






Taiwan Space Weather Operation Update and COVID-19 Situation

Space Weather Operational Office
Central Weather Bureau, Taiwan




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-  COVID-19 Situation in Taiwan
-  SWOO Operation Update
-  R202R Procedure and Products
-  New SWOO Website
-  Conclusion

COVID-19 Situation in Taiwan



 Confirmed its first COVID-19 case in Taiwan and raised up border quarantine control on 21 January, 2020.

Import Policy

- All visitors from abroad and returning citizens were requested to fill out the “COVID-19 Health Declaration Card” upon entry into Taiwan and then local jurisdiction/quarantine at home/qualified hotel for 14 days.
- Banned the export of medical-grade and N95 face masks, announced the mask-rationing plan to give people an equal amount of masks.
- Doctors will be alerted by the NHI MediCould System if a patient has the travel history from specified regions in the past 14 days.
- **Wear a mask and check body temperature before using public transportation and entering indoor area.**
- **Keep a safe distance of 1.5 meters when possible.**

From February 6th, 2020,
NHI Cards or Resident Certificate
are required to purchase **Masks**



- 1** Limited to **two masks** per purchase
Within a seven-day span, you may only make one purchase, 2 masks for NT\$10
- 2** Based on the last digit of your NHI card or Resident Certificate number, you may purchase on the following days:
Odd: Monday, Wednesday, Friday
Even: Tuesday, Thursday, Saturday
- 3** Sunday: **No limitation to the last digit of your NHI or Resident Certificate number**, you can make a purchase at a NHI contracted pharmacy
- 4** **Purchase by proxy**: only one purchase by proxy per person; purchase must be made on the day allowed for the proxy card
- 5** 200 adult masks and 50 child size masks will be provided to every NHI contracted pharmacy daily but the amount may be adjusted according to needs

*Rural areas or districts without NHI contracted pharmacies may make a purchase at their local public health center

Total

Reported
107,880

Excluded
106,360

Confirmed
618

Deaths
7

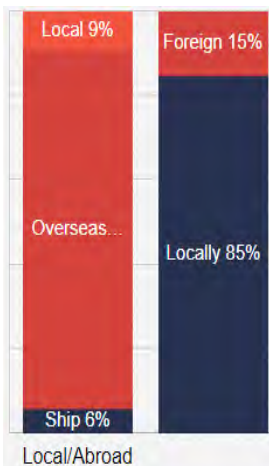
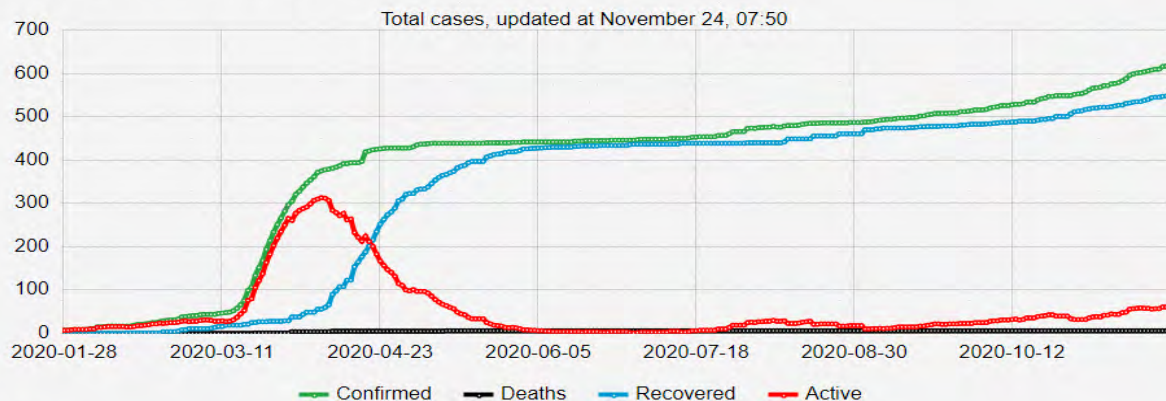
Recovered
549

Tests Conducted
248,628

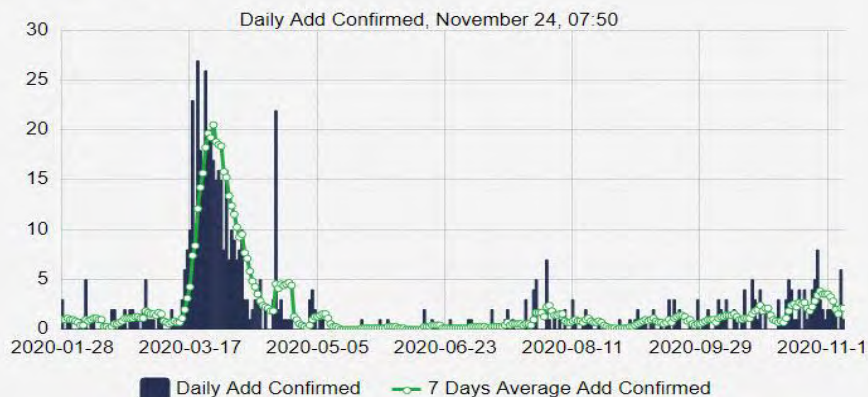
Resource: <https://www.cdc.gov.tw/en/Disease/SubIndex/>

Updated at 2020-11-24

Taiwan COVID-19 total cases



Taiwan COVID-19 daily cases



Taiwan Centers for Disease Control (Taiwan CDC) reports 2 more confirmed cases on Nov 18



Daily Summary publish by CDC via Facebook, Line and other media.

