	
FL290	29000	314.9	X	X	X	X	
FL300	30000	300.9	X	X	X	X	
FL310	31000	287.4	X	X	X		
FL320	32000	274.5	X	X	X		
FL330	33000	262.0	X	X	X		
FL340	34000	250.0	X	X	X		
FL350	35000	238.4	X	X	X		

Flight Level	Geopotential Altitude (FT)	ICAO Standard Atmosphere pressure level (hPa)	Wind	Temp	Turbulence Severity	Icing Severity	Humidity
FL360	36000	227.3	X	X	X		
FL370	37000	216.6	X	X	X		
FL380	38000	206.5	X	X	X		
FL390	39000	196.8	X	X	X		
FL400	40000	187.5	X	X	X		
FL410	41000	178.7	X	X	X		
FL420	42000	170.4	X	X	X		
FL430	43000	162.4	X	X	X		
FL440	44000	154.7	X	X	X		
FL450	45000	147.5	X	X	X		
FL460	46000	140.6	X	X			
FL470	47000	134.0	X	X			
FL480	48000	127.7	X	X			
FL490	49000	121.7	X	X			
FL500	50000	116.0	X	X			
FL510	51000	110.5	X	X			
FL520	52000	105.3	X	X			
FL530	53000	100.4	X	X			
FL540	54000	95.7	X	X			
FL550	55000	91.2	X	X			
FL560	56000	87.0	X	X			
FL570	57000	82.8	X	X			
FL580	58000	79.0	X	X			
FL590	59000	75.2	X	X			
FL600	60000	71.7	X	X			

Note: Existing levels shown in blue.

Improvements in the WAFC data sets

Improved Temporal Resolution

NOW:	T+6	T+9	T+12	T+15	T+18	T+21	T+24	T+27	T+30	T+33	T+36	

NOV 2022:	T+6	T+7	T+8	T+9	T+10	T+11	T+12	T+13	T+14	T+15	T+16	T+17
	T+18	T+21	T+24	T+27	T+30	T+33	T+36	T+39	T+42	T+45	T+48	
	T+54	T+60	T+66	T+72	T+78	T+84	T+90	T+96	T+102	T+108	T+114	T+120

Next-generation of SIGWX forecasts

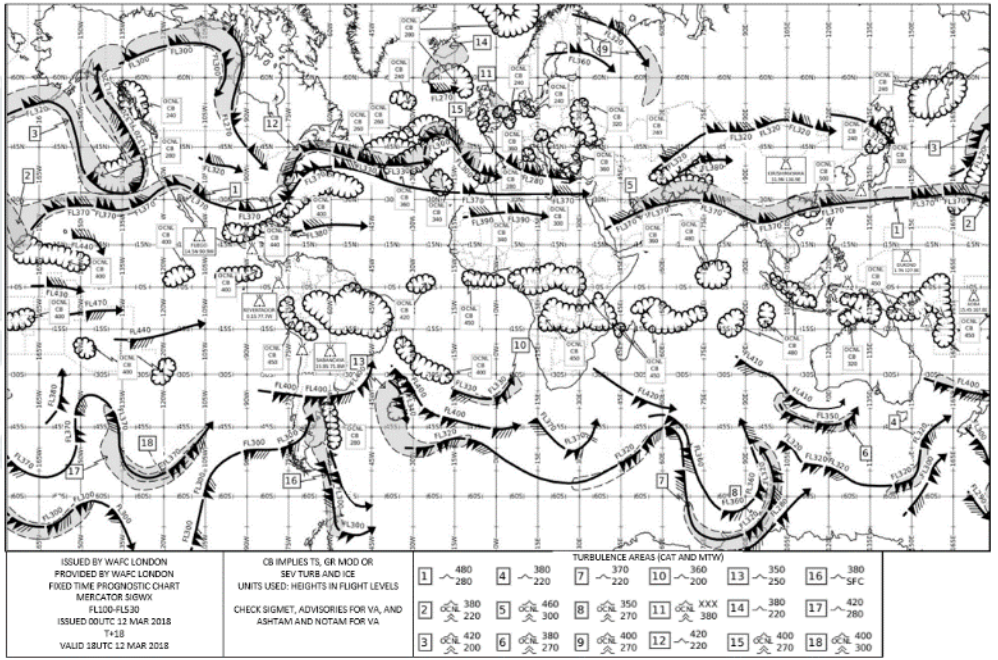
Why change them?

