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

IRS L2 Meteorological User Preparation Workshop (20-22 May 2025)

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

<u>Workshop objectives:</u>

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:

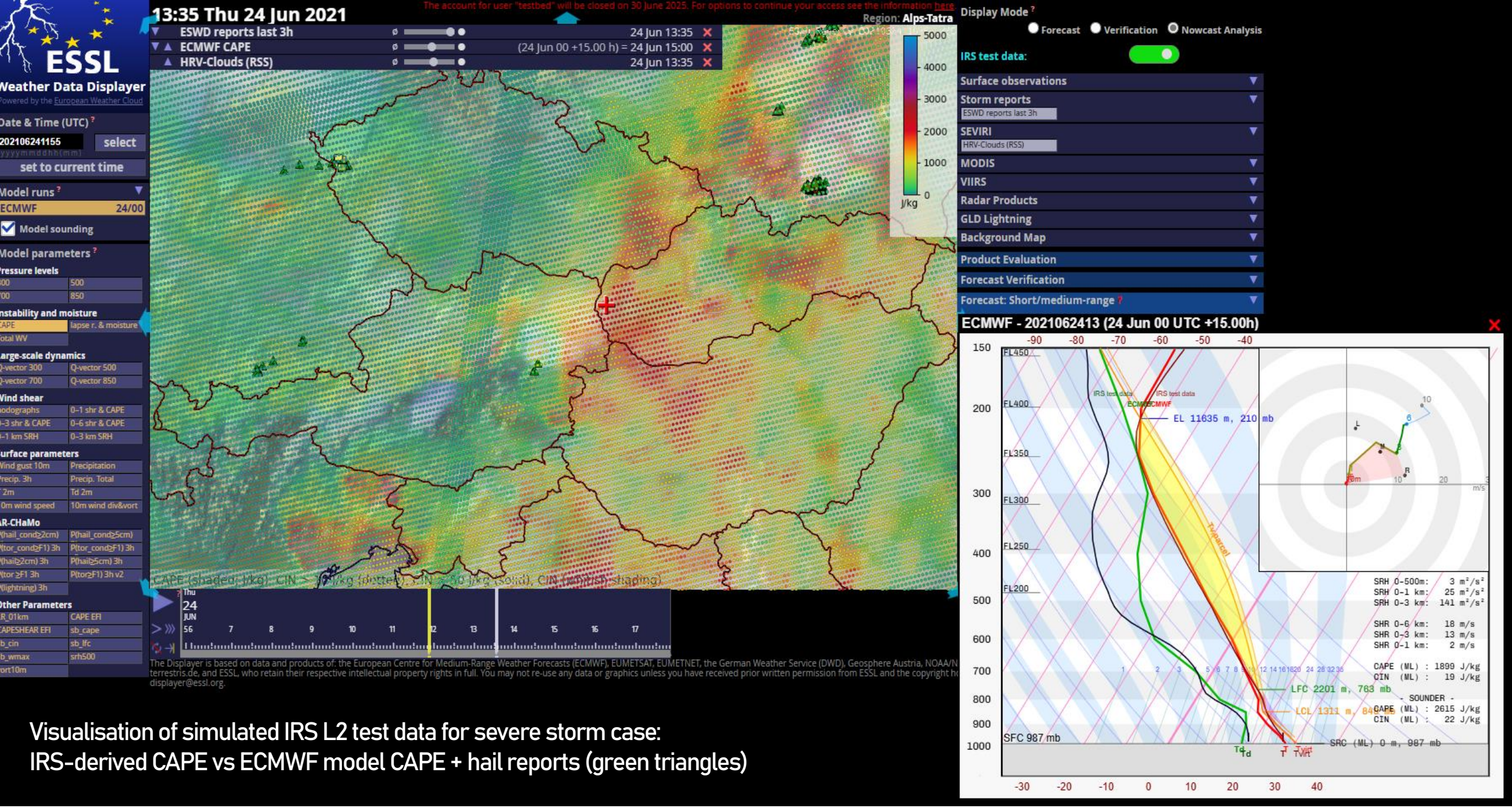
- Instrument experts
- Developers of IR-based L2 products (EUM HQ; NWCSAF; CMA; U.S. NWS; JMA)
- European Severe Storms Laboratory (ESSL) experts
- Trainers
- Users and senior forecasters with experience with IR sounder-derived L2 products