#中國武漢市2019新型冠狀病毒肺炎最新消息

請大家勿恐慌

疾管署針對新型冠狀病毒未排除人傳人之可能相關防治措施皆以該病毒可能人傳人情形研擬並已完備

衛福部提醒

境內春節期間，國人入境 14 日內如出現發燒、咳嗽、氣喘、呼吸困難等症狀，應主動告知航管檢疫人員，依指示配戴口罩並就醫，並主動告知醫師所遊、職業別、接觸史及發展情形 (IDCC)，以供醫師及時診斷通報。如有症狀可隨時向當地衛生局諮詢。或撥打免費防疫專線 1922 (或0800-801922) 洽詢。

病毒基因體定序出爐確定39於埃及感染

Virus genome sequence disclosed; Case #39 confirmed to be infected with COVID-19 in Egypt

On March 8, the Central Epidemic Command Center reported details about a cluster of coronavirus disease 2019 (COVID-19) infection on a Nile River cruise boat. A research team at the National Taiwan University College of Medicine discovered that there is a significant difference between the genome sequence of the strain of virus isolated from Case #39's specimen and the sequences from Taiwanese patients and that the strain of virus from Case #39 belongs to the same clade of the strains of virus in Europe, Nigeria, Brazil and Italy. The study showed that Case #39 is only an index patient who was first diagnosed with COVID-19 but not the source of infection.

It is determined that Case #39 contracted the novel coronavirus in Egypt, and developed symptoms after returning to Taiwan and that this is an imported case.

2020.03.08 時間 13:00

Taiwan to ban airline passenger transits through the country starting March 24 until April 7

In order to stop the spread of COVID-19 through air transport

The CECC has announced that it will suspend the transit of airline passengers through Taiwan (from 00:00 Taipei Standard Time (CST) on March 24 (Tuesday) until April 7) to decrease the cross-border movement of people and to reduce the risk of disease transmission

2020.03.22 時間 19:30

Taiwan Centers for Disease Control (Taiwan CDC) reports no new confirmed cases on April 27

No new confirmed cases of coronavirus disease 2019 (COVID-19) for two consecutive days

Of 429 confirmed cases in Taiwan, 343 are imported and 55 are locally acquired while 31 are Navy members aboard the Panshi fast combat support ship.

Of the confirmed cases, there have been 6 deaths, and 290 patients have been released from isolation, with the remainder remaining hospitalized in isolation.

2020.04.27

#COVID-19 #TaiwanCanHelp

MOHW of Taiwan

Influence by COVID-19 in Taiwan



- Early this year, most meeting/conference/workshop/active are canceled/postponed or turned to online meeting, government employees are further divided three group to work at office, backup sites and from home once necessary.
- While the daily confirm cases are decreased after May 2020, domestic travel, outdoor activities, meeting, baseball games, exhibitions, etc, are almost back to normal as usual, in addition to wear a mask and check body temperature .
- Due to Taiwan government still do not allow non-necessary oversea travel, as well as foreigner can not enter Taiwan without permission, all international collaborations are limited continuously via online meeting and email discussion.
- Domestic collaborations are not significant affect by COVID-19, and 2 systems are also successfully transited from scientific groups to operation center.



**Be sure to wear face masks
when it is crowded or in an
enclosed area.**



2020.08.06

SWOO Operational Products



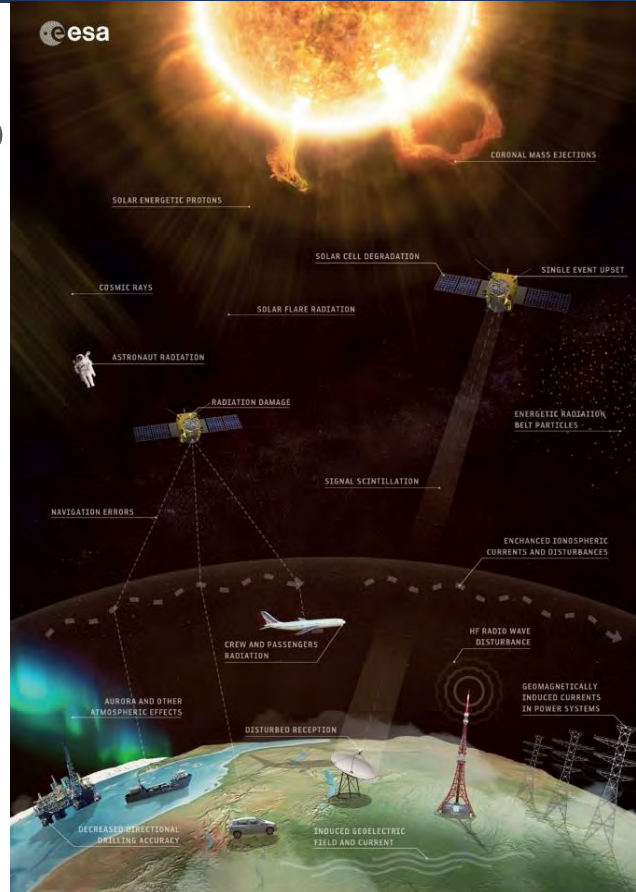
Solar Telescope NASA/SDO
NOAA/GOES
NASA-ESA/SOHO

