出國報告（出國類別：其他）

參加「航空氣象資料技術協調」視訊報告

服務機關：交通部民用航空局飛航服務總臺

姓名職稱：官岱煒 副主任

莊清堯 臺長

派赴國家：臺灣，中華民國

出國期間：民國 111 年 11 月 22 日

報告日期：民國 111 年 12 月 28 日

列印 匯出

提 要 表

系統識別號：	C11101043
視訊辦理：	是
相關專案：	無
計畫名稱：	航空氣象資料技術協調
報告名稱：	參加「航空氣象資料技術協調」視訊報告
計畫主辦機關：	交通部民用航空局
出國人員：	姓名 / 服務機關 / 服務單位 / 職稱 / 官職等 / E-MAIL 信箱 官岱煒 交通部民用航空局飛航服務總臺 臺北航空氣象中心 副主任 薦任(派) 莊清堯 交通部民用航空局飛航服務總臺 臺北航空氣象中心 臺長 薦任(派) 聯絡人ufvejuan@anws.gov.tw
前往地區：	臺灣，中華民國
參訪機關：	日本氣象協會
出國類別：	其他
實際使用經費：	年度 / 經費種類 / 來源機關 / 金額 111年度 其他經費 民航事業作業基金 0元
出國計畫預算：	年度 / 經費種類 / 來源機關 / 金額 111年度 其他經費 民航事業作業基金 100,000元
出國期間：	民國111年11月22日 至 民國111年11月22日
報告日期：	民國111年12月28日
關鍵詞：	航空氣象資料技術協調，航空，氣象，衛星
報告書頁數：	14頁
報告內容摘要：	民用航空局飛航服務總臺(下稱本總臺)自民國 80 年 5 月份開始，以付費方式透過日本氣象協會(JWA)取得國際衛星通信系統接收日本氣象廳(JMA)所製作的氣象數據傳真資料(CDF)各種天氣圖表。近年隨網際網路傳輸技術發展，資料傳送方式已由國際衛星通信系統改為檔案傳輸協議(FTP)方式傳送，目前本總臺接收資料包括 CDF 各種天氣圖、氣象衛星資料以及美國華盛頓、英國倫敦等世界區域預報中心(WAFC)所發布顯著天氣圖(SIGWX Charts)。「航空氣象資料技術協調」出國案係依據本總臺與JWA簽訂之氣象資料服務合約規定所舉行之年度會議，會議目的在於確保雙方業務合作順利，並了解國際航空氣象業務最新發展趨勢及日方航空氣象服務發展方向，作為我方航空氣象作業參考，精進預報能力與飛航服務。
報告建議事項：	建議事項 / 狀態 / 說明 持續研議取得日本氣象廳氣象數值預報模式資料方式 研議中 掌握國際航空氣象文件及作業規定更新情況 研議中 深化國際及國內飛航服務單位合作，並厚植我國航空氣象科技發展 研議中 積極參與國際性航空氣象會議及訓練 研議中
電子全文檔：	C11101043_01.pdf
出國報告審核表：	C11101043_A.pdf
限閱與否：	否
專責人員姓名：	莊順淑
專責人員電話：	02-23496197

列印 匯出

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壹、目的

民用航空局飛航服務總臺(以下簡稱本總臺)自民國 80 年 5 月份開始，以付費方式透過日本氣象協會(Japan Weather Association，JWA)，利用國際衛星通信系統接收日本氣象廳(Japan Meteorological Agency，JMA)所製作的氣象數據傳真資料(Coded Digital Facsimile，CDF)各種天氣圖表。近年隨著網際網路傳輸技術發展，資料傳送方式已由國際衛星通信系統改為檔案傳輸協議(File Transfer Protocol，FTP)方式傳送，目前本總臺透過 JWA 管道所接收資料包括 CDF 各種天氣圖、氣象衛星資料以及美國華盛頓、英國倫敦兩個世界區域預報中心(World Area Forecast Centre，WAFC)所發布顯著天氣圖(Significant Weather Charts，SIGWX Charts)。

「航空氣象資料技術協調」出國案係依據本總臺與 JWA 簽訂之氣象資料服務合約規定所舉行之年度會議，會議目的在於確保雙方業務推展順利，持續深化臺日雙方於航空氣象作業與服務合作，並了解國際航空氣象業務最新發展趨勢及日方航空氣象服務發展方向，作為我方航空氣象作業參考，進而精進預報能力與飛航服務，提升本總臺航空氣象服務品質及作業效率。

貳、過程

本案原定赴日本氣象協會執行，惟受新冠肺炎(COVID-19)疫情影響，經雙方協調改為以視訊會議方式辦理。會議時間為 111 年 11 月 22 日下午 2 時至 4 時，共計 2 小時，由日本氣象協會防災解決方案事業部部長小玉亮先生擔任會議主席，並率該協會岡村和賛課長、後藤あずみ組長、関根雅人技師及須藤智博亞太區經理與會，本總臺則由飛航服務總臺總臺長室余曉鵬簡任技正、飛航業務室于守良課長及臺北航空氣象中心余祖華主任率出國計畫執行人員(官岱煒副主任及莊清堯臺長)、許依萍技正與相關業務同仁參與。

本次會議討論內容如下：

(一) 日本向日葵八號及九號衛星切換準備工作；

(二) 航空氣象現代化作業系統汰換及更新計畫整合日本亂流預報產品工作討論；

(三) 本總臺接收日本氣象廳氣象數值預報模式資料討論；

(四) 日本民航局調整空域管理簡介；

(五) 日本機場自動天氣測報作業(AUTO METAR)實施現況及相關工作；

(六) 日本推行國際民航組織氣象資料交換格式(IWXXM)作業方式說明。

叁、會議內容及結論摘要

一、 日本向日葵八號及九號衛星切換準備工作

向日葵八號及九號衛星現由日本氣象廳(JMA)管理，目前本總臺臺北航空氣象中心透過 FTP 方式向日本氣象協會(JWA)之資料主機取得向日葵八號衛星資料，並透過航空氣象現代化作業系統進行資料處理，顯示於航空氣象服務網及新一代航空氣象多元產品顯示系統(JMDS)。另該資料亦運用於即時積冰診斷(CIP)演算。因此為本總臺航空氣象作業及服務重要資料(如圖 1 及 2)。

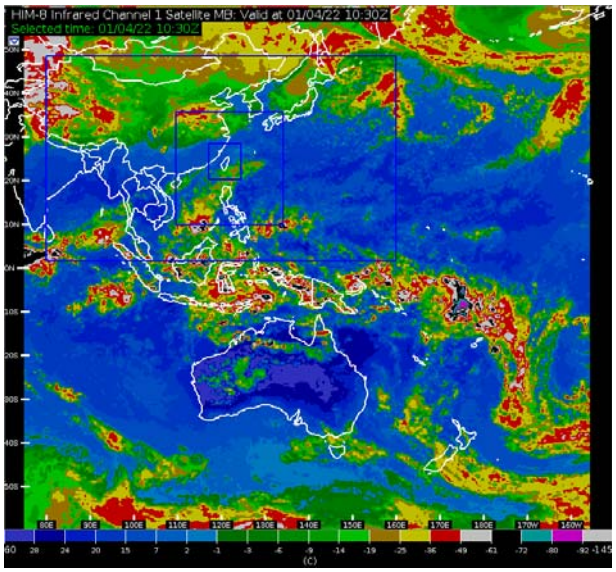

圖 1、向日葵衛星八號紅外線雲圖

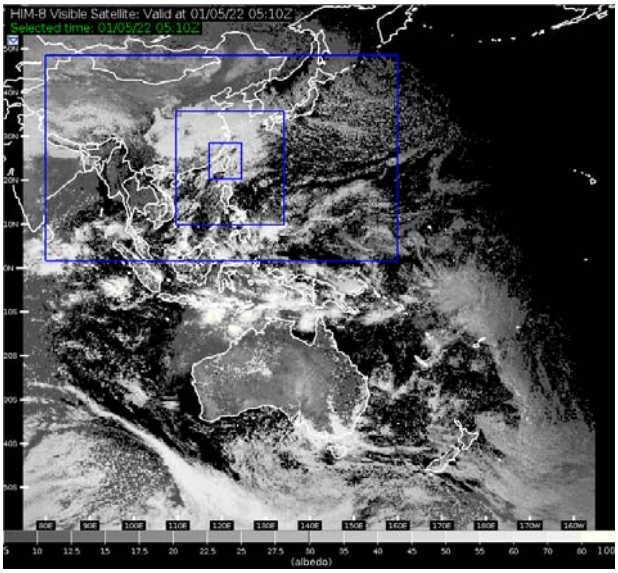

圖 2、向日葵衛星八號可見光雲圖

為配合日本氣象廳計畫於本(111)年 12 月 13 日 0500UTC 進行衛星切換，屆時向日葵九號衛星轉為作業模式，向日葵衛星八號調整為待命模式。為因應此調整，經過本次會議確認，我方及日方業完成下列工作：

(一) 日本氣象協會：

1. 資料主機提供不同資料目錄，以區分向日葵八號及九號衛星資料(如圖 3)。
2. 提供向日葵八號及九號衛星資料技術文件(如圖 4)。
3. 由於向日葵八號及九號衛星部分觀測頻道波長不完全相同，故提供兩衛星相關資料差異及特性予本總臺參考，其中第 1、5、7 及 16 觀測頻道有較明顯之色溫差異，第 3 觀測頻道則有些微差異。
4. 協助持續關注日本氣象廳衛星切換計畫情況。