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

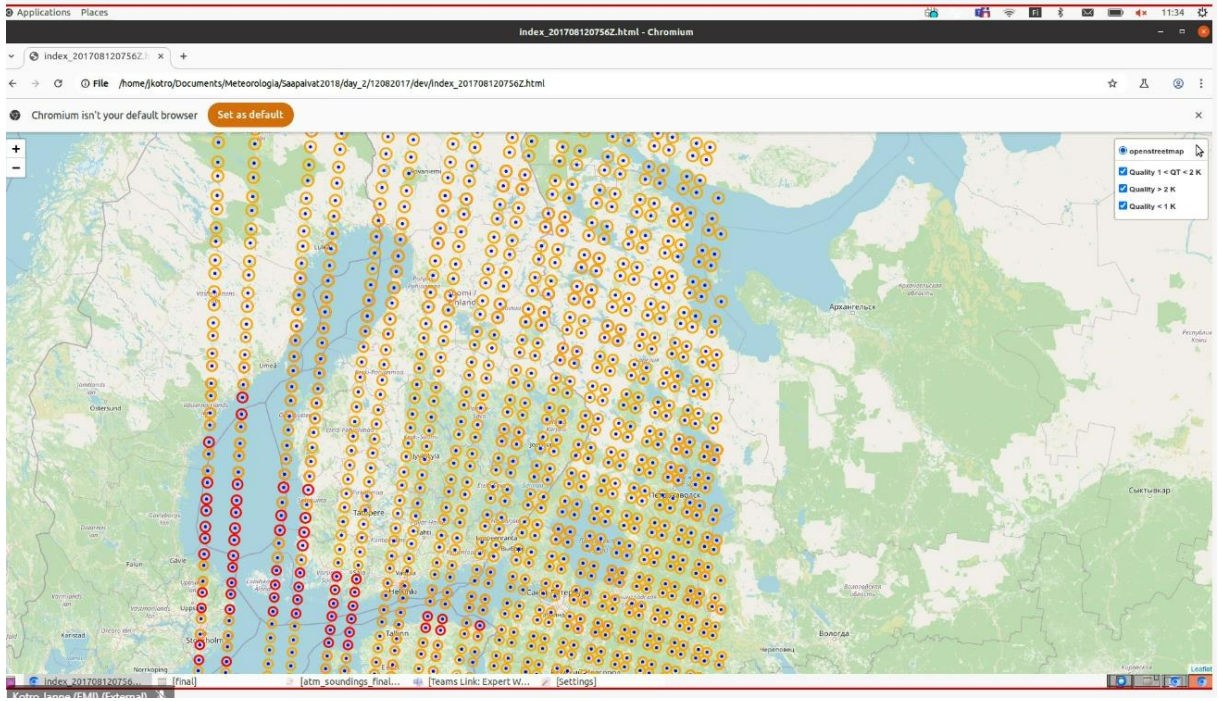
Discussions focussed mainly on:

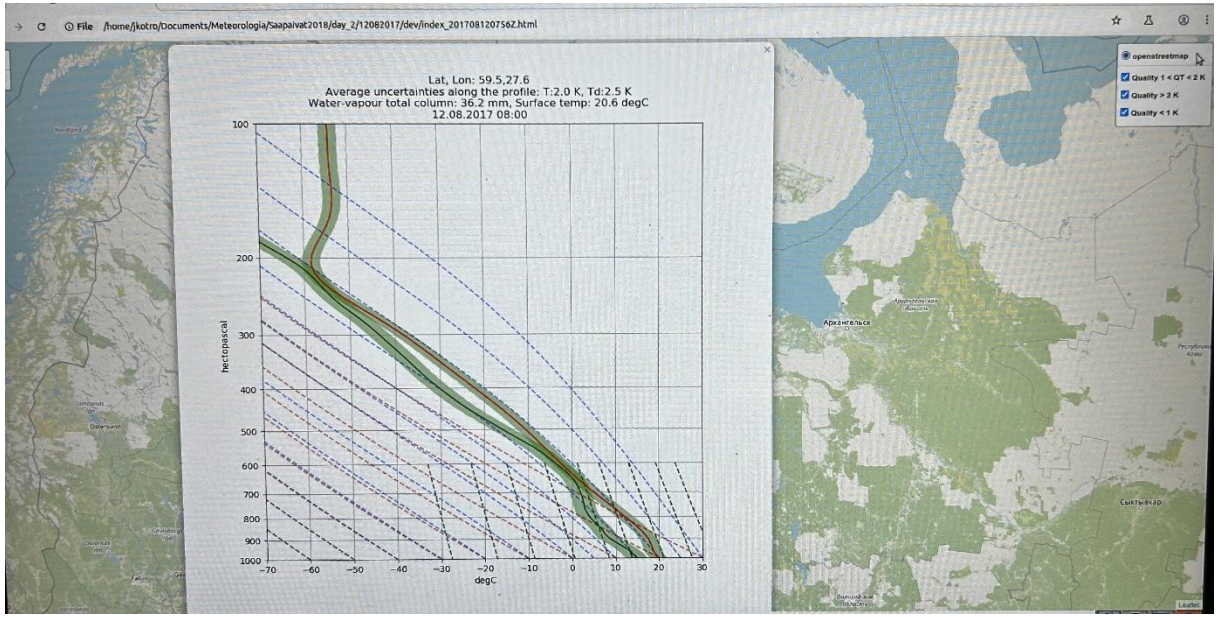
1. the characteristics of IRS L2 products (physical meaning, Earth scan, format),
2. the representation of uncertainty in sounding products, especially in cloudy conditions,
3. the pros and cons of model-free vs model-blended L2 products,
4. forecasting situations where IRS could bring benefit: pre-convective 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.



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

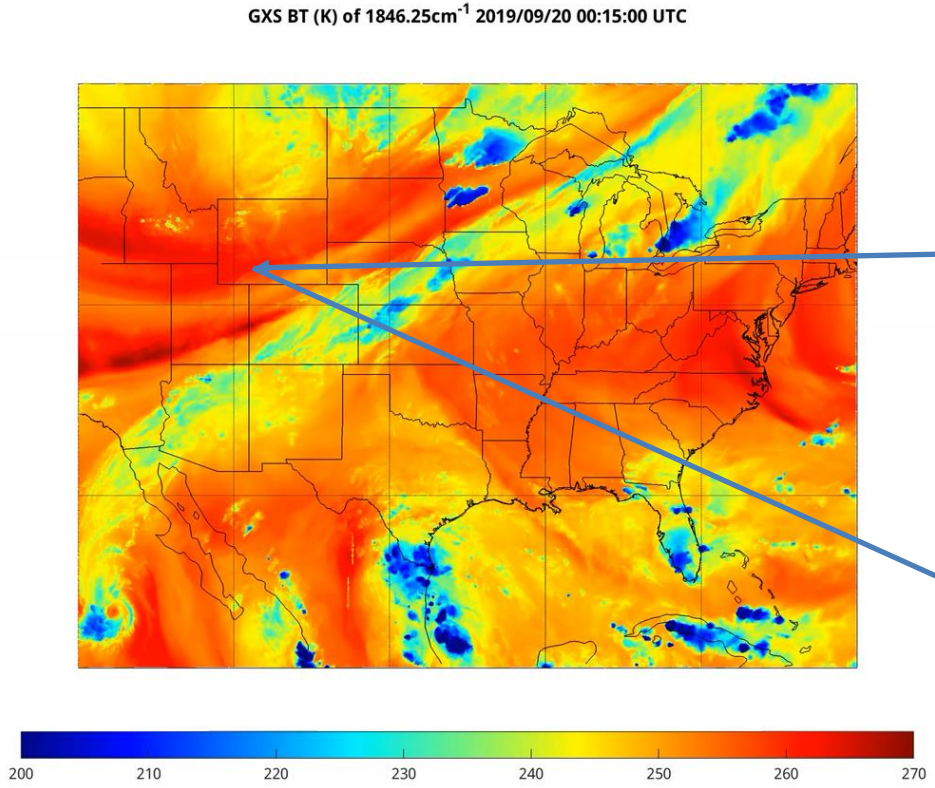
IASI L2 sounding visualisation (FMI)