NOAA/DSCOVR

NOAA/GOES

FORMOSAT-7/COSMIC-2
Ionospheric profile
Global Ionospheric Specification

Ionosonde
GNSS observations IGS GNSS
TEC, ROTI, S4 and PPP
Magnetometer
Magnetic Disturbance Kp index
Dst index



WSA-Enlil Solar Wind Model
(Results from NOAA/SWPC)

Magnetopause Position
(Operational since 2015)

OVATION Aurora Model
(Results from NOAA/SWPC)

Ionosphere-Thermosphere Model
(Operational since 2020 with data assimilation)

Ionospheric Scintillation Model
(Operational since 2018)

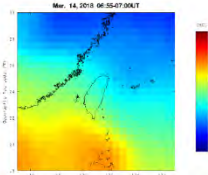
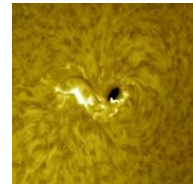
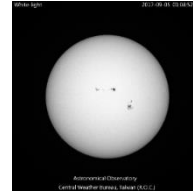
D-region Radio Absorption Model
(Operational since 2016)

SWOO Observation Updates



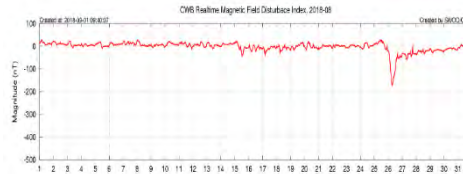
Ground-based

- Solar Telescope
 - Sunspot drawing and analysis
 - White-light 、H-alpha 、Ca-K images
- GNSS Receiver
 - 1Hz/50Hz RINEX Ofile 、0.5Hz TEC values
 - Taiwan Realtime Global/Regional TEC Map
- 3 Component Magnetometer
 - X, Y, Z, H, and B components
 - Taiwan Geomagnetic Disturbance Index
- Ionosonde
 - Electron density profiles
 - Global Ionospheric parameters