(二) 本總臺：

1. 修改抓取日本氣象協會資料主機程序，以正確取得向日葵九號衛星資料。
2. 評估兩衛星切換作業後，對於現有系統之影響。確認前述衛星部分觀測波長差異對於現有系統影響有限。
3. 修改航空氣象現代化作業系統資料處理程序，以因應兩衛星檔名及資料內容之差異。
4. 修改航空氣象服務網及新一代航空氣象產品顯示系統之顯示設定。

Server	Item	Himawari-8	Himawari-9
ftpport6	Upload directory	~/sat_h08	~/sat_h09
	Storage period	12 hours	12 hours

圖 3、日本氣象協會資料目錄及保存資料時間

Product	item		Himawari-8	Himawari-9
HSD (Himawari Standard Data)	File name		HS_H08_*yyyymmdd_hhnn*_Bbb_cccc_R*jj*_S*kkll*.DAT	HS_H09_*yyyymmdd_hhnn*_Bbb_cccc_R*jj*_S*kkll*.DAT
			yyyymmdd_hhnn : observation start time *bb* : band number *cccc* : observation area and number *jj* : spatial resolution at SSP(*2) *kkll* : information of the segment division (*kk*: segment number *ll*: total number of segment)	
	Header Block (#1 Basic information block)	No.5 Satellite name	Himawari-8	Himawari-9
		No.20 File name	HS_H08_*yyyymmdd_hhnn*_Bbb_cccc_R*jj*_S*kkll*.DAT	HS_H09_*yyyymmdd_hhnn*_Bbb_cccc_R*jj*_S*kkll*.DAT

圖 4、向日葵八號及九號衛星資料差異說明

結論：經本次會議確認雙方皆已完成相關準備工作，將配合後續期程進行作業轉移。附註：本工作業於本年 12 月 13 日 0500UTC 順利完成，本總臺現已向日葵九號衛星資料提供作業及服務(如圖 5 及 6)

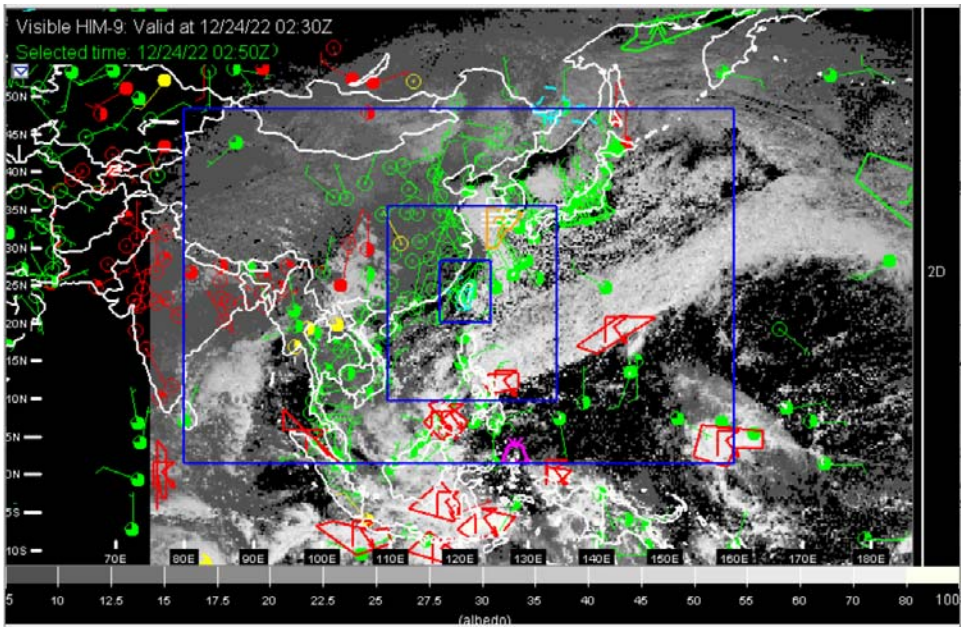

圖 5、向日葵衛星九號可見光觀測頻道資料顯示於 JMDS

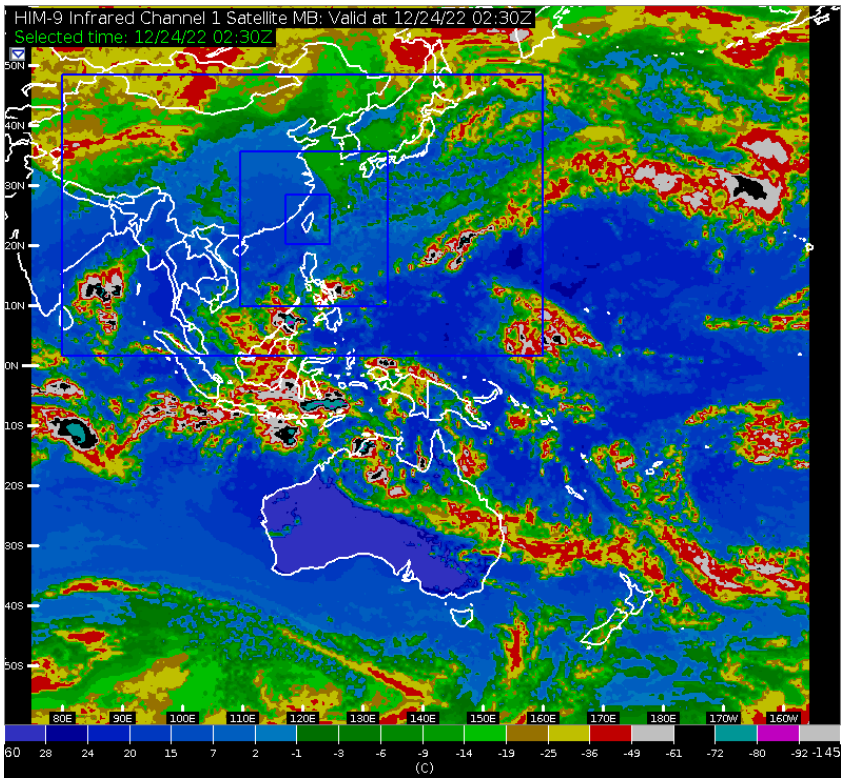

圖 6、向日葵衛星九號紅外線觀測頻道資料顯示於航空氣象服務網

二、 航空氣象現代化作業系統汰換及更新計畫整合日本亂流預報產品工作討論

JWA 亂流預報系統係其提供予全日本空輸(ANA)之亂流預報產品，該產品係計算氣象數值模式資料內每千呎風速向量差，由計算所得差推算亂流強度，對應強度門檻值如下：

(一)無亂流：<8kt/1,000ft;

(二)輕度亂流：≧8kt/1,000ft 及<12kt/1,000ft;

(三)中度亂流：≧12kt/1,000ft 及<16kt/1,000ft;

(四)強烈亂流：≧16kt/1,000ft 及<20kt/1,000ft;

(五)嚴重亂流：≧20kt/1,000ft。(

JWA 業依據雙方氣象資料服務合約(期限:109.05.01 至 111.04.30)於 110 年 11 月於本總臺完成系統建置，該系統使用中央氣象局提供之天氣研究與預報模式(WRF)3 公里解析度資料計算亂流強度，並提供臺北飛航情報區及周邊範圍內 100、150、200、250、300、400、500、700、850 及 925hPa 等不同高度之亂流產品，與臺北飛航情報區內 22 條主要航路之亂流剖面產品(如圖 7 及 8)。