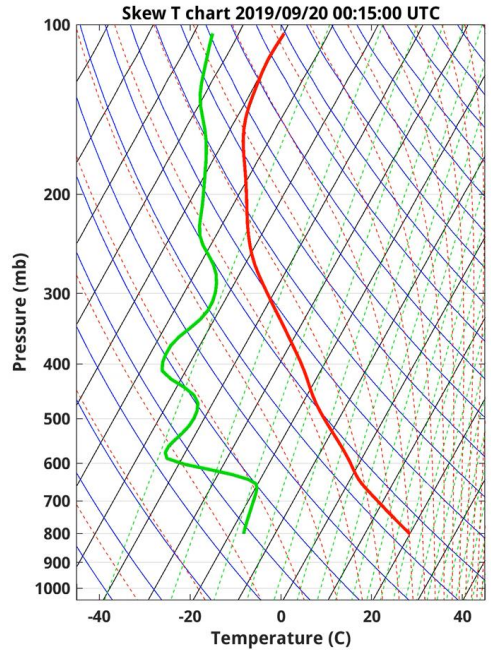


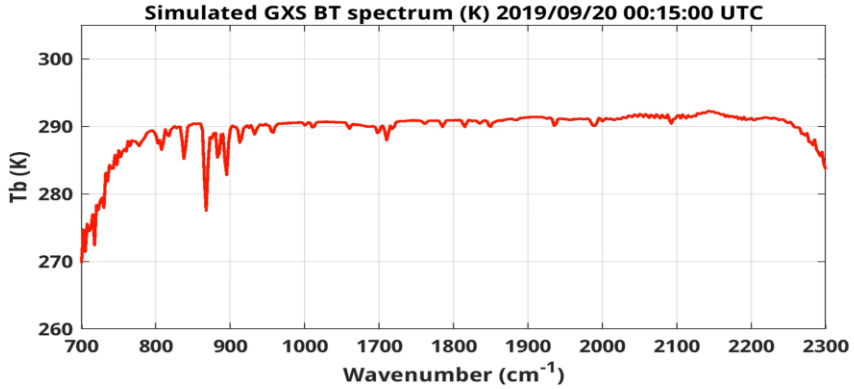


Online-Offline Technique to detect Temperature Inversions

Wyoming Temperature inversion seen by GXS (24 hours)