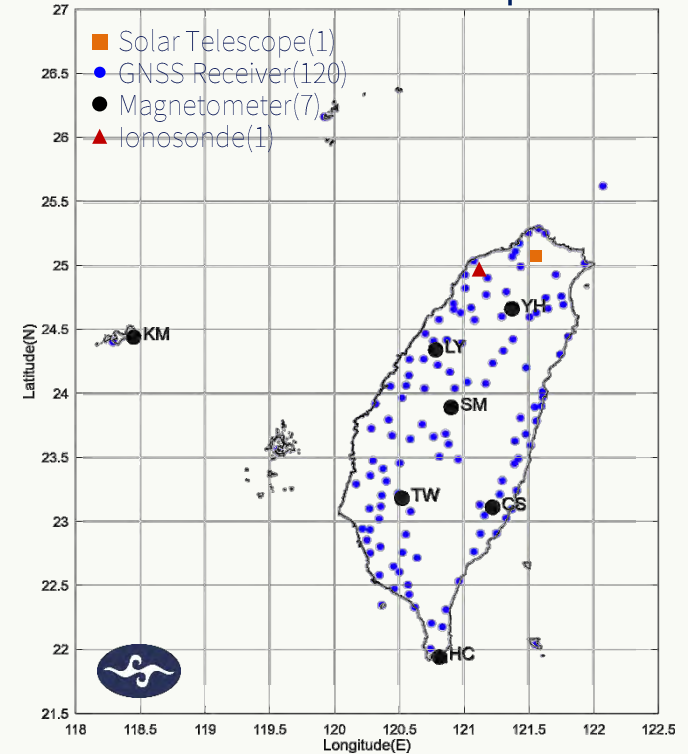


Satellite

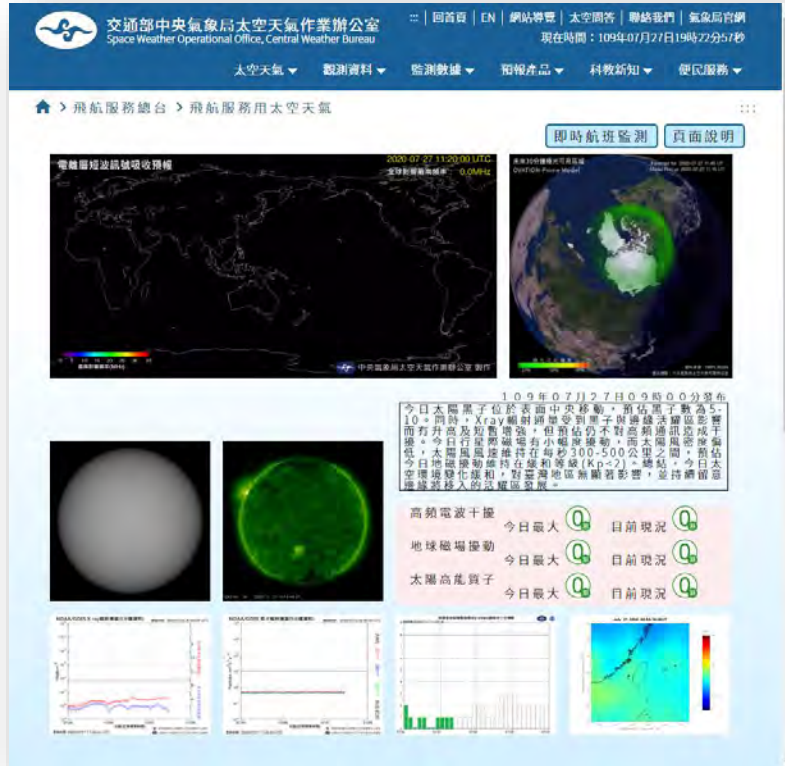
- FORMOSAT-7/COSMIC-2



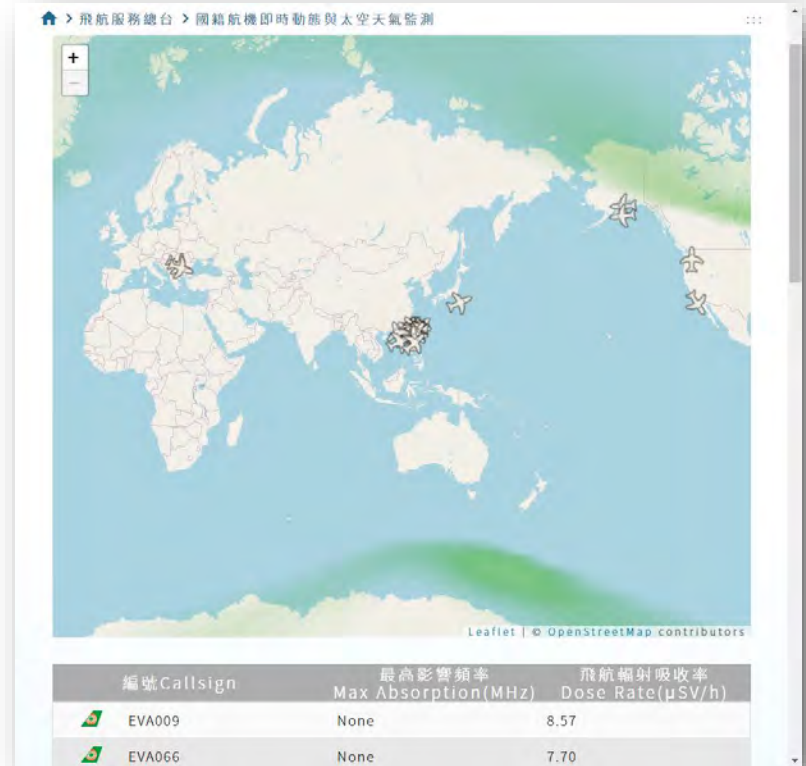
Observation Map



Webpage for Aviation/ICAO






Space Weather Information

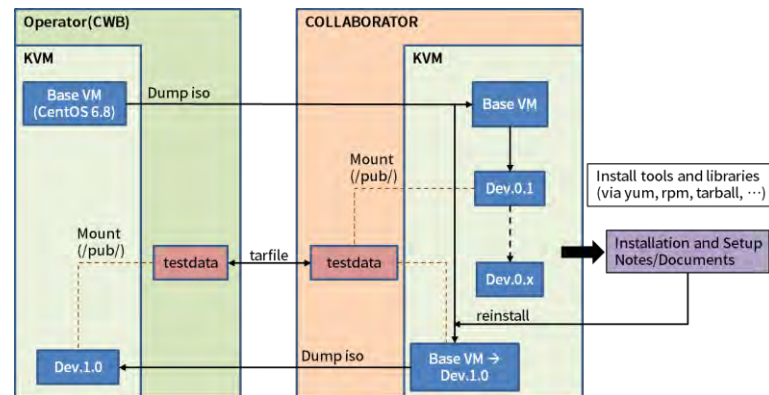
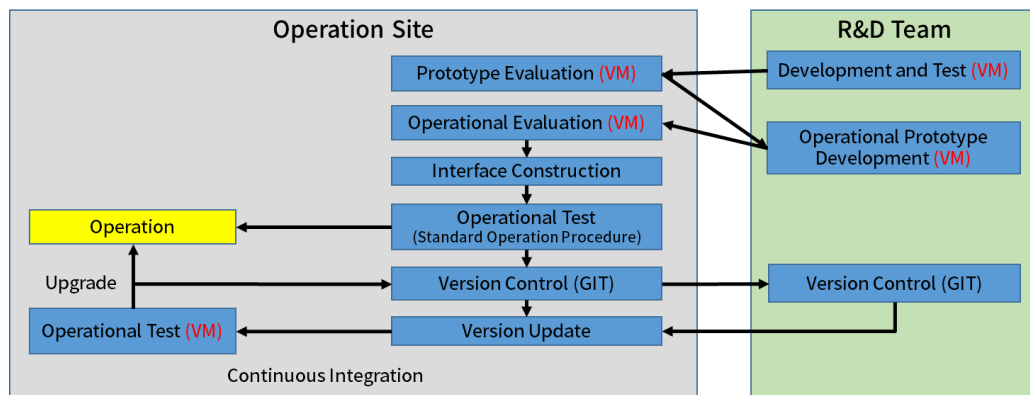


Realtime Flight Impact Monitor

R2O2R : Transition Procedure



-  **Uncomplicated programs:**
 - Do not rely on system OS, libraries, and compilers.
 - Directly transit to operation site.
-  **Complex system:**
 - Request to develop in the CWB virtual machine.
 - Exchange VM ISO files for prototype/operational evaluation process.
-  **Seasonal meeting with research groups**



Successful R202R Products



 TW Realtime Global/Regional TEC Map



NCU



NCKU

 The Earth's Magnetopause Position



NSPO

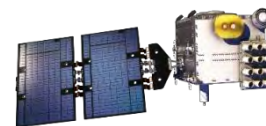


NCTU

 Global Ionospheric Specification

- Reconstructed 3D ionospheric electron density with RO and GNSS-TEC.