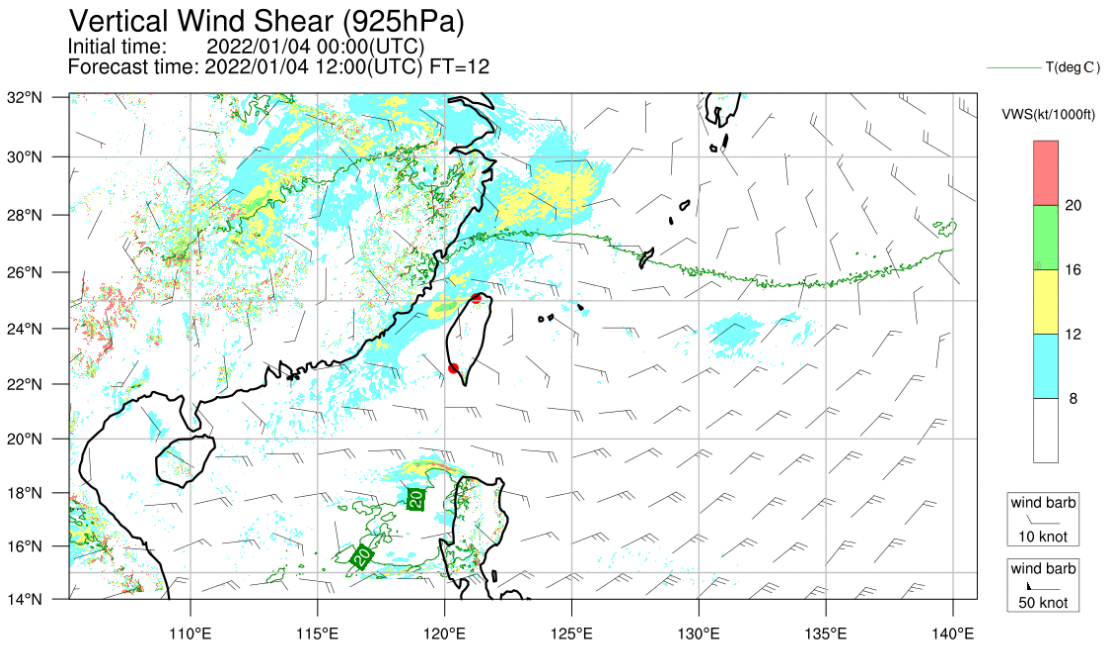

圖 7、925hPa 高度之亂流產品圖

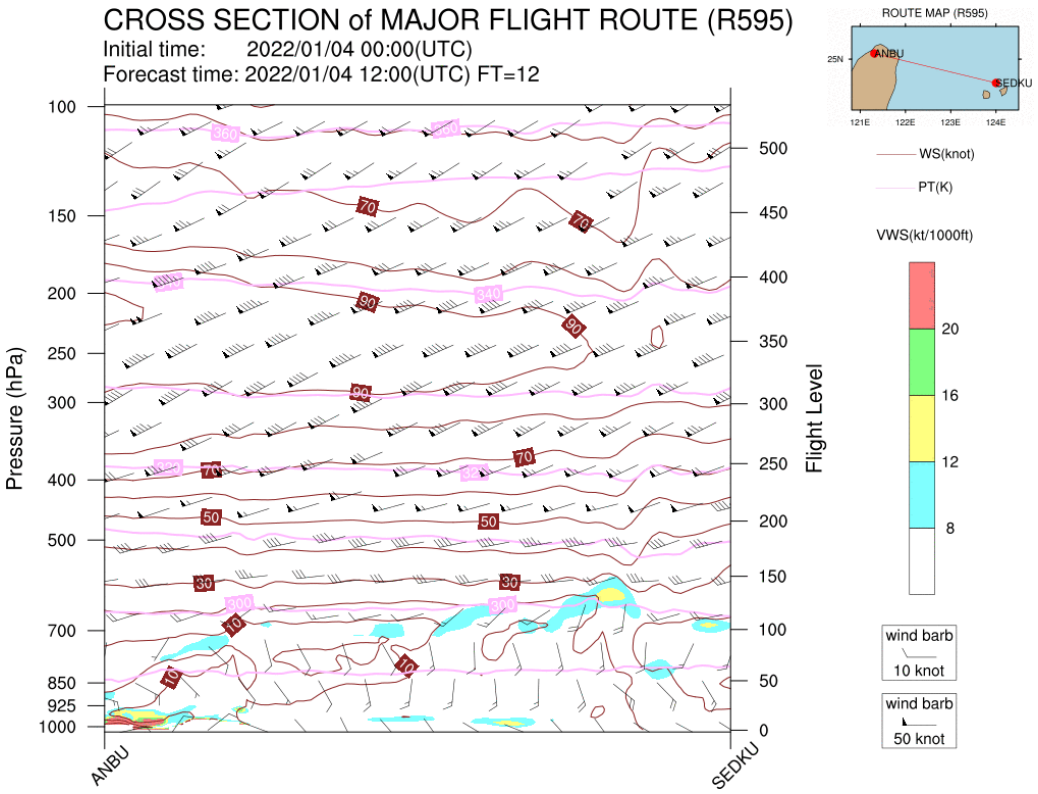

圖 8、R595 航路亂流剖面圖

為因應本總臺刻正推動之航空氣象現代化作業系統汰換及更新計畫(AOAWS-RU)進行，爰本議題分為以下四個子議題進行討論:

1. 產品上游資料調整

AOAWS-RU 計畫除持續推動現有系統與應用程式汰換及更新外，亦努力整合現有各類航空氣象資料，並依作業與服務需求新增資料。本系統所使用中央氣象局 3 公里解析度天氣研究與預報模式資料，將為本總臺航空氣象重要決定預報作業參考資料。

目前日本亂流預報產品所採用的是原始 WRF 資料，而為使該產品整合至 AOAWS-RU 資料流中，故向 JWA 提出產品上游改以 AOAWS-RU 處理過後之 WRF 模式資料(處理內容包含排除本產品所需風場以外之資料及完成產品產製所需飛航空層層數)。

經會議討論，JWA 人員認為本總臺規劃可行，並配合後續 WRF 資料處理完成後，改使用該資料進行運算並產製產品。

2. 增加系統產品之飛航空層層數

本議題為前一子議題之延續，目前 JWA 亂流產品採用原始 WRF 資料之 52 層氣壓高度層。惟氣壓高度產品需由使用人自行轉換，才能對應作業用之飛航空層高度。

為此，本總臺規劃將 WRF 原始資料高度分層先行處理為飛航空層，再用以亂流產品產製，使其以飛航空層高度呈現，提升使用便利性。

經會議討論，JWA 亦將配合使用本總臺處理後之 WRF 進行產品產製。

3. 調整系統產品資料傳送資料流

目前日本亂流產品共有兩種資料輸出，分別為圖檔及網路通用資料格式(NetCDF)，圖檔部分用於網頁顯示，NetCDF 資料則規劃用作業系統應用。為配合本總臺推動之 AOAWS-RU 計畫系統建置，由我方於本次會議提出，前述兩種產品資料分流概念，圖檔部分仍持續傳送予現行系統並透過網頁顯示，NetCDF 資料部分則改送予前述計畫建置之系統，並由新系統進行顯示。

未來當新系統建置完成後，新系統除透過顯示介面展示 NetCDF 資料外，亦將自行將 NetCDF 資料繪製網頁圖檔，屆時現行所產製之圖檔資料則予以停送(相關調整詳如圖 9 說明)。

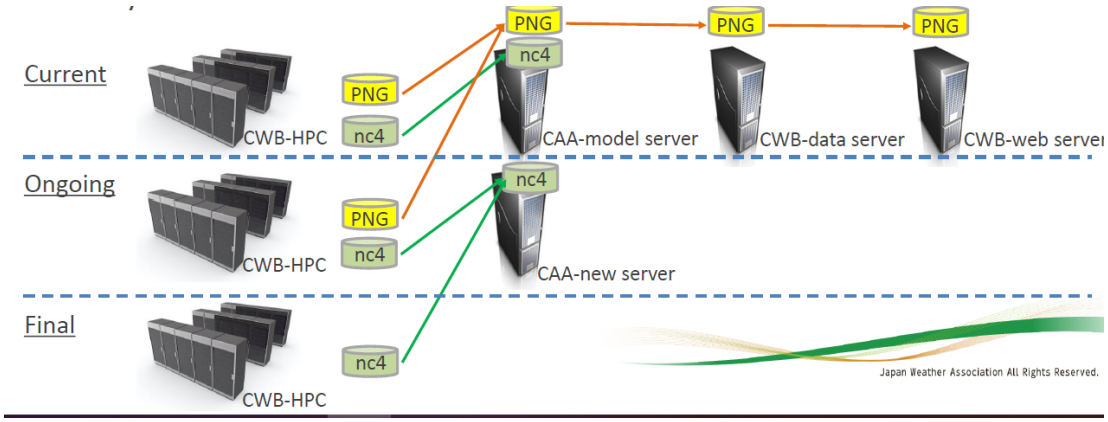

圖 9、日本亂流產品調整圖說(規劃分兩階段進行)

4. 系統技術轉移

有鑒於日本亂流產品發展迄今約兩年，系統運作及產品製作已經相當穩定，惟考量目前刻正推動之 AOAWS-RU 計畫具有相當之人力及系統資源，因此規劃透過技術轉移取得此產品相關技術，後續由我方自力發展，並創造未來雙方新合作項目與契機。

JWA 表示系統相關技術文件已提供予本總臺，後續由本總臺先行研讀，再由雙方討論技術轉移期程及方式。

結論：本議題經過雙方討論，初步已有相當共識，後續另擇期研商各技術細節及執行方式。

三、 本總臺接收日本氣象廳氣象數值預報模式資料討論

為擴充本總臺 AOAWS-RU 計畫所需，經洽 JWA 確認目前已將日本氣象廳之氣象數值預報模式(全球尺度、中尺度、區域尺度及日本範圍各 1 種模式資料)予中央氣象局(模式清單及資料內容如圖 10)，後續若有資料需求亦可提供予本總臺使用。

Model	Update frequency	Area	Mesh size	layer	File size	Forecast period	Format
GSM(*1) (global)	6 hourly	global	50km (*planned to be 13km in future)	Surface,2m(T,RH),10m(UV),1000,925, 850,700,600,500,400,300,250,200, 150,100,70,50,30,20,10hPa	1.5GB/initial run (00,12UTCinitial)	06,18UTC init:132hr 00,12UTC init:264hr	grib2
GSM (Japan)	6 hourly	20-50N/ 120-150E	20km (*planned to be 13km in 2023)	Surface,2m(T,RH),10m(UV),1000,975,950, 925,900,850,800,700,600,500,400,300, 250,200,150,100hPa	300MB/initial run (00,12UTC initial)	06,18UTC init:132hr 00,12UTC init:264hr	grib2
MSM(*2)	3 hourly	22.4-47.6N/ 120-150E	Surface:5km Upper:10km	Surface,1000,975,950,925,900,850,800, 700,600,500,400,300,250,200,150,100hPa	600MB/initial run (00,12UTC initial)	03,06,09,15,18,21UTC init:39hr 00,12UTC init:78hr	grib2
LFM(*3)	hourly	22.4-47.6N/ 120-150E	Surface:2km Upper:4km	Surface,1000,975,950,925,900,850,800, 700,600,500,400,300,250,200,150,100hPa	1GB/initial run	10hr	grib2