- WAFC London and Washington SIGWX forecasts will be harmonised
- SIGWX and WAFC gridded data sets will be harmonised
- Better suited to the needs of short haul (T+6 to T+12), and ultra long haul operations (>T+24)

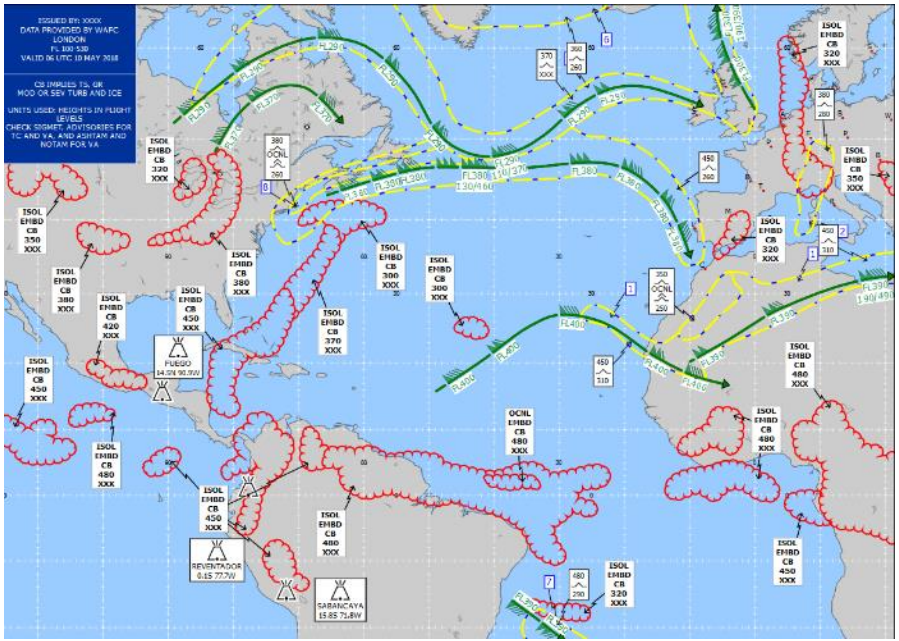
SIGWX forecasts better suited to the needs of users:

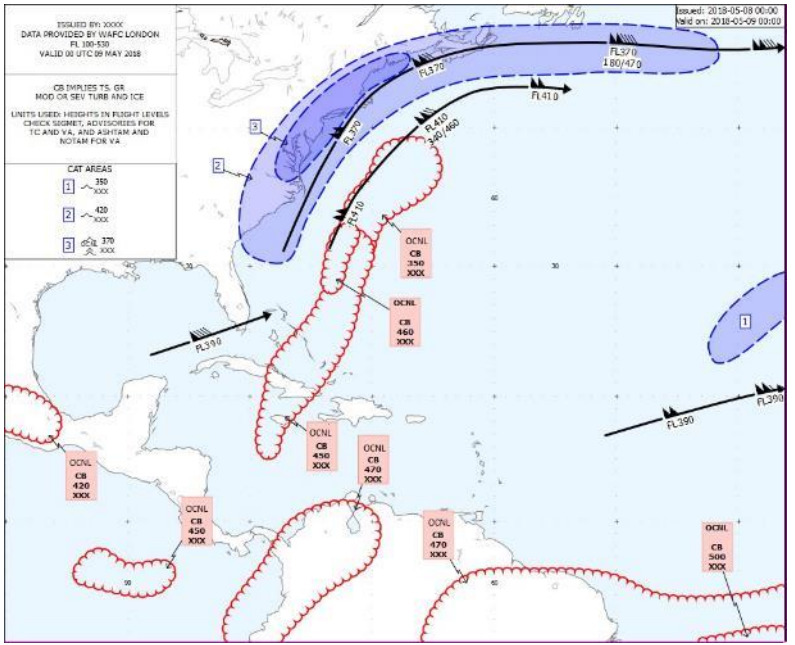
NOW:	T+24

NOV 2022:	T+6	T+9	T+12	T+15
	T+18	T+21	T+24	T+27
	T+30	T+33	T+36	T+39
	T+42	T+45	T+48	



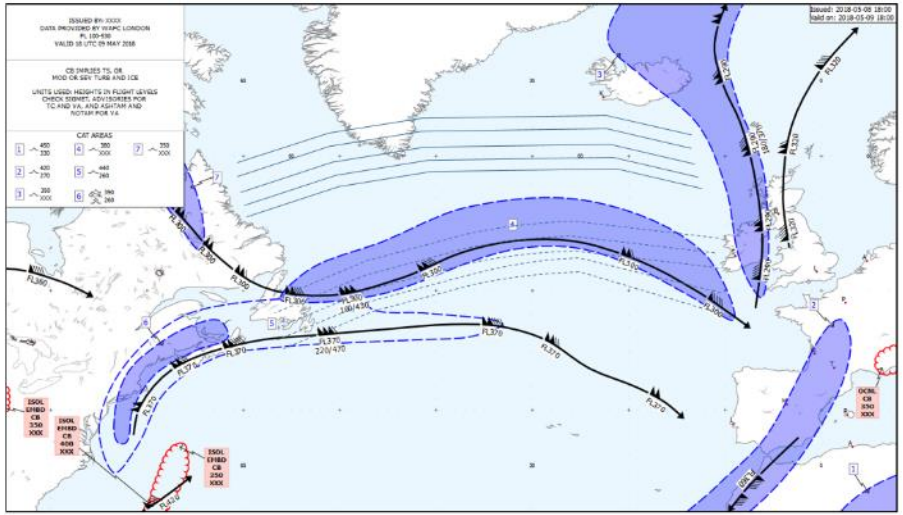
Colourful SIGWX, user customised map areas



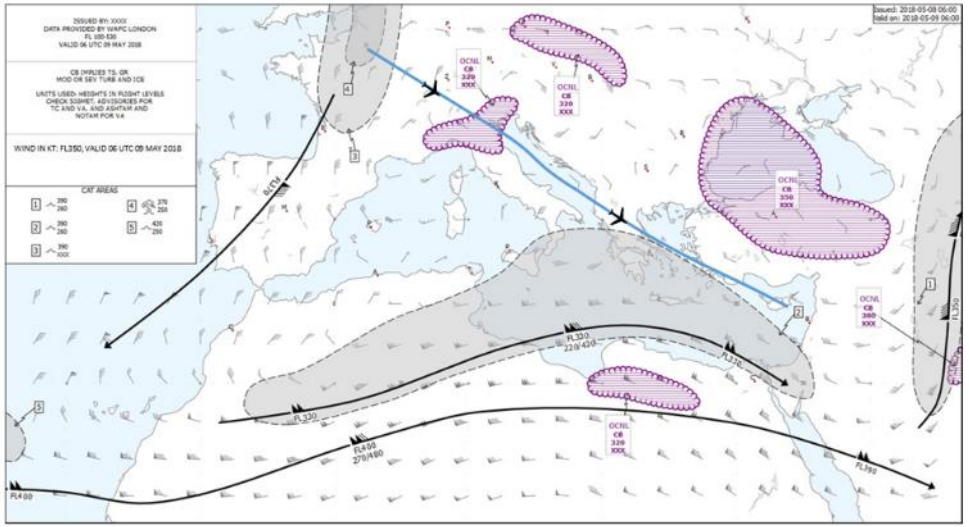


The WAFC's supply the SIGWX data, and users can visualise it however they wish.

