



ESSL-EUMETSAT Expert Workshop on Use of MTG-IRS L2 Products for Nowcasting 20-22 May 2025

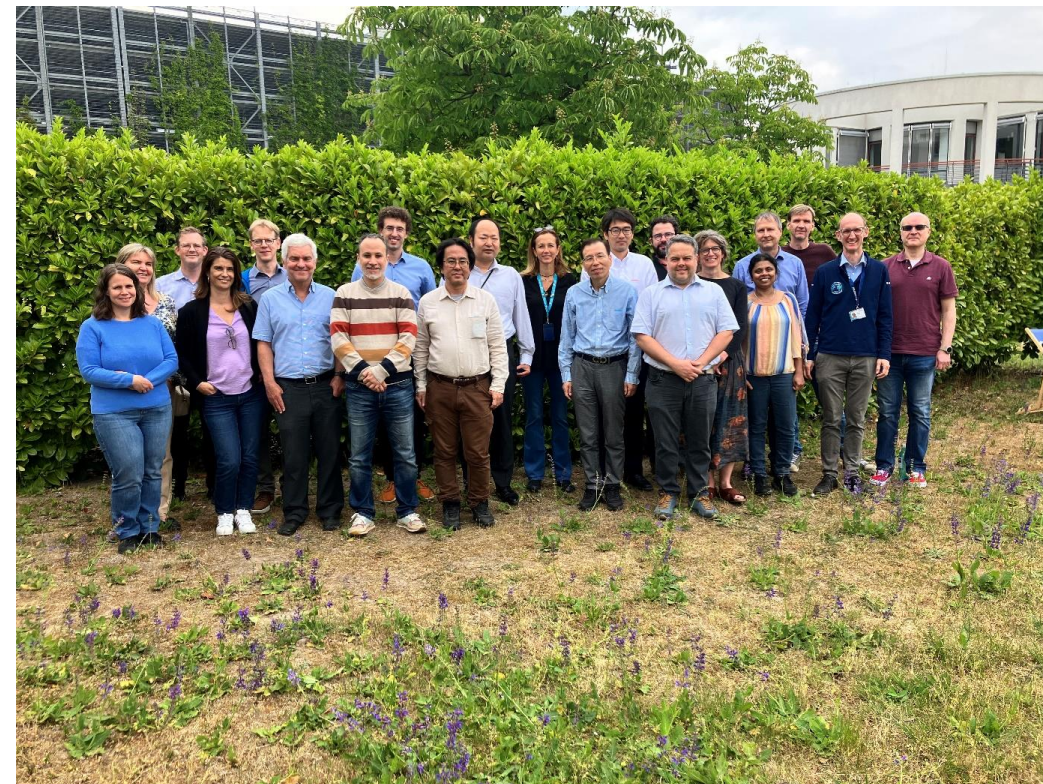
GEO Hyperspectral IR sounder L2 products are “new” to meteorological community

Workshop objectives:

1. Assess state-of-the-art in the use of IR-based sounding products in weather forecasting
2. Explore and document possible use scenarios of meteorological MTG-IRS L2 products in forecasting

Expertise from Europe, North America, China and Japan, along the following lines:

- Instrument experts
- Developers of IR-based L2 products (EUM HQ; NWCSAF; CMA; U.S. NWS; JMA)
- European Severe Storms Laboratory (ESSL) experts
- Trainers
- Users and senior forecasters with experience with IR sounder-derived L2 products





Agenda:

- Current and planned IR sounding satellite missions
- IRS product and validation plans
- Sounding (& wind) products for nowcasting & Use cases
- Training of forecasters on sounding products
- R&D perspectives : integrating sounding products in nowcasting tools

Discussions focussed mainly on:

1. the characteristics of IRS L2 products (physical meaning, Earth scan, format),
2. the representation of uncertainty in sounding products, especially in cloudy conditions,
3. the pros and cons of model-free vs model-blended L2 products,
4. forecasting situations where IRS could bring benefit: pre-convective environment and beyond, such as soundings of the mid-level troposphere above clouds, inversion detection, winter weather,
5. elements of user guidance to foster data uptake, such as the [web-based sounding training tool](#),
6. ways to combine sounding products from IRS with other products: FCI moisture products, imagery and soundings from polar orbiting instruments, GNSS-PW and surface-based observations.



Weather Data Displayer
Powered by the European Weather Cloud

Date & Time (UTC) ?

202106241155

select

yyyy-mm-dd hh:mm

set to current time

Model runs ?