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

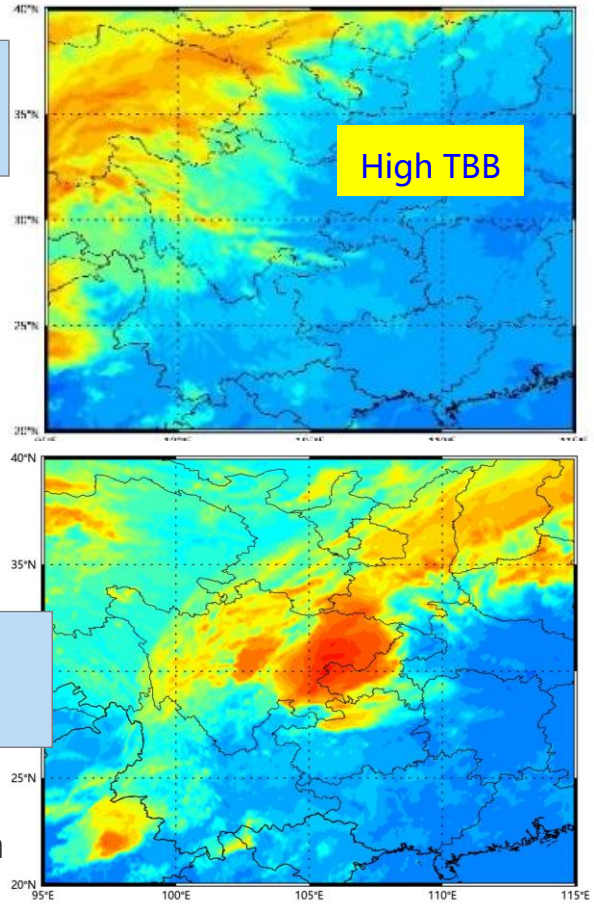
Convective storm: atmospheric characteristics in the pre-convection environment

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

On 10 April, night

TBB

On 11 April, night

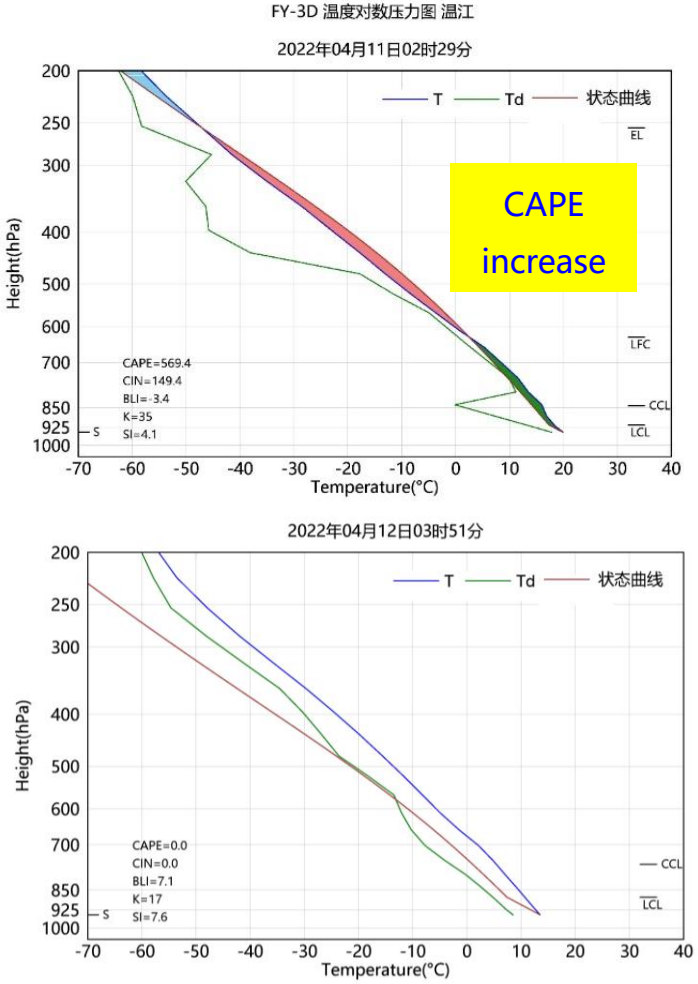


Credit:
Jun Li and Suling Ren (CMA)