Useful map overlays

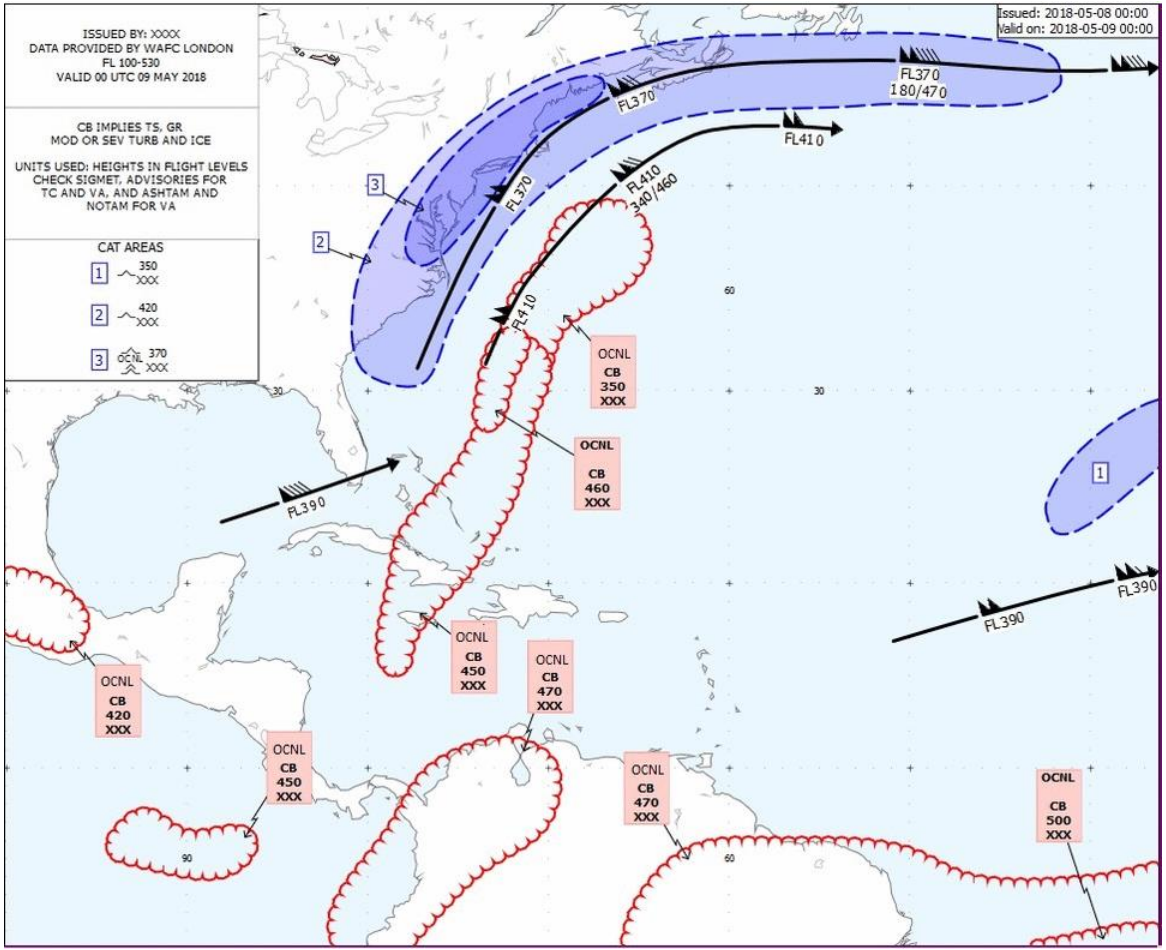


NAT Tracks



Flight path overlays

Maps you can animate



SIGWX Compromises

To deliver SIGWX forecasts for extra timesteps we need to:

- Produce a single SIGWX data set (spanning FL100-FL600)
- Retire medium level charts
- Adjust the content of the WAFC produced paper copy charts, and then retire them in 2028

But what will you get in return:

- Many extra timesteps
- Icing SIGWX objects for the whole globe
- IWXXM format SIGWX objects
- Data provided with a much shorter lead time
- Improved accuracy