ECMWF 24/00

☒ Model sounding

Model parameters ?

Pressure levels

500

850

Instability and moisture

CAPE lapse r. & moisture

total WV

Large-scale dynamics

Q-vector 300 Q-vector 500

Q-vector 700 Q-vector 850

Wind shear

0-1 shr & CAPE

0-3 shr & CAPE

0-1 km SRH 0-3 km SRH

Surface parameters

Wind gust 10m Precipitation

Precip. 3h Precip. Total

2m Td 2m

10m wind speed 10m wind div&vort

IR-ChaMo

P(hail_cond2cm) P(hail_cond5cm)

P(tor_cond2F1) 3h P(tor_cond5F1) 3h

P(hail2cm) 3h P(hail5cm) 3h

P(tor2F1) 3h P(tor5F1) 3h v2

(lightning) 3h

Other Parameters

IR_01km CAPE EFI

CAPE SHEAR EFI sb_cape

sb_cin sb_ifc

sb_wmax sb500

ort10m

13:35 Thu 24 Jun 2021

The account for user "testbed" will be closed on 30 June 2025. For options to continue your access see the information page

Region: Alps-Tatra

Display Mode ?

☐ Forecast ☐ Verification ☒ Nowcast Analysis

IRS test data:

Surface observations

Storm reports

ESWD reports last 3h

SEVIRI

HRV-Clouds (RSS)