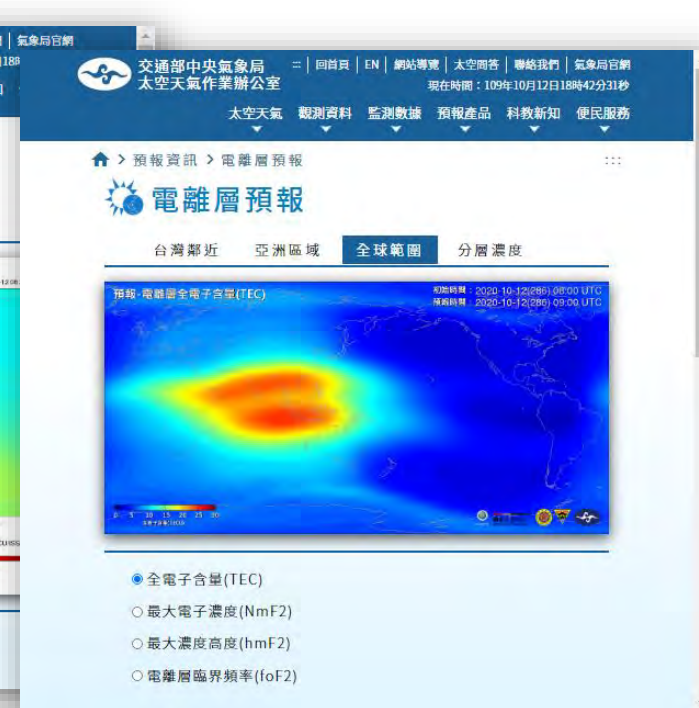
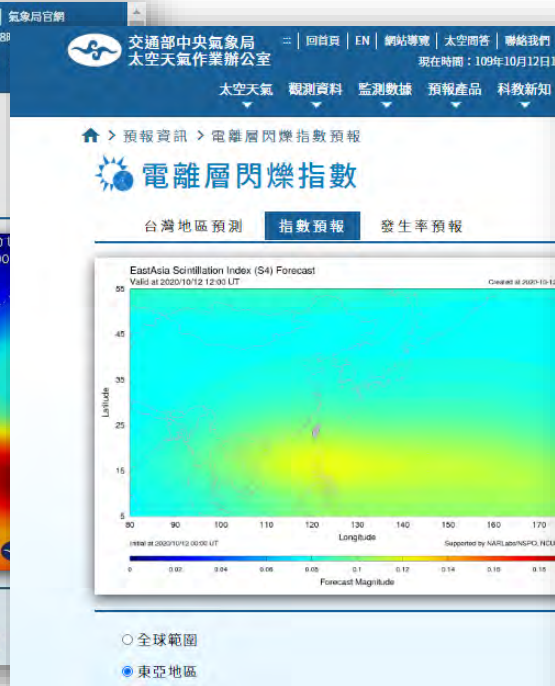
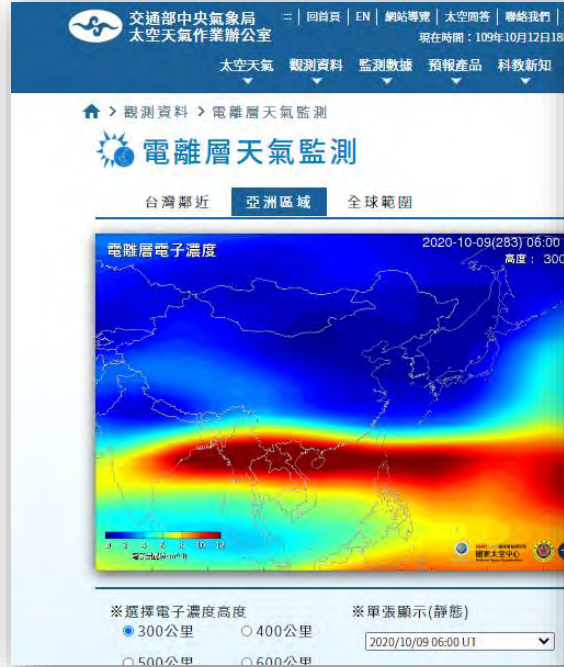
 Ionospheric Scintillation Empirical Model



- Parameter fitting by entire FORMOSAT-3/COSMIC observations.

 Ionosphere-Thermosphere Coupling Model with Data Assimilation

- NCAR TIE-GCM assimilated with RO profiles and GNSS-TEC.



GIS
Daily Update
60 minutes
3 regions
4 altitude layers

Scintillation Model
Daily Update
60 minute
Index and
Occurrence

Ionospheric Forecast
Hourly update
60 minute
3 regions, 4 parameters
4 altitude layers

