Status of QPE products from Fengyun satellites

Presented to CGMS-48 Working Group II session, agenda item [CGMS-48-CMA-WP-08]

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Outline

1. Introduction
2. FY-3D Microwave Rainfall Rate (MRR) product
3. FY-4A infrared QPE product
4. Applications

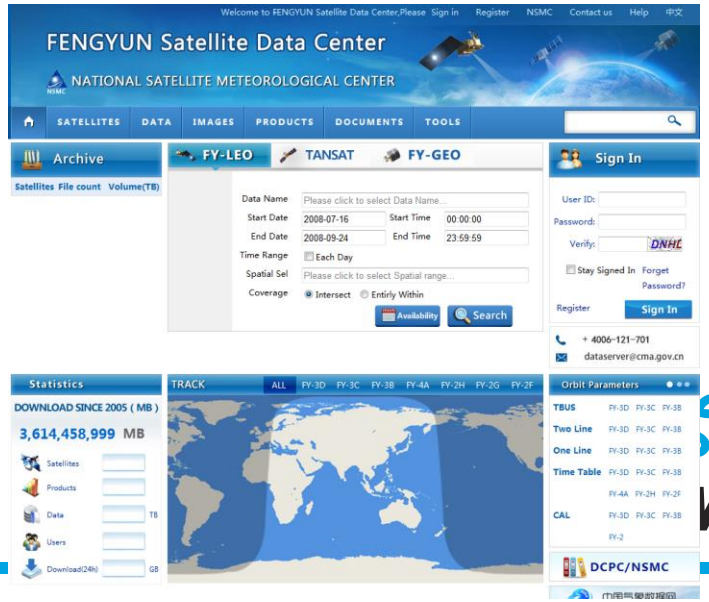
1. Introduction

Associated sensors onboard FY-3 and FY-4 satellites

Sensor	Satellite	Starting date*	Ending date*	Contact email
MWRI (MicroWave Radiation Imager)	FY-3B	2011.11.07	2019.08.19	Xiaoqing Li lixq@cma.cn
	FY-3C	2013.10.17	2020.02.04	
	FY-3D	2019.05.09		
AGRI (Advanced Geostationary Radiation Imager)	FY-4A	2018.03.12		Ran You youran@cma.cn