MODIS

VIIRS

Radar Products

GLD Lightning

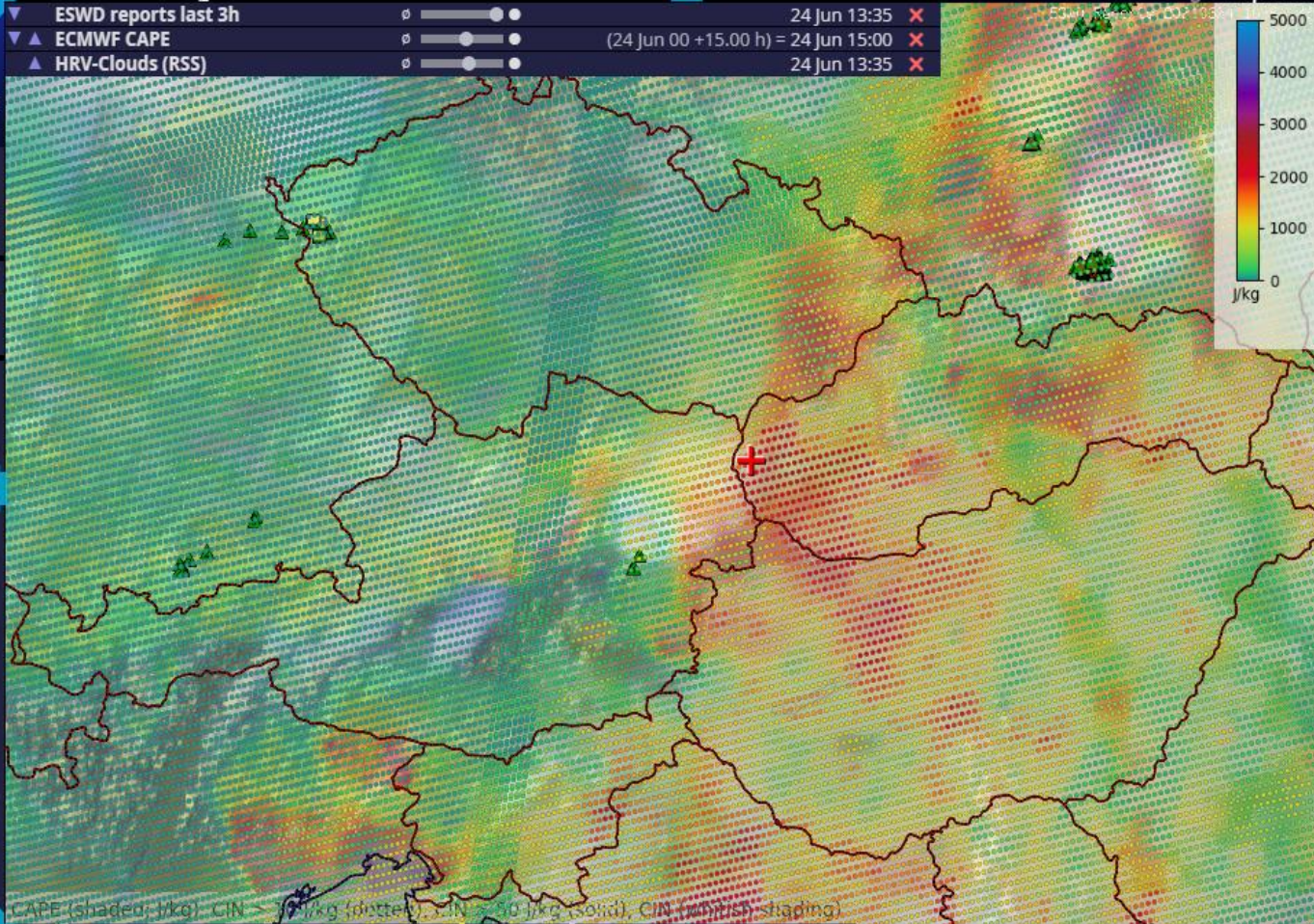
Background Map

Product Evaluation

Forecast Verification

Forecast: Short/medium-range ?

ECMWF - 2021062413 (24 Jun 00 UTC +15.00h)

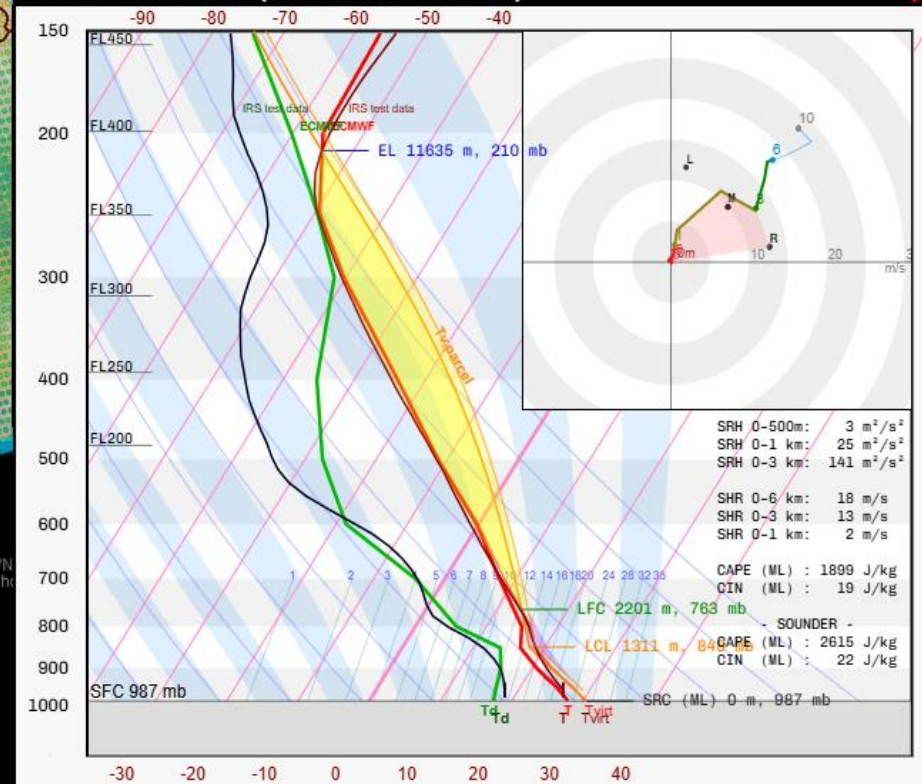


CAPE (shaded, J/kg), CIN (dashed, J/kg), CIN (solid, J/kg), CIN (lightning shading)



The Displayer is based on data and products of: the European Centre for Medium-Range Weather Forecasts (ECMWF), EUMETSAT, EUMETNET, the German Weather Service (DWD), Geosphere Austria, NOAA/NCEP, and ESSL, who retain their respective intellectual property rights in full. You may not re-use any data or graphics unless you have received prior written permission from ESSL and the copyright holder.