圖 10、JWA 所提供之日本氣象廳氣象數值模式資料

至於提供資料方式，JWA 提出兩個方案如下(詳見圖 11):

1. JWA 主動推送資料予本總臺:此方案本總臺需準備 FTP 站臺。
2. 本總臺連線至 JWA FTP 取得。

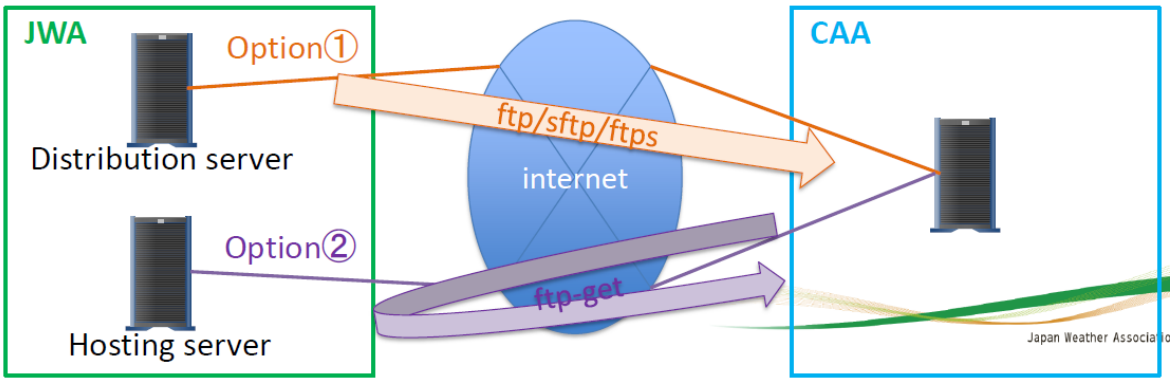

圖 12、本總臺取得日本氣象廳氣象數值預報模式資料方案

經會議進一步確認日本氣象廳氣象數值預報模式資料量頗大，本總臺需進一步考量資料網路頻寬及是否由 JWA 先進行預報場縮減(只取得所需預報場及預報時間長度)再取回資料等議題。另本總臺業於本年 5 月與 JWA 簽署完成 111 年 5 月至 113 年 4 月之合作協議，未來若需要取得本議題所述氣象數值預報資料，亦需將修訂雙方協議工作納入考量。

結論：由本總臺持續研議本議題所涉資料取得及更新協議相關工作，並通知 JWA 討論結果。

四、 日本民航局調整空域管理簡介

日本民航局(JCAB)為因應未來空中交通需求的增長和基於軌跡之作業(Trajectory Based Operations, TBO)的預期，決定於 2020 年至 2025 年間分階段重組福岡飛行情報區的國內空域，並以 FL335 設定為國內航線高空及低空分界(如圖 13)，以增加起飛和到達日本的航班與過境飛機數量，並減少飛航管制員之工作負擔及複雜度。

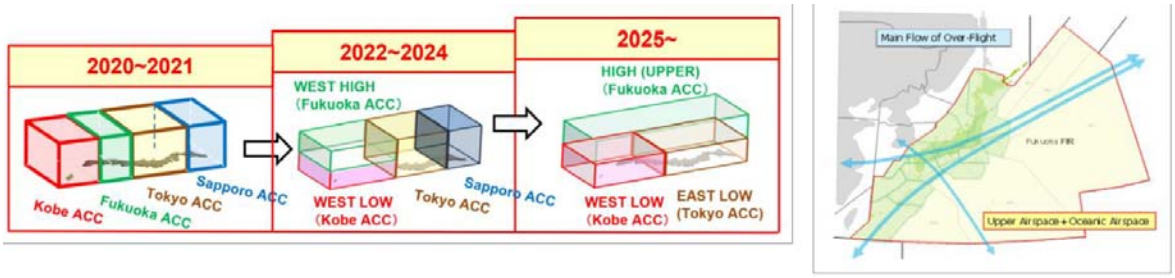

圖 13、日本空域調整及管制單位負責區域規劃

五、 日本機場自動天氣測報作業(AUTO METAR)實施現況及相關工作

因考量人力成本，日本氣象廳自 106 年 3 月開始在部分機場實現航空氣象自動化觀測報告，截至本年 3 月 16 日為止，已有 15 個機場實施了全面自動化航空氣象觀測(實施機場如圖 14)。

Fully automated hours	Airports
some hours (at night)	Narita International, Chubu International, Kansai International, Fukuoka, Naha, Osaka International, Amami, Shin-Ishigaki.
all day	Iki, Kikai, Tokunoshima, Yoron, Minami Daito, Kita Daito, Yonaguni.

圖 14、目前日本實施航空氣象自動化觀測報告之機場

日本於準備實施航空氣象自動化觀測前之準備工作如下，並經日本氣象廳、航空公司及日本民航局審慎討論評估，以控制自動化觀測與目視觀測之差異，

1. 比對近三年的自動觀測及目視觀測結果，了解該機場實施航空氣象自動化觀測報告後與人工目視觀測之差異。

2. 設置機場攝影機並回傳影像至航空氣象辦公室，以補足冬季固態降水之觀測資訊。
3. 對於實施航空氣象自動觀測之機場，分別於每日八次（0030，0330、0630、0930、1230、1530、1830、2130UTC）之全日機場天氣預報。

至目前為止，日本機場改以航空氣象自動觀測成果良好，爰日本氣象廳計劃在本年底再增加五個機場（高知、宮崎、宮古、下地島和多良間），現正進行最後調整，未來計畫於每年度五個機場改以航空氣象全自動觀測之方式持續推動。

六、 日本推行國際民航組織氣象資料交換格式(IWXXM)作業方式說明

依據國際民航組織附約 3 號第 80 次修正文件(ICAO Annex3 AMD 80)規定，國際民航組織氣象資料交換格式(IWXXM)應於 110 年 11 月開始上線作業，本區業依規定完成相關工作。

日本氣象廳亦依規定完成 IWXXM 格式報文服務作業，目前與傳統文數字報文格式(TAC)於飛航訊息處理系統(AMHS)平行運作。發送電報與負責單位如下：

1. 熱帶氣旋資料報告(Tropical Cyclone Advisory)：日本熱帶氣旋警告中心(日本氣象廳下轄)負責發布；
2. 火山灰資料報告(Volcanic Ash Advisory)：日本火山灰預警中心(日本氣象廳下轄)負責發布；
3. 機場例行及特別天氣報告(METAR/SPECI)與顯著天氣報告(SIGMET)：由日本氣象廳負責發布。

由於國際民航組織尚未訂定 TAC 格式報文停止服務時間，故日本氣象廳亦為訂定該格式報文停止服務時間表。而目前本總臺亦以相同方式運作，將 IWXXM 及 TAC 格式報文同時送予香港天文臺進行國際氣象報文交換，而國內則因考量使用人系統調整及使用習慣問題，尚以 TAC 格式報文為主。

肆、心得與建議

自民國 80 年 5 月本總臺與 JWA 簽署氣象資料提供服務合約，長期以來建立了良好的互信基礎與珍貴友誼，經由非官方的 JWA 管道，本總臺得以網際網路 FTP 取得天氣圖表資料、氣象衛星及美國、英國世界區域預報中心發布之顯著天氣圖等資料，並經由臺北和東京每年兩次的技術協商會議中，解決傳送資料品質或過程等問題。此外，我方透過此技術協商會議交流平臺，得到 JWA 主動提供國際及日本氣象廳(JMA)之最新航空氣象作業資訊，與航空氣象發展中的新技術以及未來規劃資訊。在我國尚未成為世界氣象組織（WMO）及國際民航組織（ICAO）會員的情況下，透過 JWA 取得世界最新的航空氣象技術及資訊，實為重要之對外資訊管道。

雖受新冠肺炎疫情影響，使原訂赴日本氣象協會會議及其他當地飛航作業單位參訪計畫，改為約 2 小時視訊會議方式辦理，雖因而缺少實體會議討論效率，反促使雙方有更多業務相關同仁參與會議，使討論議題更具深入細節。另除前述例行性每年兩次的技術研商會議外，本總臺及日本氣象協會之合作業務人員平時亦透過電郵或視訊方式進行業務溝通協調，持續精進臺日雙方於臺日雙方於航空氣象作業與服務之合作，確保業務持續順利推展。謹就參與本次會議建議事項如下：

一、 持續研議取得日本氣象廳氣象數值預報模式資料方式

為精進我國航空氣象客觀預報技術，除與中央氣象局合作提升天氣研究與預報模式(WRF)準確度外，取得具先進技術之國際預報資料亦為重要課題。本次會議於取得日本氣象廳氣象樹值預報模式資料議題上，與會雙方已有相當共識。建議後續儘速完成研議實施方式，以達截長補短，提升航空氣象預報品質。