Profiles and High Level Products



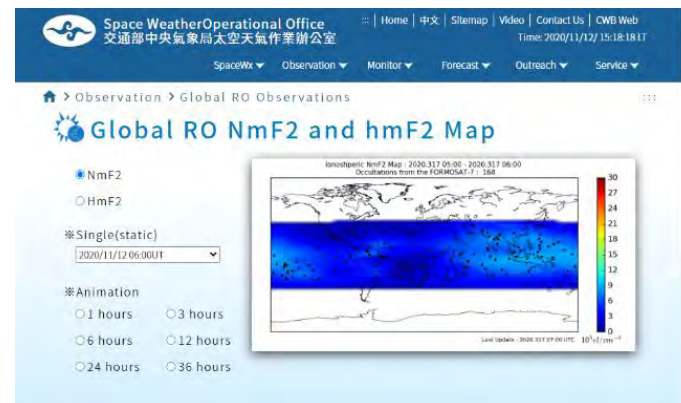
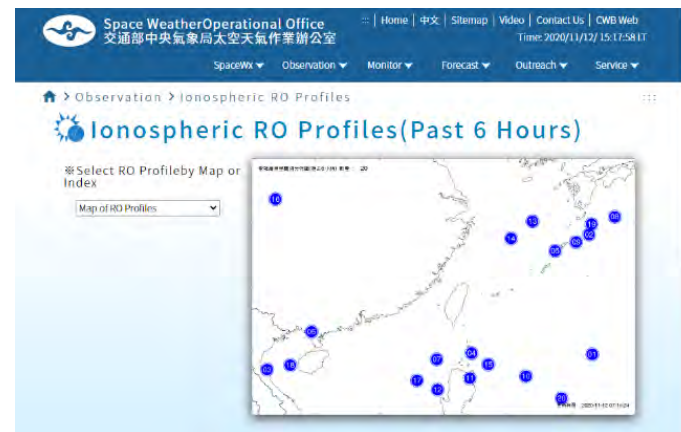
✓ Ionospheric RO profiles:

- Last 6 hours observations
- Click and show ionospheric profiles

✓ Global RO NmF2 and hmF2 Map

- Reconstructed global NmF2 map
- Reconstructed global hmF2 map

✓ Updated Hourly



TW Realtime Global (TWRG) TEC Map



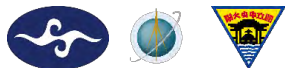
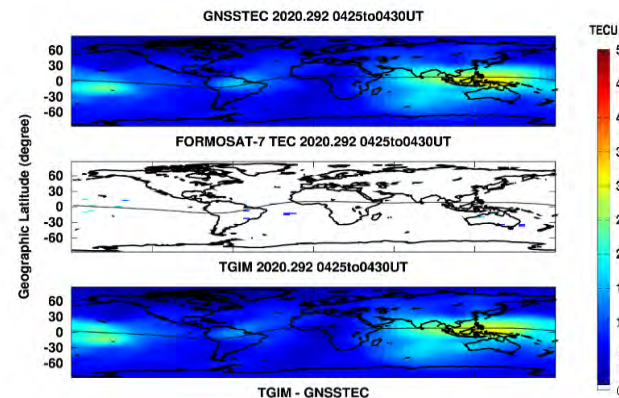
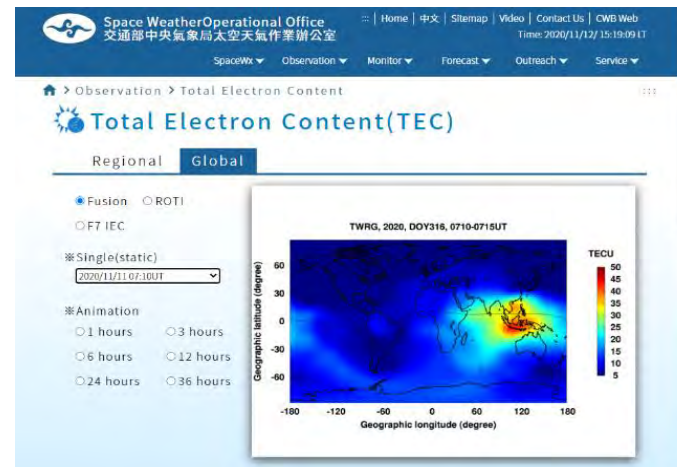
✓ Observation:

- Ground-based GNSS TEC
- F7/C2 IEC (integrated from density profile)
- F7/C2 Absolute TEC (GPS only now)

✓ Information:

- Smoothing by spherical harmonic function
- Accumulated period: 60 min.
- Temporal resolution: 5 min.
- Spatial resolution: $5.0^\circ \times 2.5^\circ$

✓ Updated Hourly



Global Ionospheric Specification (GIS)



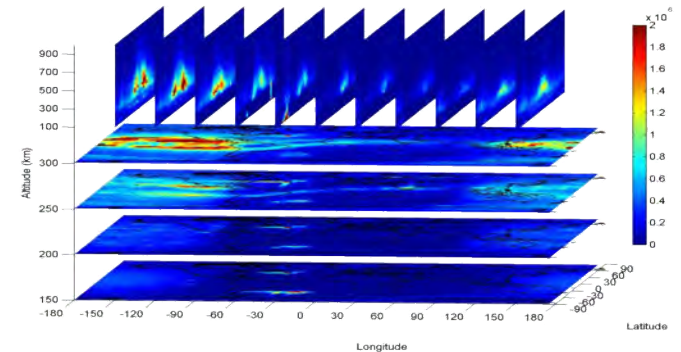
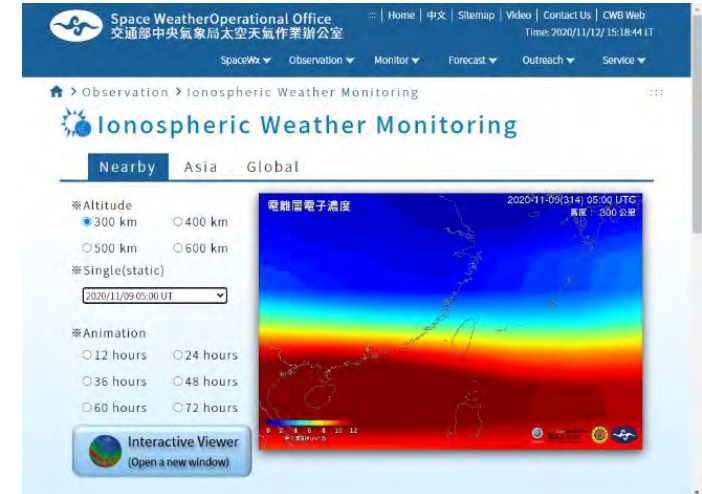
✓ Input:

- Radio Occultation Data (ionPhs & ionPrf)
- Ground-based GNSS Observations
- IRI-2016 serves as background model

✓ Output:

- Global 3D structure of ionospheric density
- Spatial resolution: $5^\circ \times 2.5^\circ \times 20$ km
- Temporal resolution: 60min.

✓ Updated daily but for 2 days ago.



Ionosphere-Thermosphere Model



✓ System:

- NCAR TIE-GCM serve as forecast model
- Ensemble Kalman Filter with 48 Ensembles
- Spatial resolution: $5^\circ \times 5^\circ \times 0.5\text{plev}$
 - Will be improved to $2.5^\circ \times 2.5^\circ \times 0.25\text{plev}$
- Temporal resolution: 60min.

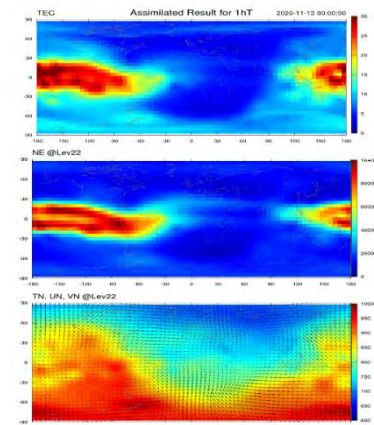
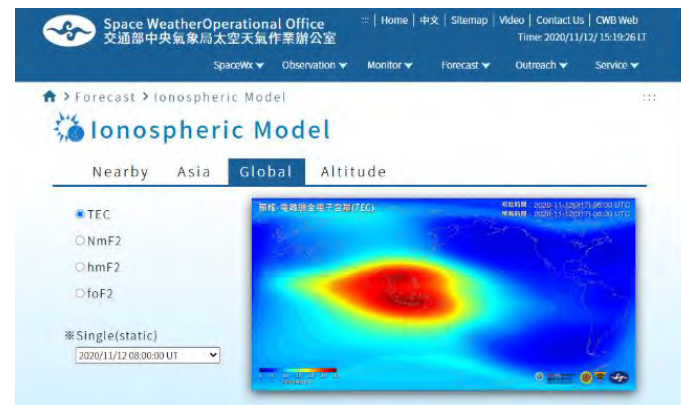
✓ Input parameter/observation:

- Solar 10.7cm flux (F10.7) & Kp index
- Universal date/time
- Assimilate RO ionospheric profiles and GNSS-TEC

✓ Output:

- Ionosphere and thermosphere parameters.

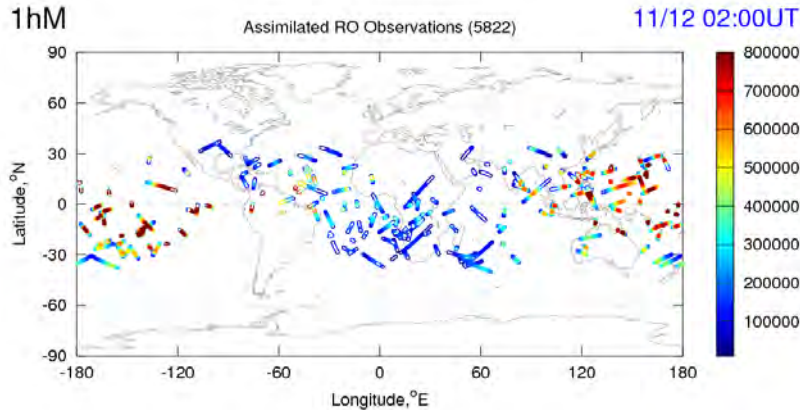
✓ Updated hourly and forecast for next 3 hours.