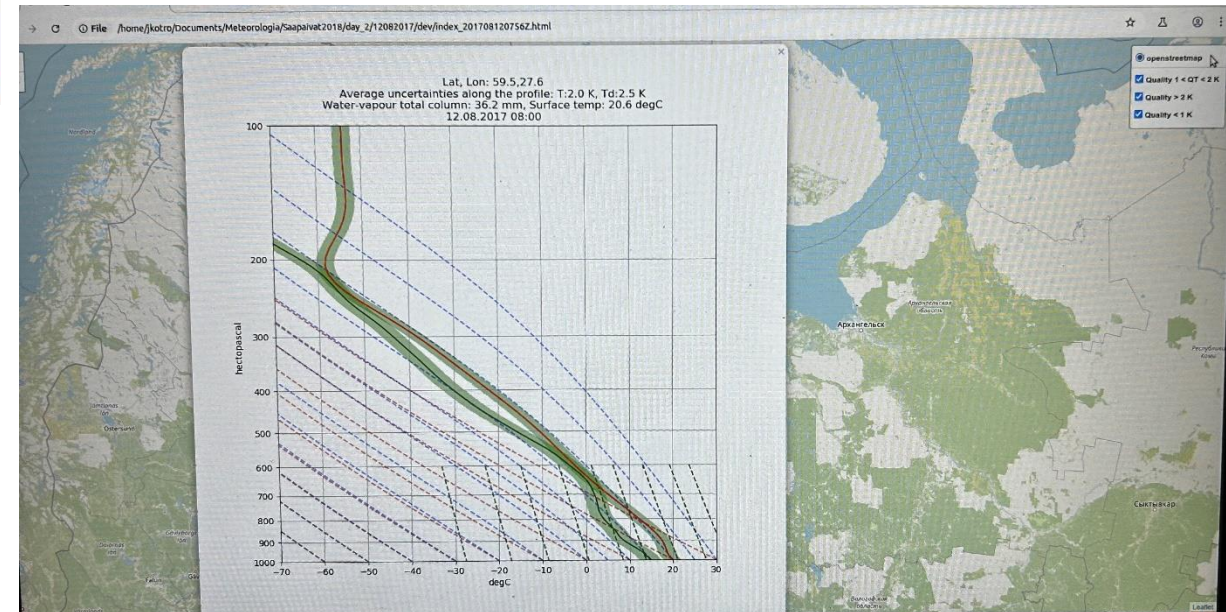
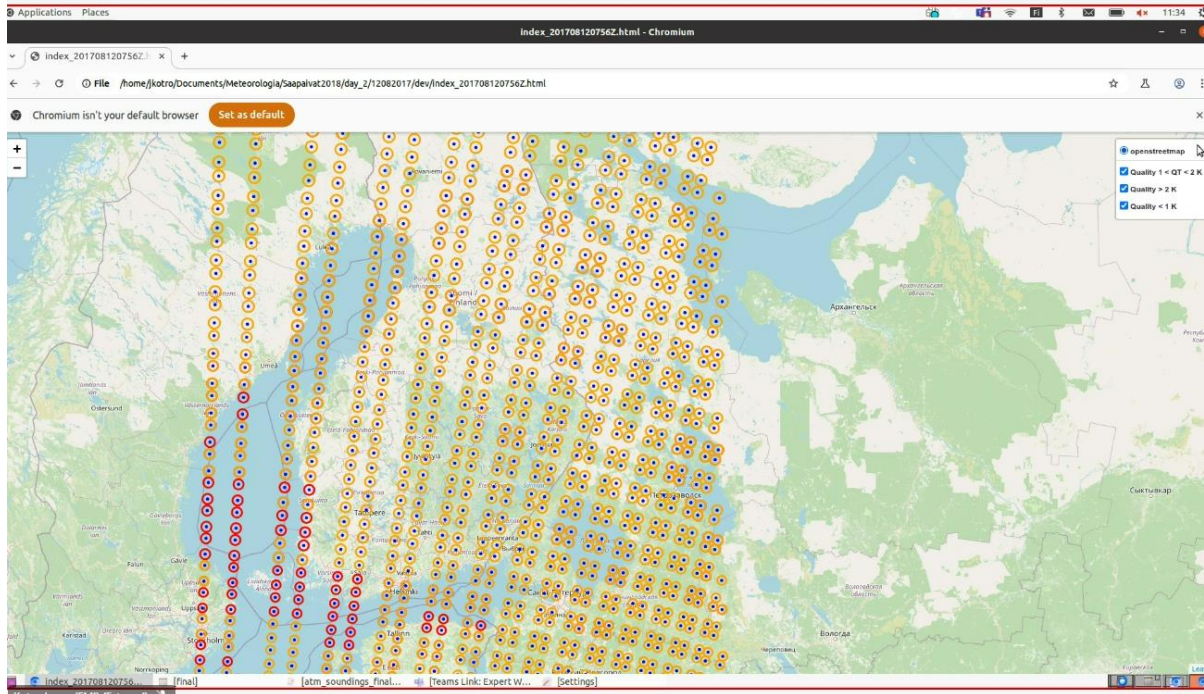
Visualisation of simulated IRS L2 test data for severe storm case:
IRS-derived CAPE vs ECMWF model CAPE + hail reports (green triangles)