二、 掌握國際航空氣象文件及作業規定更新情況

國際間為配合推動國際民航組織(ICAO)之全系統信息管理(SWIM)計畫，相關國際航空氣象文件頻繁調整，惟我國因受限國際情勢，非世界氣象組織（WMO）及國際民航組織（ICAO）會員，爰建議持續深化與現行國際夥伴合作關係，取得最新文件及作業資訊，儘早進行業務、服務及系統等面向之規劃調整，確保我國航空氣象業務持續與國際規定接軌。

三、 深化國際及國內飛航服務單位合作，並厚植我國航空氣象科技發展

持續深化國內外飛航服務單位合作，藉由瞭解作業及使用需求，依需求設計服務方式及系統，並建議妥善利用本總臺航空氣象現代化作業系統汰換及更新計畫(AOAWS-RU)執行期間(110 至 113 年)，有效整合現有航空氣象資源並與合作夥伴合力開創更多合作項目及空間，並適時回饋成果予合作單位，深化各方合作友誼，並厚植航空氣象科技發展。

四、 積極參與國際性航空氣象會議及訓練

因受疫情影響，目前國際性航空會議多改為線上會議方式進行，相較過去實體會議方式，減少了舟車勞頓及公帑資源，卻反而成為參與國際性會議之契機。雖然隨著我國及國際間疫情應對策略調整，預期未來將逐漸走向實體混合線上方式進行會議或訓練，未來建議持續選派優秀且有興趣同仁參與，並鼓勵作業同仁透過視訊方式一同參與，以精進自身專業知能，並提升本區航空氣象作業及服務品質。

伍、附錄

一、會議簡報

二、會議備忘錄

Japan Weather Association

CAA-JWA annual meeting

At Taipei
November 22nd, 2022

Discussion Topics

Japan Weather Association

1. Transition from Himawari-8 to Himawari-9
2. JWA's turbulence products
3. JMA model products
4. Brief introduction of airspace reconstructions in Japan
5. Implementation status of AUTO METAR in Japan
6. Status of migration from TAC to IWXXM in Japan

Discussion Topics

Japan Weather Association

1. Transition from Himawari-8 to Himawari-9
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1. Transition from Himawari-8 to Himawari-9

Japan Weather Association

The latest information from JMA is as follows;

1) Outline

First image of Himawari-9 (March 10, 2017, 02:40 UTC)
https://www.data.jma.go.jp/mscweb/ja/general/gms9.html

- Currently, Himawari-8 is operating as a geostationary meteorological satellite that monitors the western Pacific Ocean, and Himawari-9 is on standby.
- Both Himawari-8 and Himawari-9 are located within the orbit-holding range of 140.7° E ± 0.1° E, and the specifications of them are the same. However, there are slight individual differences in sensors (shown on pp. 6-7).
- The operation satellite is scheduled to be replaced by Himawari-9 at 0500 UTC on December 13, 2022. The plan is subject to change.
- After the replacement, Himawari-9 will continue to operate until 2029.

1. Transition from Himawari-8 to Himawari-9

Japan Weather Association

The latest information from JMA is as follows;

2) Change points(*1)

Product	item		Himawari-8	Himawari-9
HSD (Himawari Standard Data)	File name		HS_H08_*yyyymmdd_hhnn*_B*bb*_*cccc*_R*jj*_S*kkll*.DAT	HS_H09_*yyyymmdd_hhnn*_B*bb*_*cccc*_R*jj*_S*kkll*.DAT
			yyyymmdd_hhnn : observation start time *bb* : band number *cccc* : observation area and number *jj* : spatial resolution at SSP(*2) *kkll* : information of the segment division (*kk*: segment number *ll*: total number of segment)	
	Header Block (#1 Basic information block)	No.5 Satellite name	Himawari-8	Himawari-9
		No.20 File name	HS_H08_*yyyymmdd_hhnn*_B*bb*_*cccc*_R*jj*_S*kkll*.DAT	HS_H09_*yyyymmdd_hhnn*_B*bb*_*cccc*_R*jj*_S*kkll*.DAT

*1 Please refer to "Himawari-8/9 Himawari Standard Data User's Guide"
https://www.data.jma.go.jp/mscweb/en/himawari89/space_segment/hsd_sample/HS_D_users_guide_en_v13.pdf
*2 SSP : Sub Satellite Point

1. Transition from Himawari-8 to Himawari-9

Japan Weather Association

The following is the consensus between CAA and JWA;

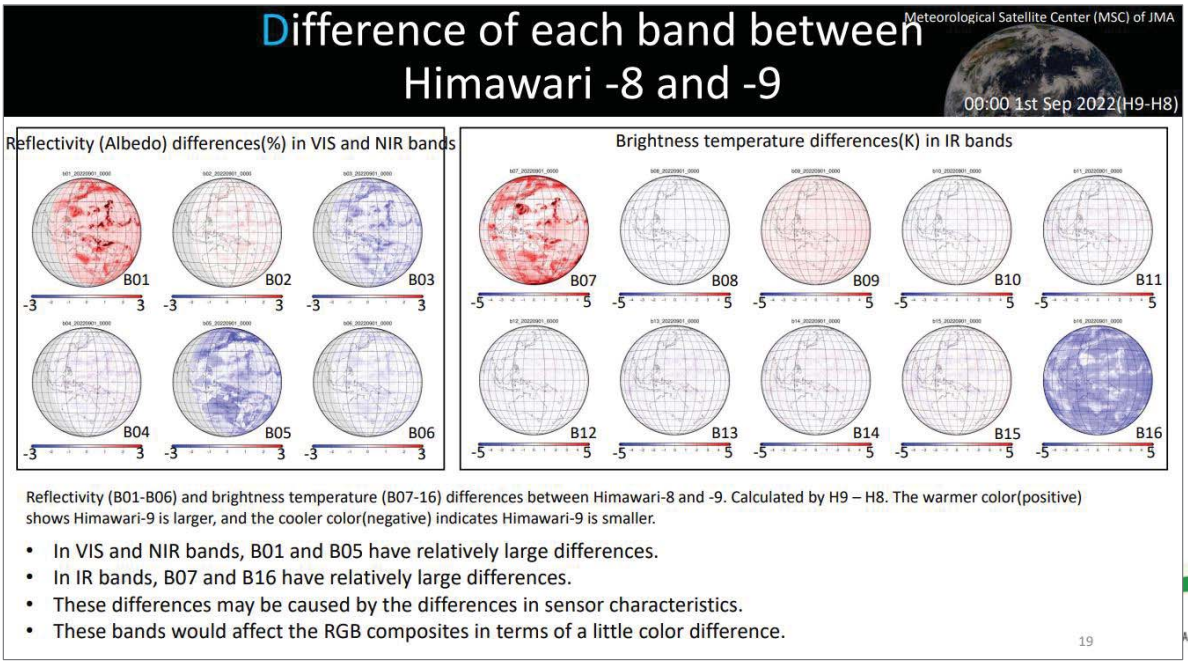
3) Providing directory on ftpport6

Server	Item	Himawari-8	Himawari-9
ftpport6	Upload directory	~/sat_h08	~/sat_h09
	Storage period	12 hours	12 hours

- There is no parallel distribution.

Japan Weather Association

4) Difference of each band between Himawari-8 and 9



Source https://www.cira.colostate.edu/wp-content/uploads/sites/4/2022/10/RGBworkshop_HANDA_TARO.pdf

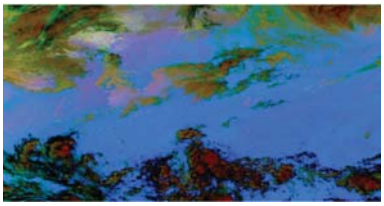
Japan Weather Association

5) Impact of the difference of each band between Himawari-8 and 9

Difference (relatively large) : band1,5,7,16
Difference : band3

Diff13-15
(122853-??0017)

Band: 13, 15
→ almost no impact

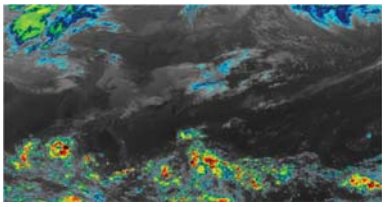


Dust-RGB
(122853-??0023)

Band: 11, 13, 15
→ almost no impact

True-color
(122853-??0021)

Band: 1, 2, 3, 4
→ might become a little bluer



Cloud Top Enhance
(122853-??0030)

Band: 13
→ almost no impact

Geo-color
(122853-??0022)

Band: 3, 13
→ brightness might be reduced a little in the daytime

★ If problems arise due to these differences, JWA will consider adjustments.

Discussion Topics

Japan Weather Association

1. Transition from Himawari-8 to Himawari-9
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2. JWA's turbulence products

Japan Weather Association

1) WRF data source change

- CAA will provide new data source samples (CWB M04 WRF) and explanatory notes to JWA.
- After that, JWA will test the new data.

2) Add more vertical levels in NetCDF [1]

- After JWA received a sample of new data source, JWA will confirm if we can calculate the 52 vertical levels CAA requests.