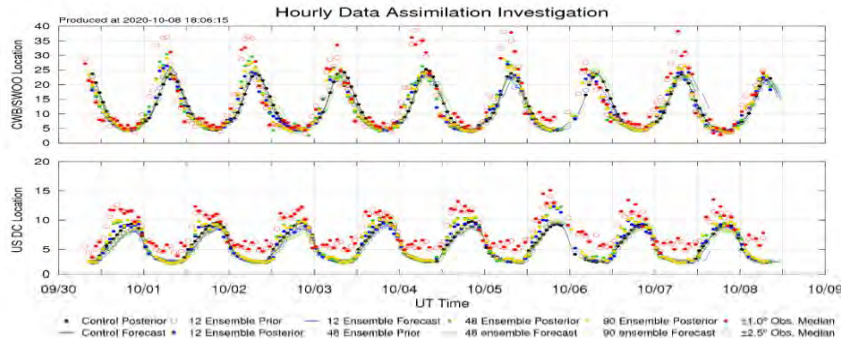
Ionospheric Forecast with DA



Distribution of Assimilated F7/C2 ionPrf



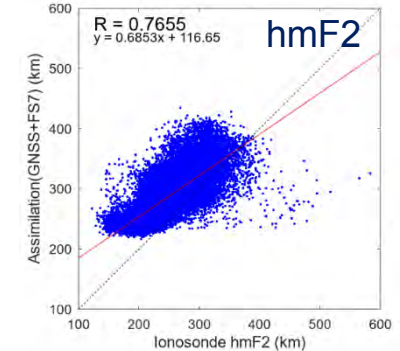
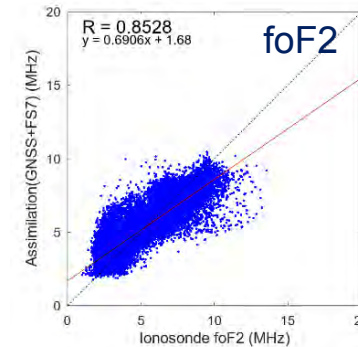
Assimilated Results Compare with TEC



Validated Results By Ionosondes

| NmF2 | Prior | Posterior |
|-----------------------|--------|-----------|
| Global | 0.7622 | 0.8528 |
| Low and Mid- Latitude | 0.7282 | 0.8341 |
| High Latitude | 0.7395 | 0.8421 |

| hmF2 | Prior | Posterior |
|-----------------------|--------|-----------|
| Global | 0.7507 | 0.7655 |
| Low and Mid- Latitude | 0.6444 | 0.6715 |
| High Latitude | 0.8874 | 0.8792 |



Website updated



Event report

(Detected and automatic generated and then further modified by manual.)

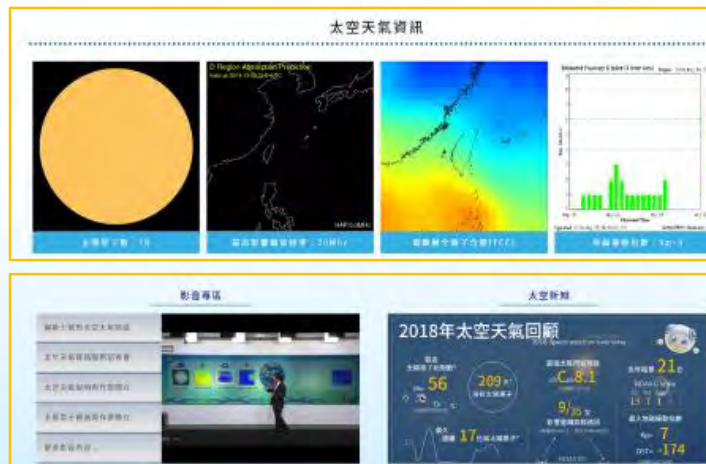


SWx Environment

(Display the latest numbers of observations and index.)



Previous Version



SWx Products

(Display and quick access for the top 4 SWx products of SWOO.)

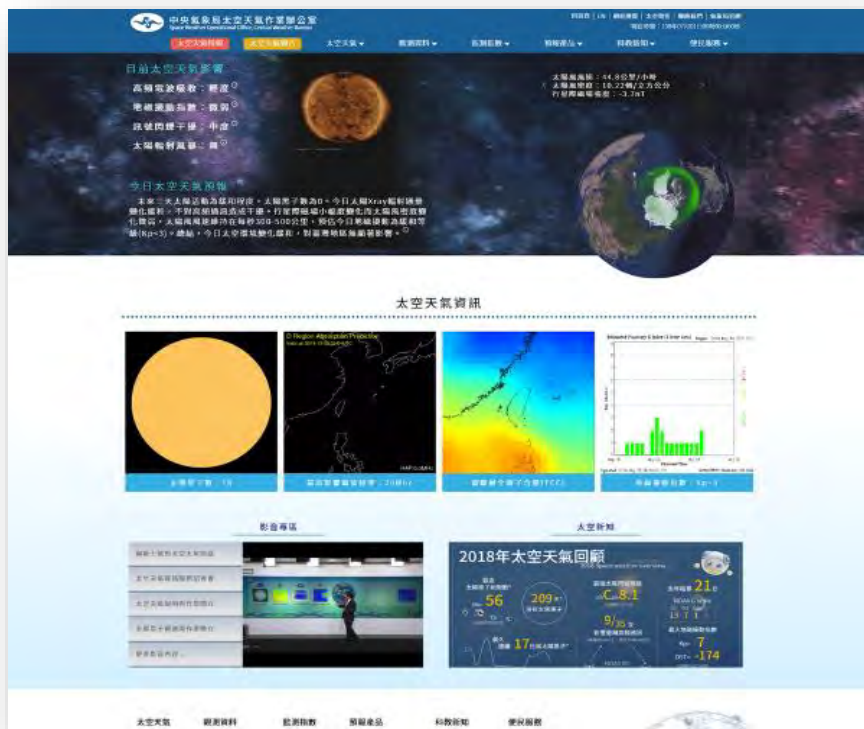
Video and News

(Public video and news for space weather, technique, and outreach education, etc.)

Welcome to Visit SWOO Web!



<https://swoo.cwb.gov.tw/>






<https://tacc.cwb.gov.tw/>



Summary



-  The COVID-19 is controlled in Taiwan, and only made slight influence for most people daily life, but still significant for international economy and collaborations.
-  There is no interruption for space weather operation at CWB in Taiwan, and we continuingly made progress for R2O activities this year.
-  The FORMOSAT-7/COSMIC data was published and SWOO website updated recently, please check out webpage for data and space weather products.



Thanks for your attention !