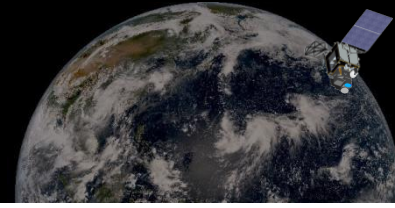


IASI L2 sounding visualisation (FMI)

www.eumetsat.int

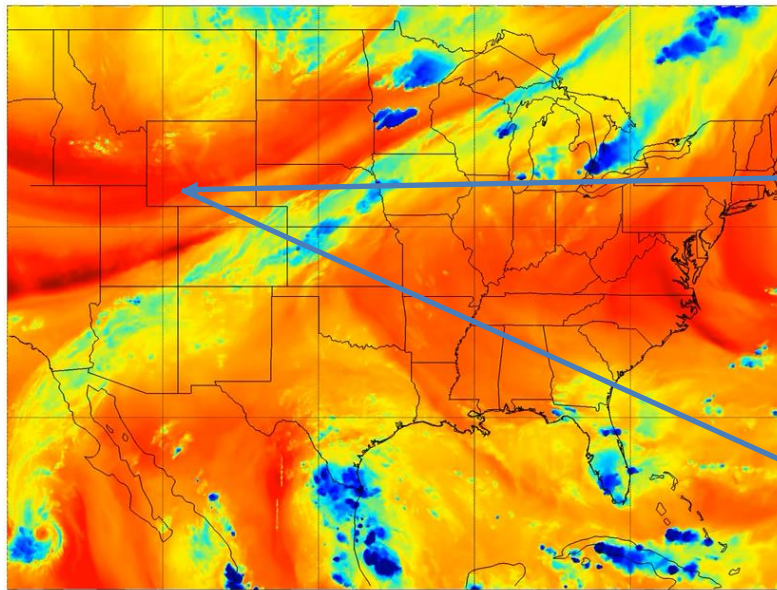


Online-Offline Technique to detect Temperature Inversions



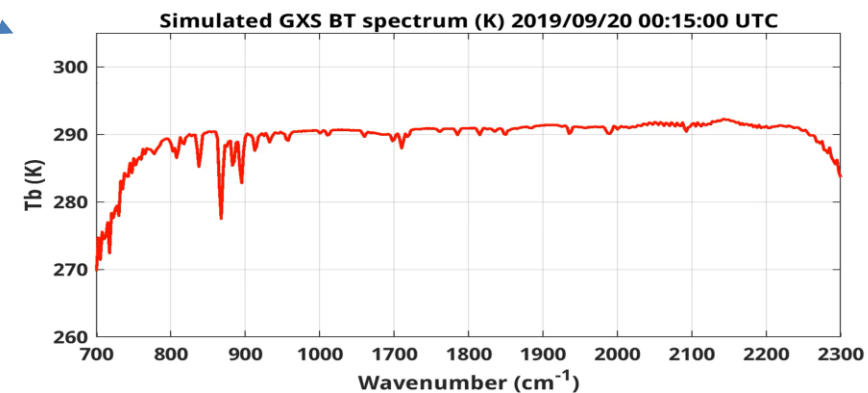
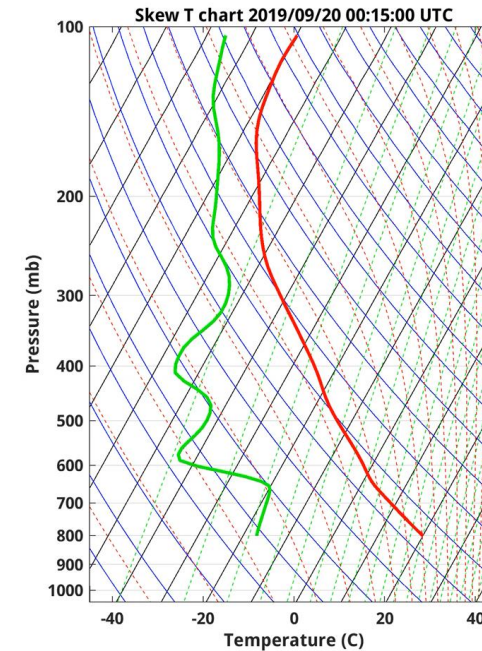
Wyoming Temperature inversion seen by GXS (24 hours)

GXS BT (K) of 1846.25cm^{-1} 2019/09/20 00:15:00 UTC



Fingers up: Temperature inversion
Fingers down: No temperature inversion

animation



Credit:
Yuuki Saeki
(JMA)