**the date means the release date of product*

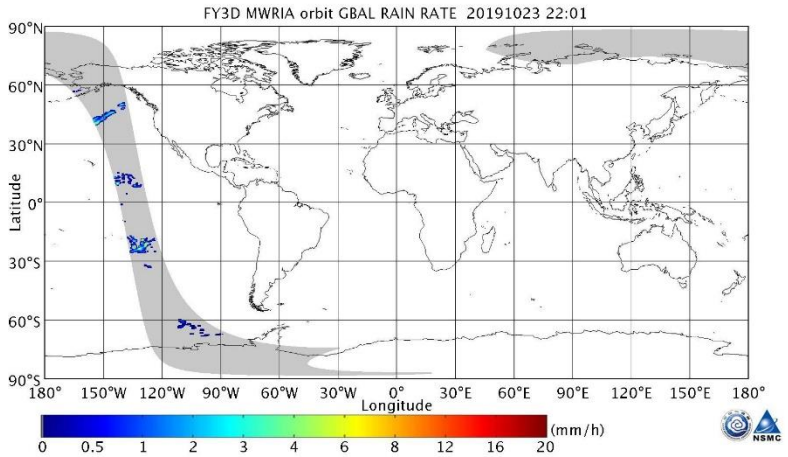
Data website *http://data.nsmc.org.cn/*

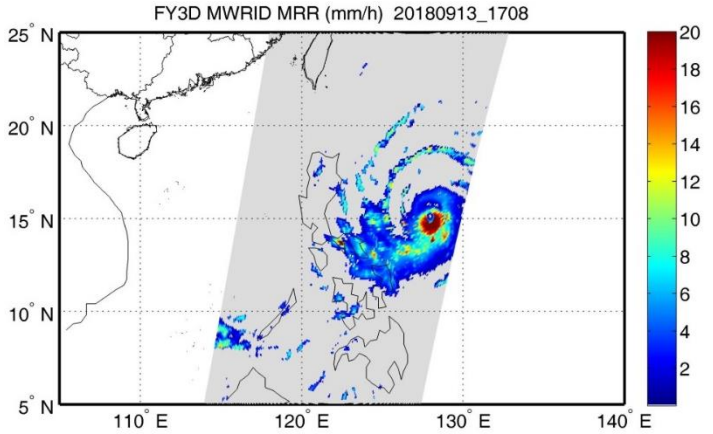


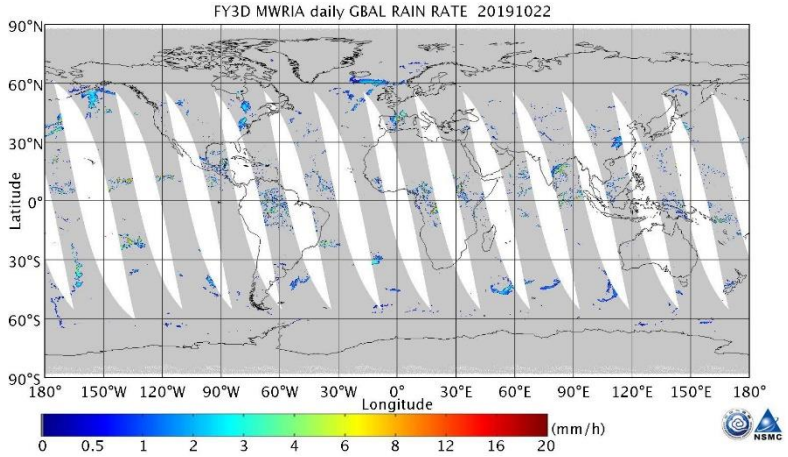
2. FY-3D Microwave Rainfall Rate (MRR) product

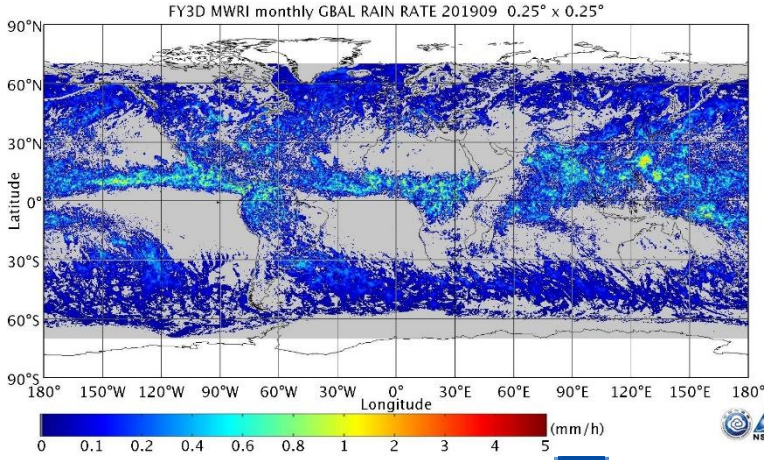
- Algorithm: A Bayesian approach
  - A priori cloud-radiation database for MWRI
  - Rain screening
  - Estimate rainfall rate based on the deviation of measured TBs from the modeled TBs in the database and the priori probabilities.

- Quick view of FY-3D MRR Products









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Resolution: 0.25°×0.25°

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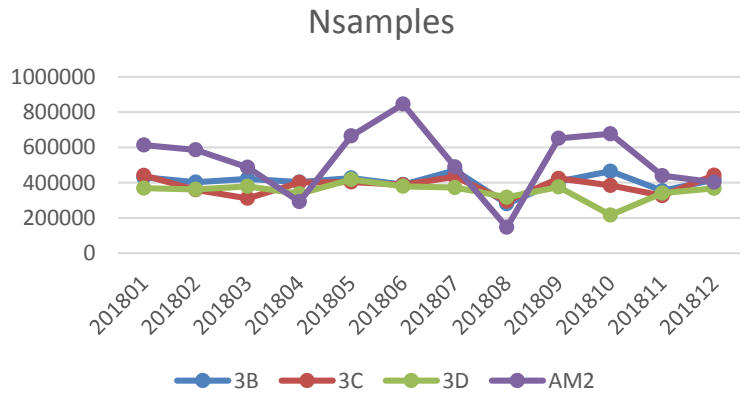
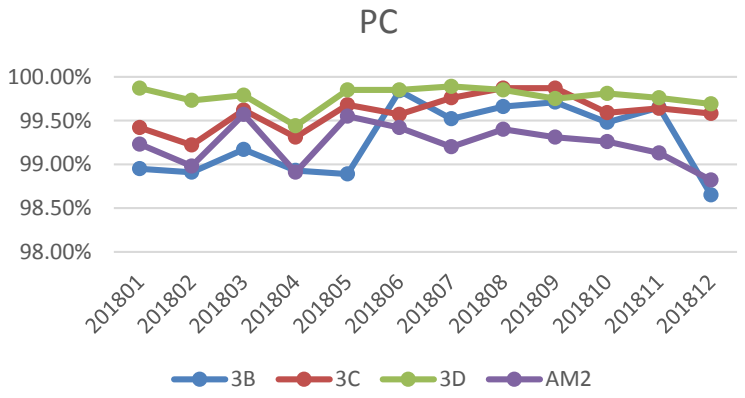
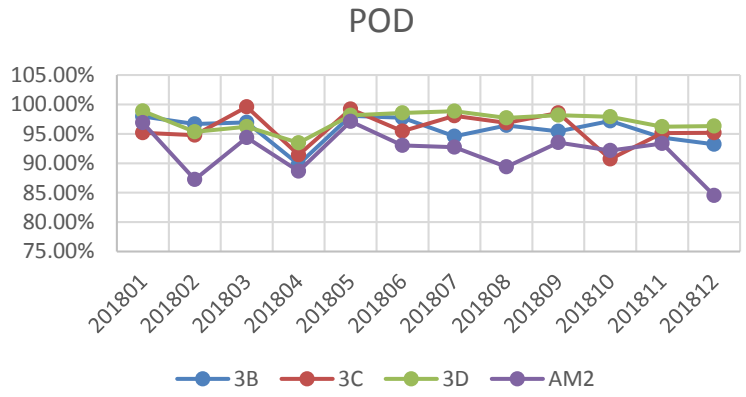
- Quality assessment of FY-3 MRR Products