Altitude(feet)	Pressure(hPa)	Altitude(feet)	Pressure(hPa)	Altitude(feet)	Pressure(hPa)	Altitude(feet)	Pressure(hPa)
0	1013.25	11000	670.20	24000	392.71	37000	216.59
1000	977.17	12000	644.41	25000	376.01	38000	206.29
2000	942.13	13000	619.43	26000	359.89	39000	196.40
2500	925.00	14000	595.24	27000	344.33	40000	186.89
3000	908.12	15000	571.82	28000	329.32	41000	177.76
4000	875.10	16000	549.15	29000	314.85	42000	169.00
4800	849.10	17000	527.22	30000	300.89	43000	160.59
5000	843.07	18000	506.00	31000	287.45	45000	144.78
6000	811.99	19000	485.47	32000	274.49	47000	130.26
7000	781.85	20000	465.63	33000	262.01	49000	116.94
8000	752.62	21000	446.45	34000	249.99	51000	104.74
9000	724.28	22000	427.91	35000	238.42	53000	93.60
10000	696.81	23000	410.00	36000	227.29	55000	83.43

← 52 levels that CAA requests.

2) Add more vertical levels in NetCDF [2]

- In the current WRF, the number of layers is 51 for staggered and 52 for unstaggered.
  staggered : intermediate levels for U (U wind component), V (V wind component), etc.
  unstaggered : basic levels for W (velocity of vertical wind), PB (base state pressure), etc.

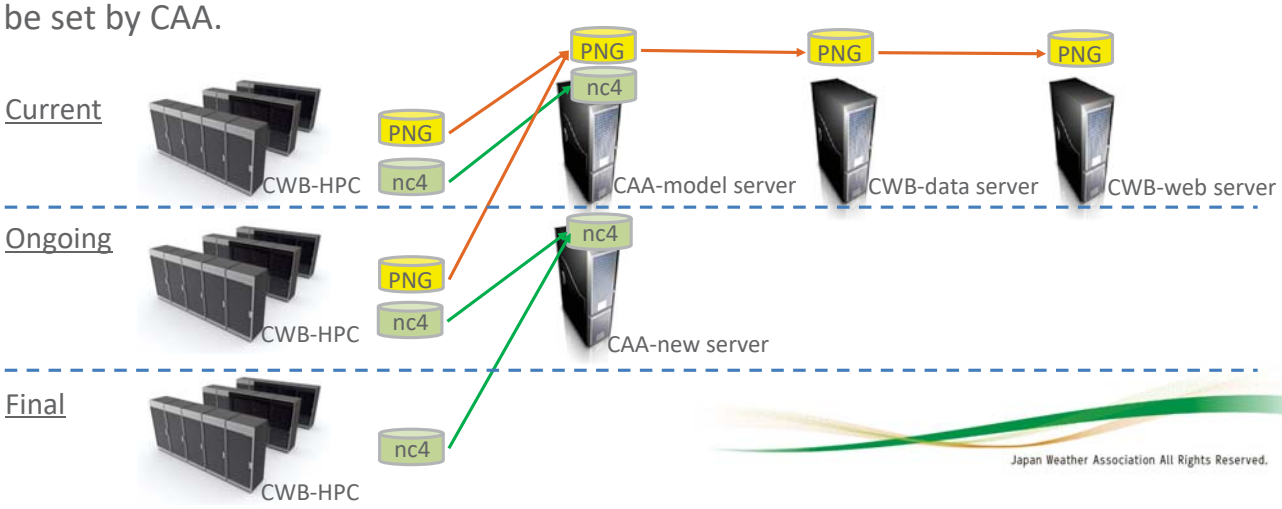
- In both cases, the relationship between altitude and pressure is not fixed, but uses the Eta value(*1), which is calculated by the following equation;
  $\eta=(P-Pt)/(Ps-Pt)$
  P: Air pressure at each layer
  Ps: Atmospheric pressure at the ground surface
  Pt: Air pressure in the uppermost layer (2000 Pa in WRF)

- JWA would like to know about the relationship between altitude and pressure of new WRF.
  Is the relationship between altitude and pressure fixed as the table you provided (P10)?
  Or will it use Eta values in the same way as current WRF?

*1 https://collaboration.cmc.ec.gc.ca/cmc/CMOI/product_guide/docs/eta_info_doc_e.html

3) Data transfer to CAA's new server

- It will be possible if CAA provide JWA access information of new server, such as IP, username, access protocol and password.
- JWA recognize that the network between CWB-HPC and CAA's new server is going to be set by CAA.



4) Technology transfer [1]

- JWA had submitted the following documents to CAA;
  - Basic specification for Turbulence forecast system
  - Operating Manual

- JWA is assuming that CAA requests more detailed supports beyond the above documents.

- Also, JWA is assuming that CAA is planning to develop new turbulence forecast program from scratch and doesn't consider porting the current program.

- Please give JWA the workload information for this support. Then we will be able to provide an estimate.

Japan Weather Association

4) Technology transfer [2]

- JWA constructed the current Turbulence Forecast system by using NCL(*1).
- Please note that the development of NCL had already stopped in 2020 and it is passed on Geoscience Community Analysis Toolkit (GeoCAT) Project(*2).
- JWA customized some parts of NCL though, CAA will be able to get most information by referring to NCL documentation.
- JWA is using various functions of NCL [version 6.6.2] as follows;
  - WRF import
  - Create vertical cross section
  - Create meteorological elements (potential temperature, VWS, etc.)
  - Map projections
  - Contour
  - Vector plots, etc.
- So, JWA doesn't write source code for the above functions.

*1 https://www.ncl.ucar.edu/ *2 https://geocat.ucar.edu/

Japan Weather Association

4) Technology transfer [3]

- JWA would like to know the following things;
  - Schedule

STEP	2023	2024	2025
Start transferring nc4 files to new server	?		
Stop creating PNG images		?	
Stop JWA's turbulence system			?

  - Specification of nc4 files

    At present, only VWS is included in the nc4 file due to the limitation of file size.
    And JWA recognize that CAA needs other meteorological elements to visualize the turbulence data.
    For example, altitude, pressure, U & V components, temperature, etc.

Discussion Topics

Japan Weather Association

1. Transition from Himawari-8 to Himawari-9
2. JWA's turbulence products
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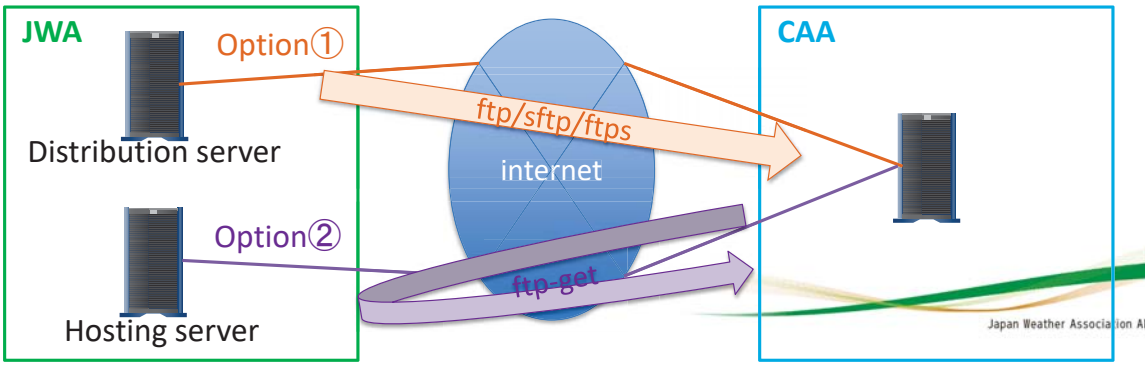
4. Brief introduction of airspace reconstructions in Japan
5. Implementation status of AUTO METAR in Japan
6. Status of migration from TAC to IWXXM in Japan

3. JMA model products

Japan Weather Association

1) Transfer method

- We are providing JMA's NWP model outputs to CWB by ftp-push via internet.
- If CAA would like to have them, JWA is ready to provide them.
- JWA proposes two options for providing JMA's NWP model outputs;
  ① ftp-push via internet : CAA needs to prepare ftp server
  ② ftp-get via internet : CAA can get JMA's NWP model outputs from JWA's server



Japan Weather Association

2) Data list

- We would like to know which model CAA is interested in.
- Table-1 shows the list of Deterministic models. If CAA is interested in Ensemble models also, JWA will give further information.

Table-1 JMA's NWP models

Model	Update frequency	Area	Mesh size	layer	File size	Forecast period	Format
GSM(*1) (global)	6 hourly	global	50km (*planned to be 13km in future)	Surface,2m(T,RH),10m(UV),1000,925, 850,700,600,500,400,300,250,200, 150,100,70,50,30,20,10hPa	1.5GB/initial run (00,12UTCinitial)	06,18UTC init:132hr 00,12UTC init:264hr	grib2
GSM (Japan)	6 hourly	20-50N/ 120-150E	20km (*planned to be 13km in 2023)	Surface,2m(T,RH),10m(UV),1000,975,950, 925,900,850,800,700,600,500,400,300, 250,200,150,100hPa	300MB/initial run (00,12UTC initial)	06,18UTC init:132hr 00,12UTC init:264hr	grib2
MSM(*2)	3 hourly	22.4-47.6N/ 120-150E	Surface:5km Upper:10km	Surface,1000,975,950,925,900,850,800, 700,600,500,400,300,250,200,150,100hPa	600MB/initial run (00,12UTC initial)	03,06,09,15,18,21UTC init:39hr 00,12UTC init:78hr	grib2
LFM(*3)	hourly	22.4-47.6N/ 120-150E	Surface:2km Upper:4km	Surface,1000,975,950,925,900,850,800, 700,600,500,400,300,250,200,150,100hPa	1GB/initial run	10hr	grib2

*1 GSM : Global Spectral Model *2 MSM : Meso-Scale Model *3 LFM : Local Forecast Model

Discussion Topics

Japan Weather Association

1. Transition from Himawari-8 to Himawari-9
2. JWA's turbulence products
3. JMA model products
4. Brief introduction of airspace reconstructions in Japan
5. Implementation status of AUTO METAR in Japan
6. Status of migration from TAC to IWXXM in Japan

4. Brief introduction of airspace reconstructions in Japan

Japan Weather Association

- JCAB(*1) is reorganizing the domestic airspace of Fukuoka FIR in order to respond to the future increase in demand of air traffic and in anticipation of future TBO (Trajectory Based Operation).
- Air traffic will increase not only for flights departing from and arriving in Japan, but also for aircraft passing over Japan.
- So, JCAB decided to change the sector shape of domestic airspace significantly during 2020 to 2025.
- JCAB is going to separate the shape of domestic airspace into High-altitude and low-altitude by the boundary of FL335.
- The distribution and reduction of air traffic controllers' workload would be expected by this reconstruction.