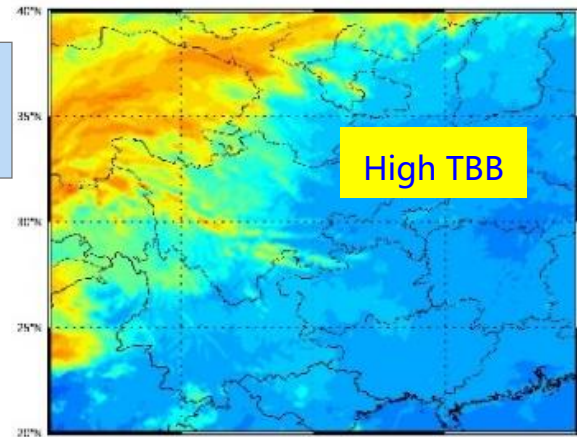
CMA: Applications of Fengyun GIIRS sounding products in nowcasting

GIIRS temperature and moisture profiles

Convective storm: atmospheric characteristics in the pre-convection environment

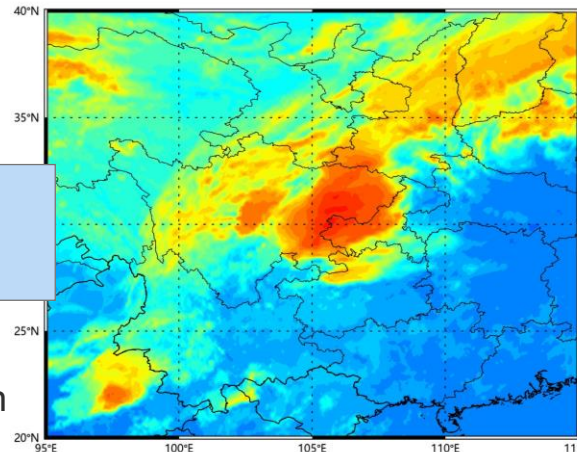
Case study on April 10-11, 2022 (Chengdu Wenjiang Station) Southwest Vortex

On 10 April,
night



TBB

On 11 April,
night



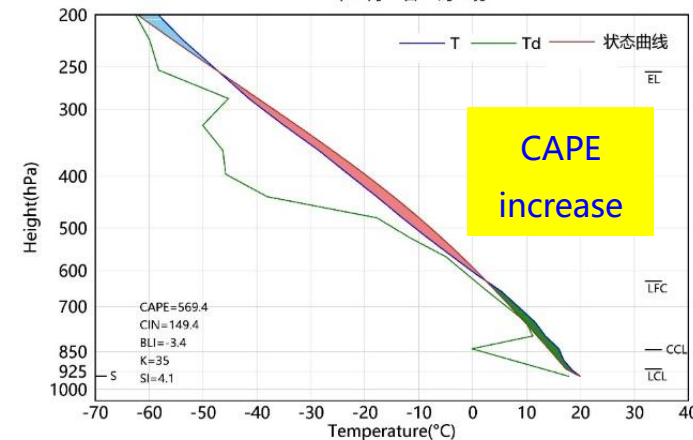
Before convection occurs: high temperature, high humidity, and high energy