How are we going to deliver this

Next-generation SADIS/WIFS systems

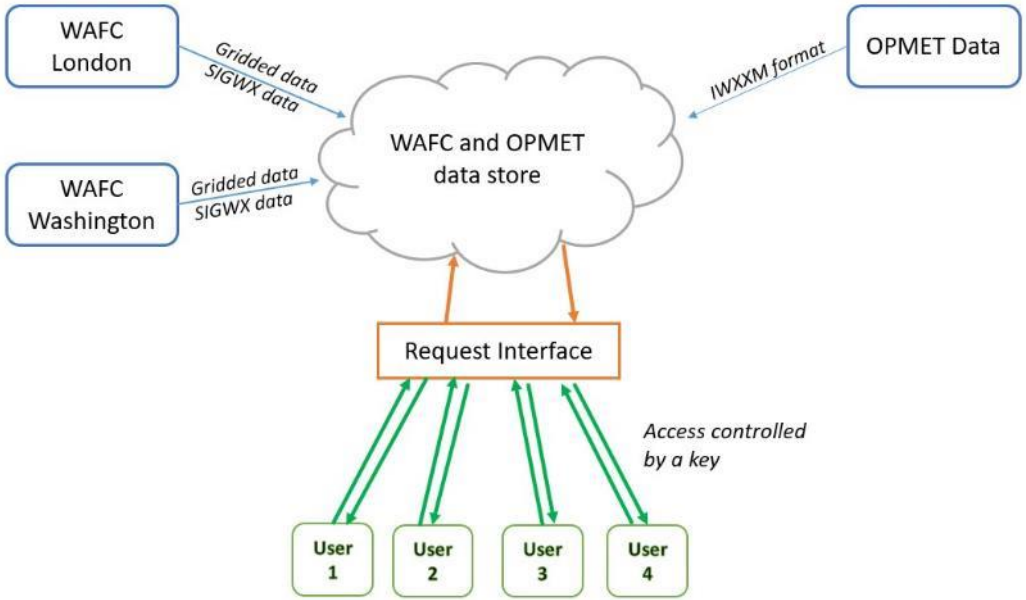
- ✈ Gridded model data sets will be much larger than now (more than 200x larger)
- ✈ SADIS (Secure Aviation Data Information System) and WIFS (WAFC Internet File Service) would slow to a crawl if everyone tried to download the data in the same way that they do now "download everything" approach
- ✈ The Global Air Navigation Plan (GANP) Aviation System Block Upgrades (ASBU) want SWIM compliant services
- "Data centric approach"
- "Flexible data requests"
- Interoperable with other SWIM compliant systems (e.g. SESAR MET-GATE and ATC systems)

Next Generation SADIS

- Will live in the “cloud”
- Will scale according to demand
- Resilient

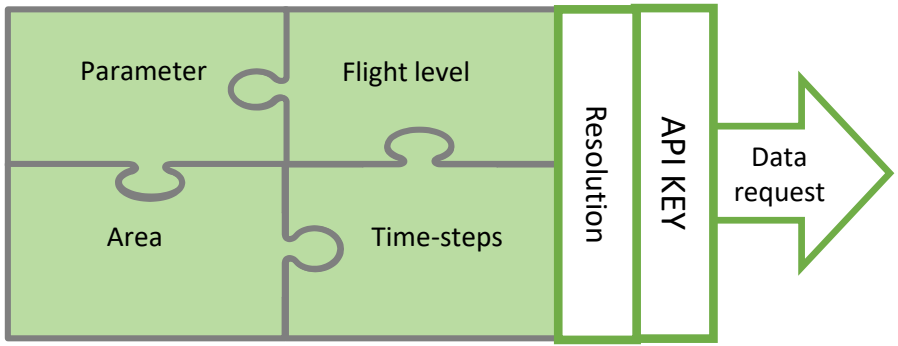
- Data will be requested via “API”

“In computer programming, an application programming interface (API) is a set of subroutine definitions, protocols, and tools for building application software. In general terms, it is a set of clearly defined methods of communication between various software components. A good API makes it easier to develop a computer program by providing all the building blocks, which are then put together by the programmer.”