Source https://www.icao.int/APAC/Meetings/2022%20ATMSG10/IP17%20Airspace%20Reconstructions%20in%20JAPAN.pdf
*1 JCAB : Japan Civil Aviation Bureau

4. Brief introduction of airspace reconstructions in Japan

Japan Weather Association

- Figure-1 shows the airspace reconstruction plan by JCAB.
  The high-altitude area will be controlled centrally by Fukuoka ACC(*1) after 2025.
  It is expected to increase the flexibility of routes connecting Asia and the Pacific Ocean.
- Figure-2 shows the main flow of passing over Japan.

Figure-1

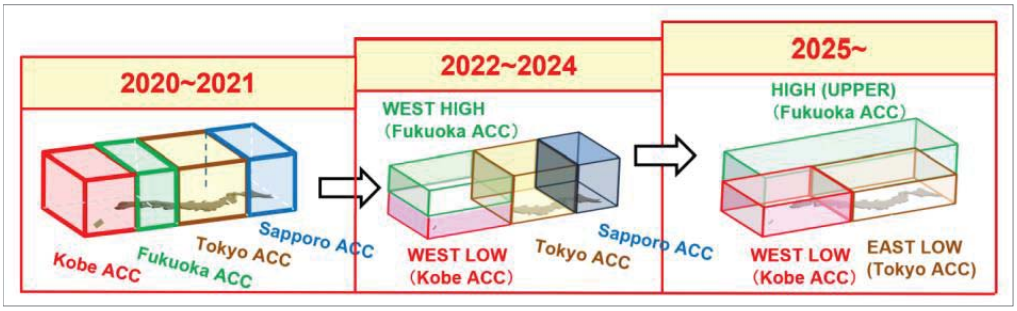
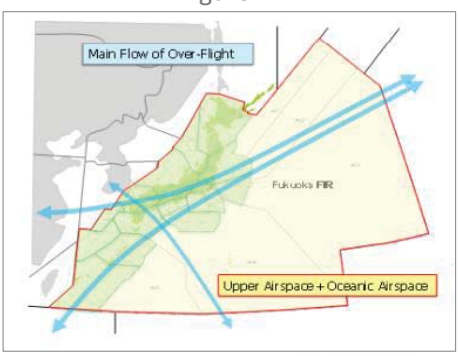


Figure-2



Source https://www.icao.int/APAC/Meetings/2022%20ATMSG10/IP08%20The%20Long-Term%20Vision%20for%20the%20Future%20Air%20Traffic%20Systems%20of%20Japan%20(CARATS).pdf
*1 ACC : Area Control Center

Discussion Topics

Japan Weather Association

1. Transition from Himawari-8 to Himawari-9
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5. Implementation status of AUTO METAR in Japan

Japan Weather Association

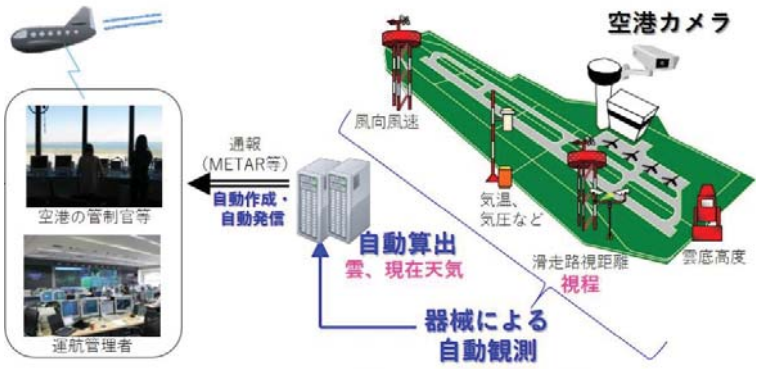


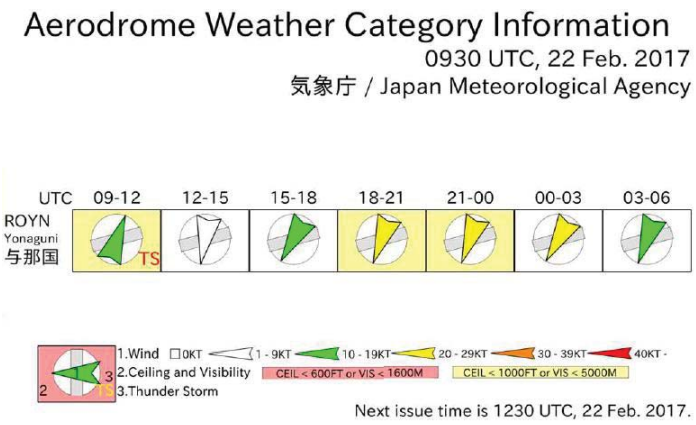
Image of AUTO METAR
https://www.jma.go.jp/jma/kishou/know/kouku/2_kannsoku/27_jidoka/27_jidoka.html

- The JMA began automating aviation weather observation reporting at some airports in March 2017.
- As of 16 March 2022, aviation weather observations are fully automated at 15 airports (see table below).

Fully automated hours	Airports
some hours (at night)	Narita International, Chubu International, Kansai International, Fukuoka, Naha, Osaka International, Amami, Shin-Ishigaki.
all day	Iki, Kikai, Tokunoshima, Yoron, Minami Daito, Kita Daito, Yonaguni.

5. Implementation status of AUTO METAR in Japan

Japan Weather Association

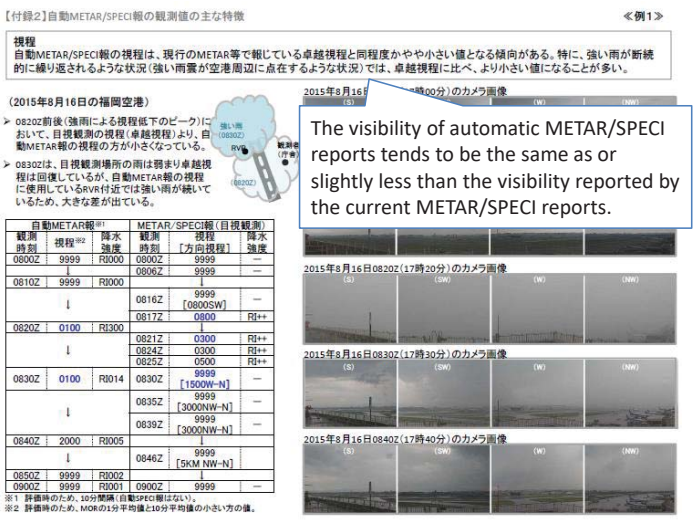


Aerodrome weather category information
https://www.jma.go.jp/jma/kishou/know/kouku/2_kannsoku/27_jidoka/jidoka_gaiyo.pdf (p. 60)

- In initiating full automation, discussions were held by the JMA, the airlines and the Civil Aviation Authority.
- To bridge the difference between visual and automatic observations, airport camera images are provided, some visual observations of solid precipitation in winter continue, and enquiries are handled at aviation meteorological offices.
- For airports that implement full automation throughout the day, weather forecast information is created eight times a day (0030, 0330, 0630, 0930, 1230, 1530, 1830, 2130 UTC) and provided by MetAir (see figure on the left).
- Automatic SPECI reports due to changes in visibility, sealing and atmospheric phenomena are conditioned on the phenomena lasting for about two minutes when deteriorating and lasting for about five minutes when recovering.

5. Implementation status of AUTO METAR in Japan

Japan Weather Association



The visibility of automatic METAR/SPECI reports tends to be the same as or slightly less than the visibility reported by the current METAR/SPECI reports.

Main characteristics of the observed values of automatic METAR/SPECI reports
https://www.jma.go.jp/jma/kishou/know/kouku/2_kannsoku/27_jidoka/jidoka_gaiyo.pdf (p. 46)

- In preparation for starting operations, the characteristics of automatic METAR (the differences from visual observations) were summarized based on the results of about three years of automatic observations (see figure on the left for an example).
- In the case of automatic observation, if it is decided to report when a condition is met even for just a moment, the frequency of reporting will be excessive. Therefore, the frequency of automatic SPECI reports was determined by review of the JMA, the airlines and the Civil Aviation Authority.
- According to the JMA, the plan is to add five more airports (Kochi, Miyazaki, Miyako, Shimojishima, and Tarama) by the end of this fiscal year, and the final adjustments are underway. If all goes well, the plan is to expand by about five airports each fiscal year.