After convection occurs: energy is released, and stable stratification occurs

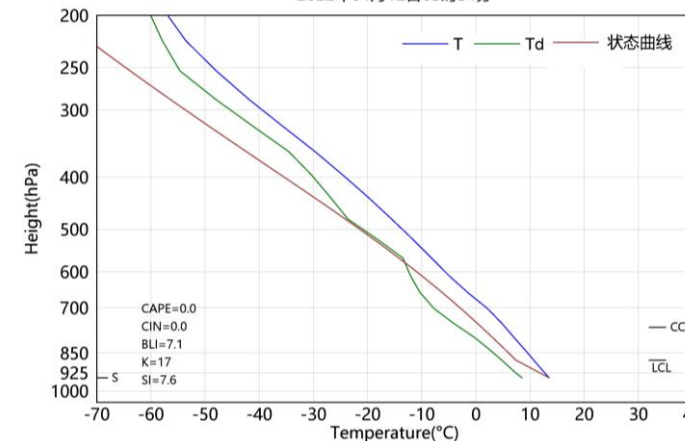
T-lnP

FY-3D 温度对数压力图 温江

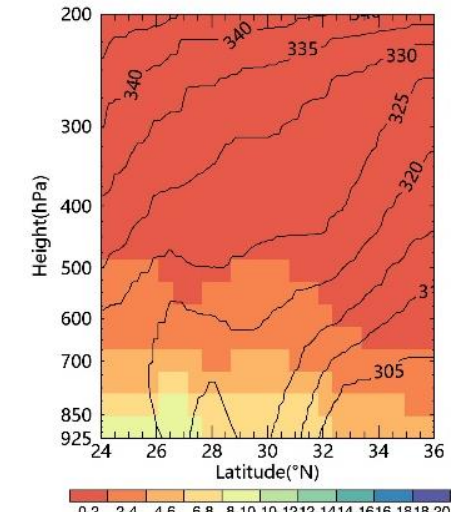
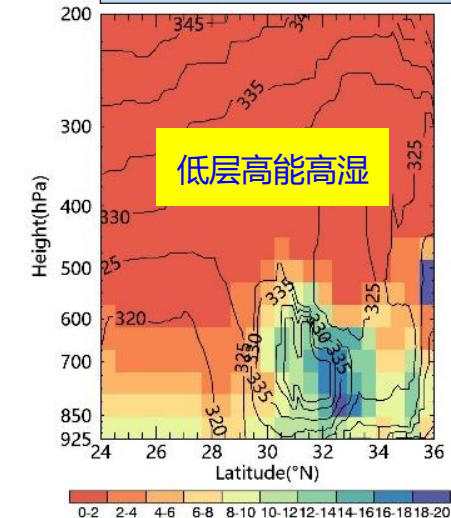
2022年04月11日02时29分