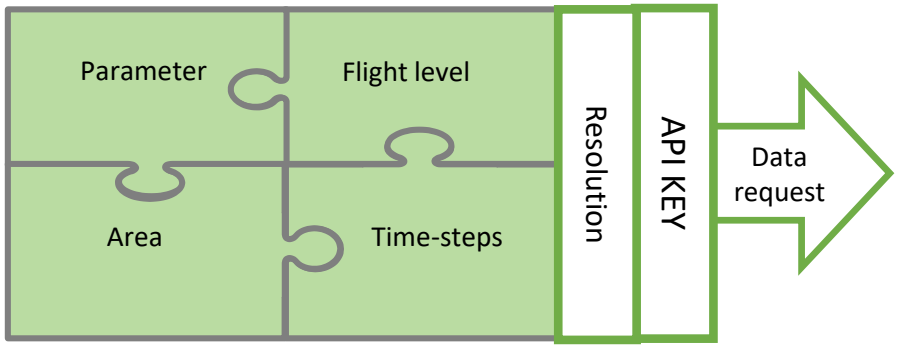


Next Generation SADIS

Model Data



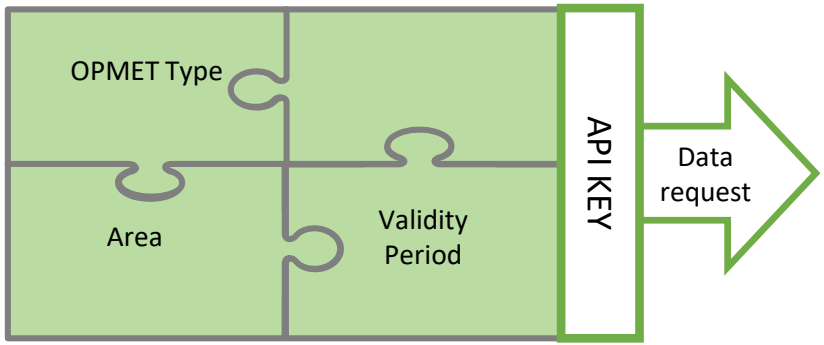
Next Generation SADIS



Component	Probable Options
Parameter	Single or multiple WAFC gridded data type e.g. temperature and/or turbulence. Choice of SIGWX Object data types. Choice of EGRR or KWBC data.
Area	Defined by a set of co-ordinates or latitude-longitude. Pre-set (continent based) areas
Flight Level	Single level, multiple levels, or all.
Time-steps	Single time-step, selection, or all within a specified range.
Resolution	0.25 degree, or 1.25 degree

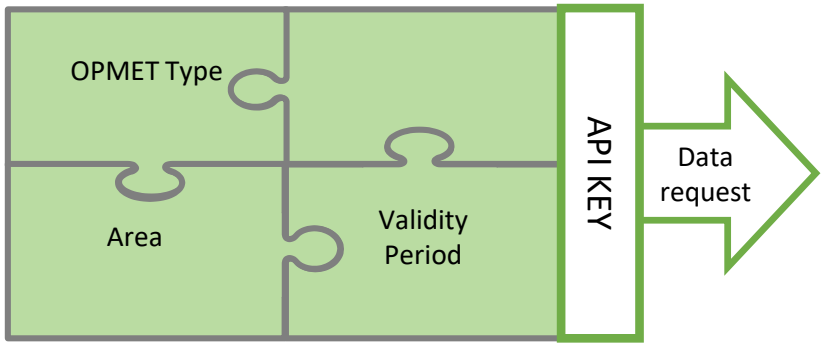
Next Generation SADIS

OPMET Data



Next Generation SADIS

OPMET Data



Component	Probable Options
OPMET Type	Single selectable data feed
Area	Defined by a set of co-ordinates or latitude-longitude. Specified via ICAO identifier.
Validity period	Latest, last hour, last 6 hours, last 12 hours

Next Generation SADIS

Two ways to get data:

- Request-Response: An API data request will generate a data file in response.
  - This type of request is suited to requesting data along a particular flight trajectory, or for bespoke sets of OPMET data

- Publish-Subscribe: Users can subscribe to data feeds, and are either notified when new data is available or sent the latest data file.
  - This type of request is suited to providing a regularly used data set, for example winds in the vicinity of an airport or a region, or to get a feed of the latest OPMET for a region whenever it becomes available.