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

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

T-lnP



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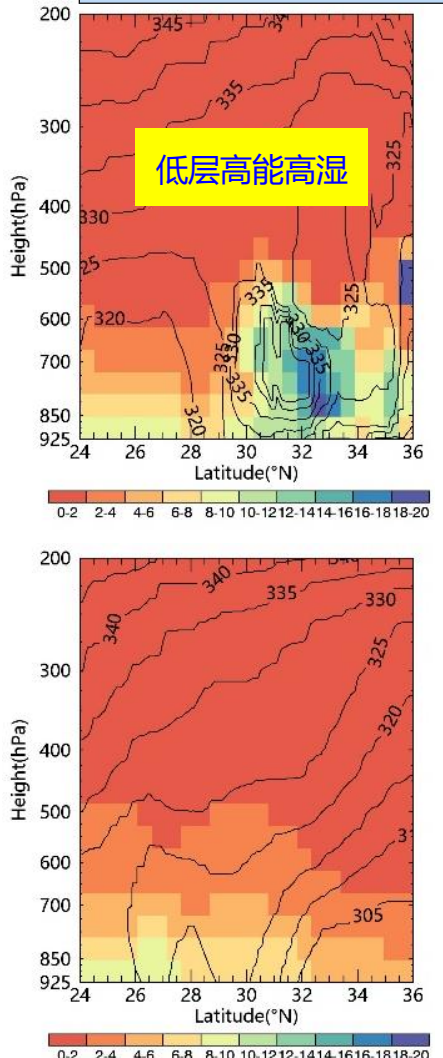
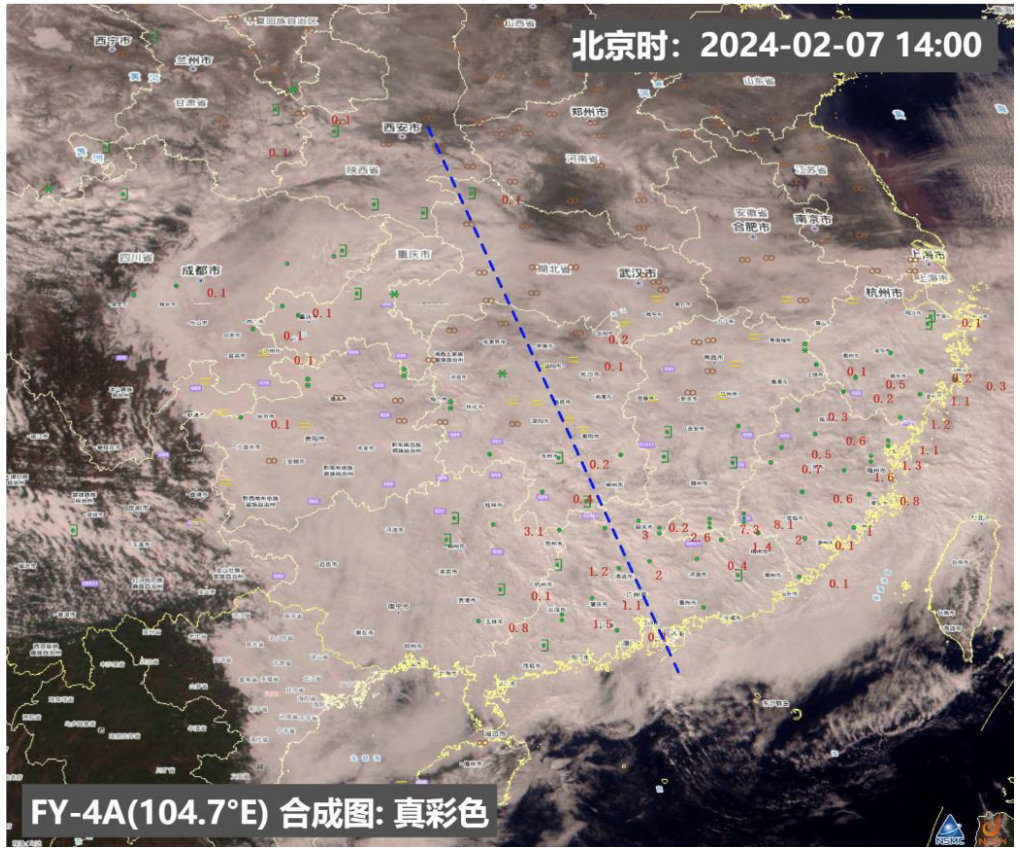
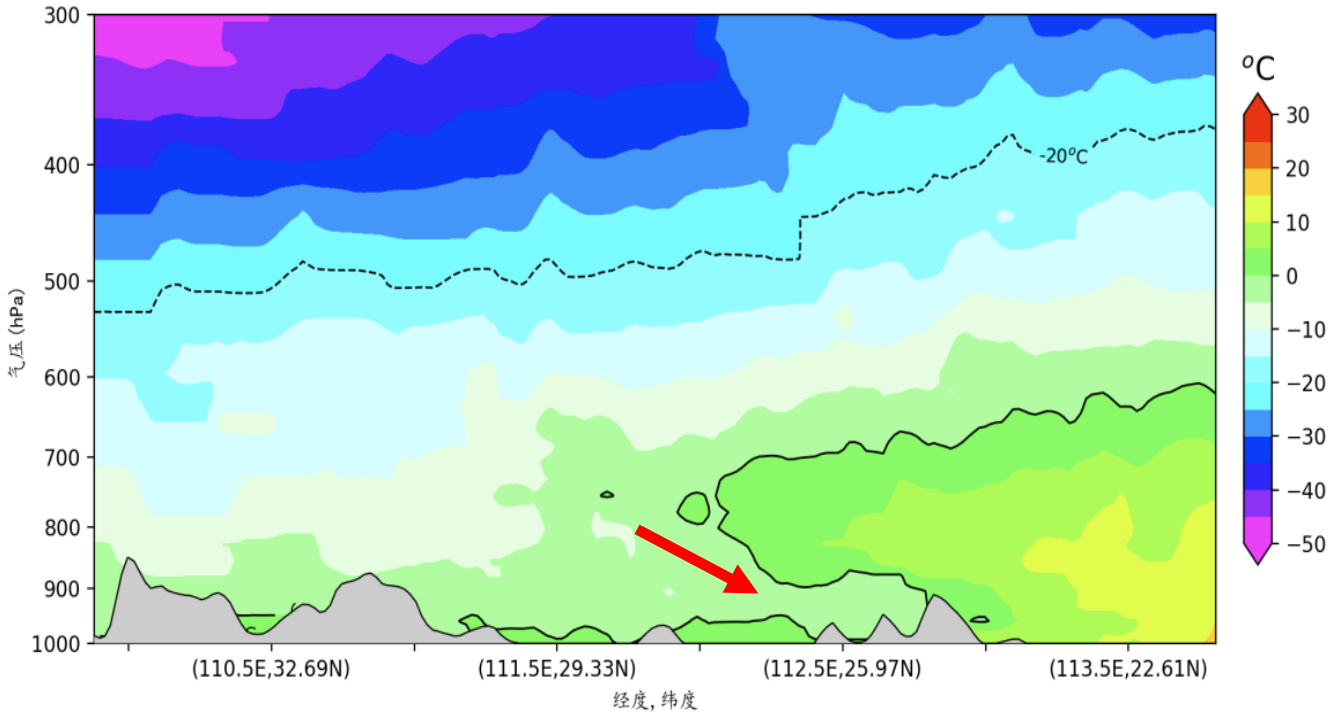


CMA Applications of Fengyun GIIRS sounding products in nowcasting

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

Credit:
Jun Li and Suling Ren
(CMA)

Preliminary conclusions: IRS information valuable for the forecasters

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 O(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 (<O(10km) needed for nowcasting of convective storms, not O(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.