2022年04月12日03时51分

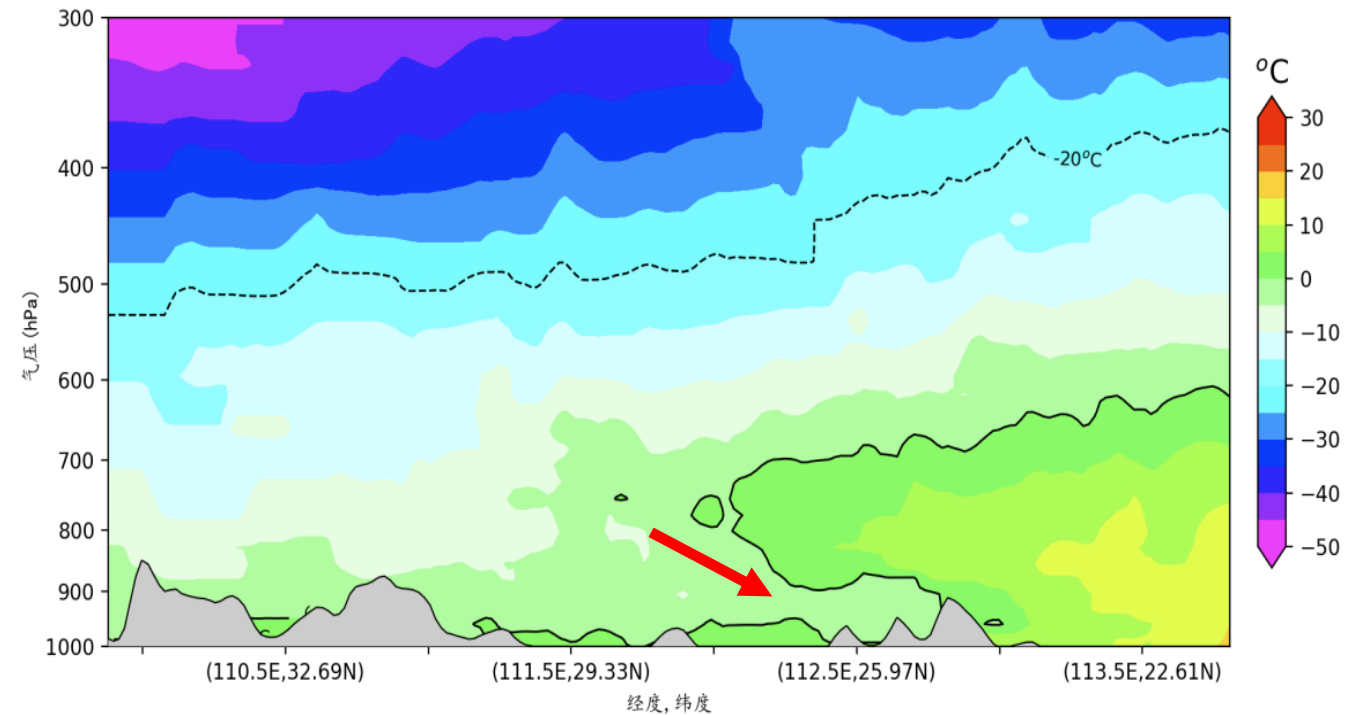
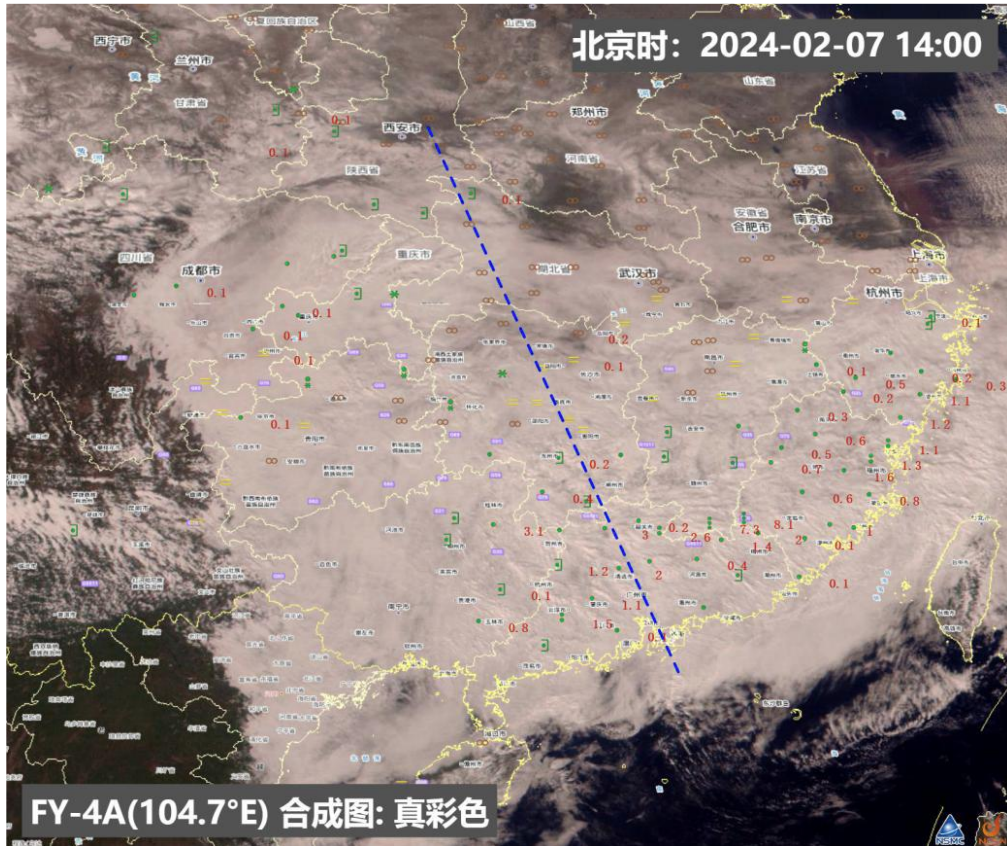


θ_{se} -比湿剖面



CMA Applications of Fengyun GIIRS sounding products in nowcasting

Frozen rain: Meteorological satellite monitors rain, snow and freezing weather in central and eastern China: On February 7, 2024, under the combined influence of cold and warm air, rain, snow and freezing weather continued in central and eastern China.



Temperature inversion: FY-4A GIIRS vertical temperature profile (profile location along the blue dashed line on the left) (10:00 on February 7, 2024)

The inversion layer and the vertical distribution of temperature are indicative of freezing rain

Parameters

- 3 D temperature and humidity information – very promising
- Instability – CAPE, other indices
- Changes/trends in stability and humidity (space and time, 30 min intervals should be good)
- Vertical information 0(100–300m) would be better
 - Also important: mid-level, above-cloud profiles
- Moisture boundaries, moisture advection
- Inversions
- Relation of IRS profiles to radiosonde and NWP profiles
- Wind (<0(10km) needed for nowcasting of convective storms, not 0(100km))
- Turbulence?
- Precipitation type (snow, freezing rain)?
- Theta-E?
- Other?

Comments

- Areas without radar coverage (sea, remote regions, Africa)
- Case studies
- International dimension important, to facilitate uptake of products
- L2 product validation needs to account for extreme cases – where IRS is expected to make a difference

- A second workshop is planned in a similar configuration end-2026 or early-2027, once early IRS L2 data has started flowing and early investigation has commenced.