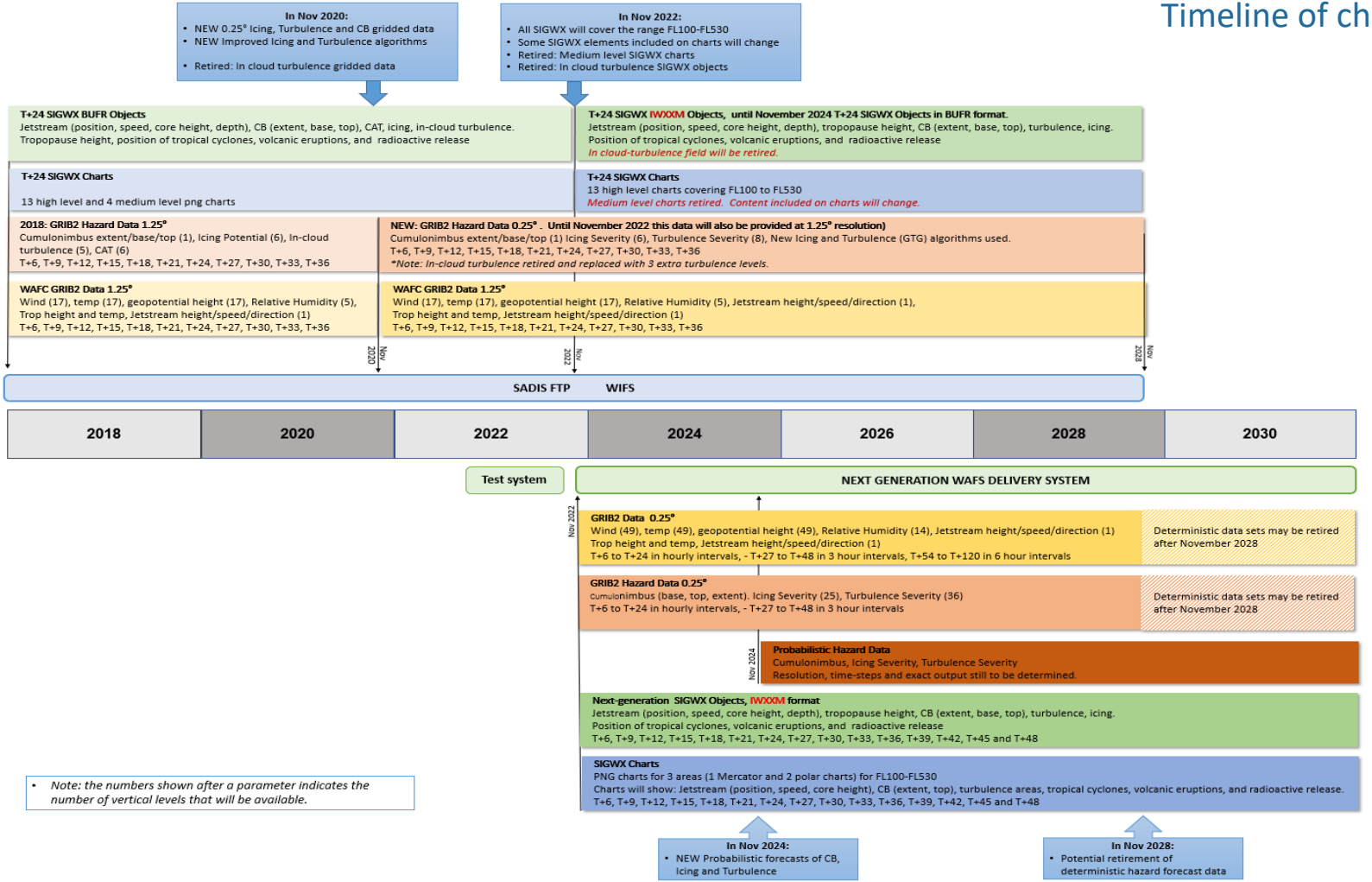
Example: A flight from Amsterdam to Zagreb

PLANNING PHASE	Example request
1) Preliminary Data set for initial route planning	Lower resolution (e.g. 1.0 degree resolution) wind and temperature data set "subscribed" data feed. For: • FL300, FL320, FL340, FL360, FL380, FL400 • Area bounded by 0E, 25E, 55N and 40N • Time-steps: T+18, T+24, T+30, T+36, T+42, T+48
2) Fine tuning the route	Request made for • 0.25 degree resolution wind and temperature data along and near the initial flight route (data corridor). • Time-steps: appropriate to the timing of the flight (1 or 3 hr intervals)
3) OPMET data request	Request made for: • Latest TAF, SIGMET and any advisories in EHAA (Amsterdam) and RJJJ (Zagreb) FIRs • Advisories and SIGMETS for the flight trajectory • Latest TAF for diversion airfields.

Example: A flight from Amsterdam to Zagreb

	Example request
Pre take off:	Request made for: • turbulence, icing and CB at 0.25 degree resolution, along (and near) flight trajectory, using T+6, T+7, T+8, T+9 data • FL050 to FL300 winds in the Amsterdam FIR • Latest OPMET for the route
In Flight	Request made for: • TAF, METAR and SIGMET data in Zagreb FIR • TAF, METAR for diversion airfields • SIGMETS along route.
Prior to descent phase	Request made for: • FL360 to FL050 wind data at 1000ft intervals, at 0.25 degree resolution for descent path • Latest METAR and TAF for Zagreb

Timeline of changes



Thank You

Please ask any questions, and feel free to contact me on SADISmanager@metoffice.gov.uk if you think of a question later on.