Discussion Topics

Japan Weather Association

1. Transition from Himawari-8 to Himawari-9
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6. Status of migration from TAC to IWXXM

Japan Weather Association

- The following OPMET(*1) are provided in TAC and IWXXM format in parallel through AMHS(*2).

    1) Tropical Cyclone Advisory for SIGMET : by JMA (Tokyo Typhoon Center)(*3)
    2) Volcanic Ash Advisory : by JMA (Tokyo VAAC)(*4)
    3) METAR/TAF/SIGMET : by JMA

- According to the "Annex3 to the Convention on International Civil Aviation", the reporting OPMET in TAC format is still standard and obligation at present.

- So, JMA has no plan to terminate providing OPMET in TAC format at present.

*1 OPMET data : Operational METeorological data
*2 AMHS : Air traffic services Message Handling System
*3 https://www.jma.go.jp/jma/jma-eng/jma-center/rsmc-hp-pub-eg/AnnualReport/2021/Text/Text2021.pdf
*4 https://ds.data.jma.go.jp/vaac/data/Inquiry/graphic_and_dispersion.htm

Thank you ！

Appendix.
- Brief introduction of remote control of regional airports in Japan (1)

Japan Weather Association

Airports where air traffic control operations, etc. are conducted (As of April 1, 2022)
https://www.mlit.go.jp/koku/content/001359496.pdf

■: Airports where Aerodrome Control Services are conducted

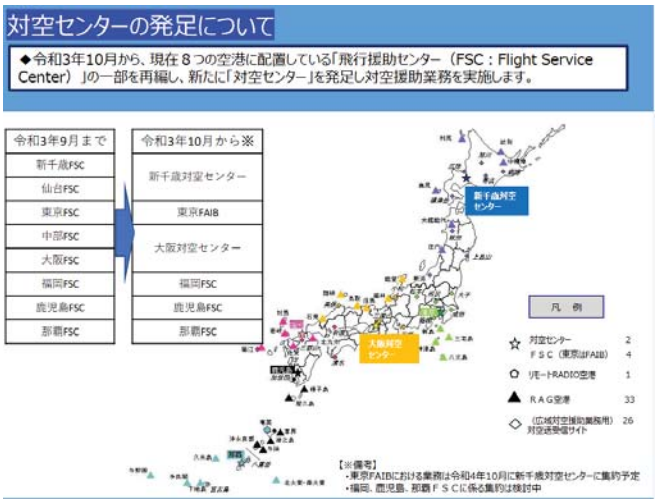
○: Airports where Aerodrome Flight Information Services are conducted

◇: Airports where Aerodrome Flight Information Services (remote) are conducted

✡: Airports shared with the Self-Defense Forces or U.S. Forces in Japan

Appendix.
- Brief introduction of remote control of regional airports in Japan (2)

Japan Weather Association



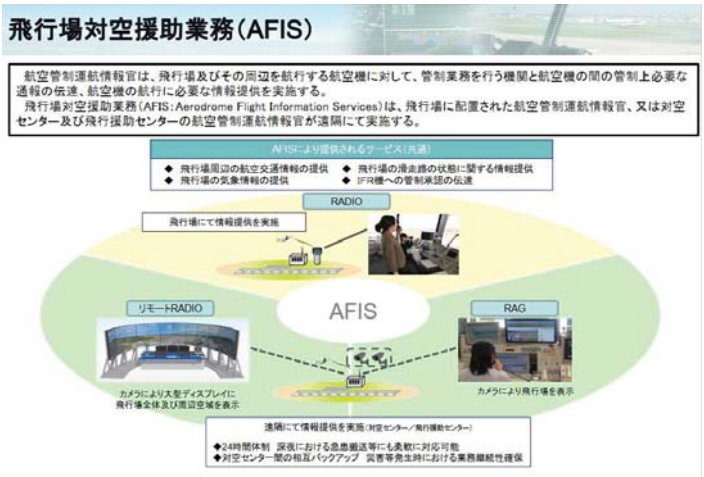
- In October 2021, some of the FSCs (Flight Service Centers) located at eight airports were reorganized and two AFIS and AEIS Centers (New Chitose and Osaka) were established.
- Consolidation of Fukuoka, Kagoshima, and Naha FSCs into a new AFIS and AEIS Center is under consideration.

AFIS = Aerodrome Flight Information Services
AEIS = Aeronautical En-route Information Services

Inauguration of AFIS and AEIS Centers
https://www.japa.or.jp/wp-content/uploads/2021/10/japacab_20211001_2.pdf

Appendix.
- Brief introduction of remote control of regional airports in Japan (3)

Japan Weather Association



- Air Traffic Control Flight Information Officers conduct Aerodrome Flight Information Services (AFIS), which transmit information between ATC (Air Traffic Control) and aircraft navigating in and around airfields and provide aircraft with the information necessary for navigation.
- AFIS is conducted by Air Traffic Control Flight Information Officers stationed at the airfield or remotely by Air Traffic Control Flight Information Officers stationed at an AFIS and AEIS Center or an FSC.

AFIS：Aerodrome Flight Information Services
https://www.mlit.go.jp/koku/content/001421068.pdf

2022.11.22

In Taipei

Minutes of CAA-JWA Annual Meeting

1. Brief introduction of airspace reconstructions in Japan

- JCAB is reorganizing the domestic airspace of Fukuoka FIR in order to respond to the future increase in demand of air traffic and in anticipation of future TBO (Trajectory Based Operation).
- JCAB decided to change the sector shape of domestic airspace significantly during 2020 to 2025. Air traffic will increase not only for flights departing from and arriving in Japan, but also for aircraft passing over Japan.

2. Brief introduction of remote control of regional airports in Japan

- In October 2021, some of the FSCs (Flight Service Centers) located at eight airports were reorganized and two AFIS and AEIS Centers (New Chitose and Osaka) were established. Consolidation of Fukuoka, Kagoshima, and Naha FSCs into a new AFIS and AEIS Center is under consideration.
- Air Traffic Control Flight Information Officers conduct Aerodrome Flight Information Services, which transmit information between ATC and aircraft navigating in and around airfields and provide aircraft with the information necessary for navigation.
- AFIS is conducted by Air Traffic Control Flight Information Officers stationed at the airfield or remotely by Air Traffic Control Flight Information Officers stationed at an AFIS and AEIS Center or an FSC.

3. Transition from Himawari-8 to Himawari-9

- Currently, Himawari-8 is operating as a geostationary meteorological satellite that monitors the western Pacific Ocean, and Himawari-9 is on standby. The operation satellite is scheduled to be replaced by Himawari-9 at 0500 UTC on December 13, 2022. The plan is subject to change.
- After the replacement, Himawari-9 will continue to operate until 2029.
- JWA confirmed that the directory and file name on the JWA's ftp site would be changed, but the similar files would continue to be distributed.

Conclusion:

- JWA will be keeping watching the Transition Plan of Himawari-8 and Himawari-9 and inform CAA.

4. JWA's turbulence products

- For CAA's development of the next generation aviation weather system, CAA would like to change the data source and transfer target of JWA's turbulence products.
- CAA also requests to add more vertical levels in the NetCDF files of JWA's turbulence products.
- JWA had submitted the "Basic specification for Turbulence forecast system" and "Operating Manual" to CAA. JWA also provide the notice information of NCL that it had been used for the

data process of turbulence products.

Conclusion:

- CAA will send the sample WRF data with flight level coordinate to JWA when data is ready.
- After receiving the sample data, JWA will confirm whether the CAA's request for vertical levels can be fulfilled.
- After confirming that there is no problem, when switching to new WRF data, JWA will fulfill the CAA's request for vertical levels.
- Once the CAA notifies JWA of access information for a new server, JWA can provide data to that server.
- The CAA and JWA will continue to discuss specifics regarding technology transfer.

5. JMA model products

- JWA had introduced the JMA's model, GSM(global), GSM(Japan), MSM and LFM, to CAA.
- JWA can deliver JMA products to the CAA via ftp-push or ftp-get.
- JWA can also deliver only a subset of JMA products to reduce data size.

Conclusion:

- CAA will inform JWA that CAA decide to get JMA's model and then CAA and JWA will discuss the amendment of the current contract for this issue.

6. **Implementation status of AUTO METAR in Japan**

- The JMA began automating aviation weather observation reporting at some airports in March 2017. As of 16 March 2022, aviation weather observations are fully automated at 15 airports.
- In preparation for starting operations, the characteristics of automatic METAR (the differences from visual observations) were summarized based on the results of about three years of automatic observations.
- According to the JMA, the plan is to add five more airports (Kochi, Miyazaki, Miyako, Shimojishima, and Tarama) by the end of this fiscal year, and the final adjustments are underway. If all goes well, the plan is to expand by about five airports each fiscal year.

7. Status of migration from TAC to IWXXM in Japan

- Tropical Cyclone Advisory for SIGMET, Volcanic Ash Advisory and METAR/TAF/SIGMET were provided in TAC and IWXXM format in parallel through AMHS.
- According to the "Annex3 to the Convention on International Civil Aviation", the reporting OPMET in TAC format is still standard and obligation at present.
- JMA has no plan to terminate providing OPMET in TAC format at present.

Signature

余曉鵬	小玉亮
Yu Sheau-Perng	**Kodama Ryo**
CAA	**JWA**