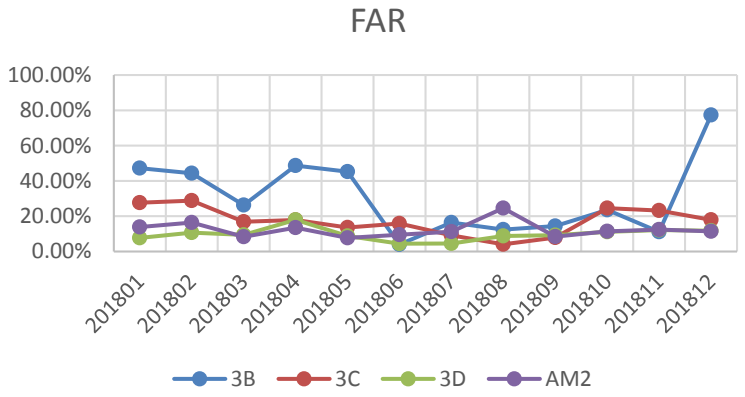
  - Period: 2018.01~2018.12
  - Validated products:
    - Orbital rainfall rate products (Level 2) from FY-3B/3C/3D MWRI, and that from GCOM-W1 AMSR2 as similar satellite product
  - Match-up data:
    - GPM DPR near surface precipitation rate (Level 2)
  - Spatial coverage
    - 65°S~65°N
  - Statistics
    - ***Scores for continuous statistics:***
      - Correlation Coefficient (CC)
      - Relative error-bias: Bias/Mean (%)
      - Relative error-rmse: RMSE/Mean (%)
    - ***Scores for dichotomous statistics:***
      - Percent Correct (PC)
      - Probability Of Detection (POD)
      - False Alarm Rate (FAR)

Scores for dichotomous statistics









1) The matchable samples of AMSR2 is more than others
2) Scores of 3D are superior to others
3) PC and FAR of 3B in cold season are worse

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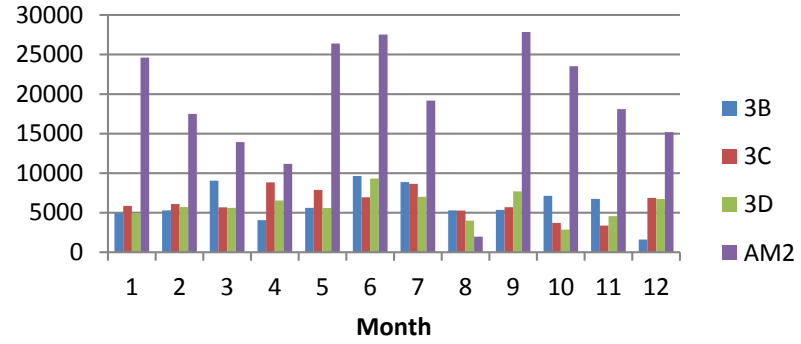
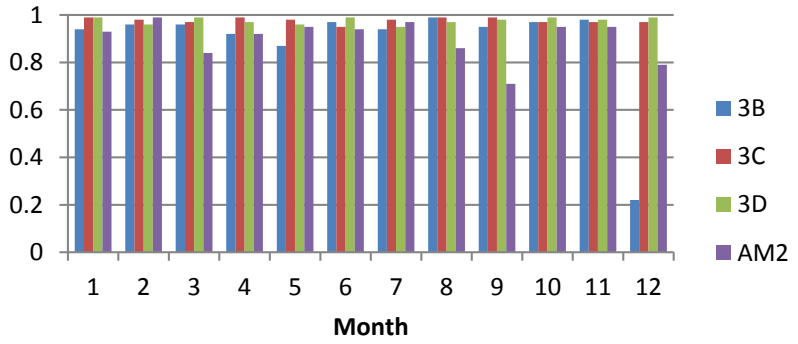
Scores for continuous statistics

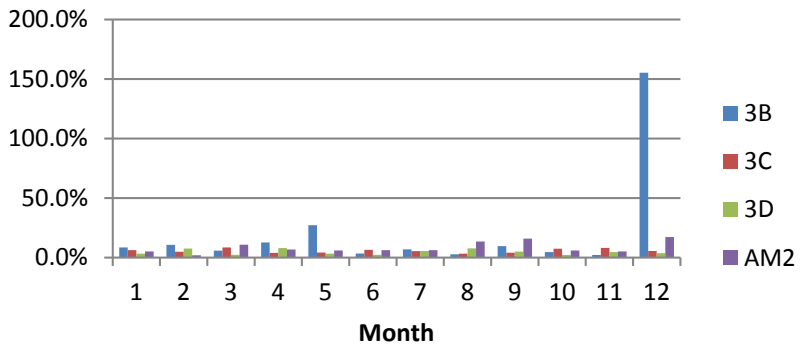
Number of Samples



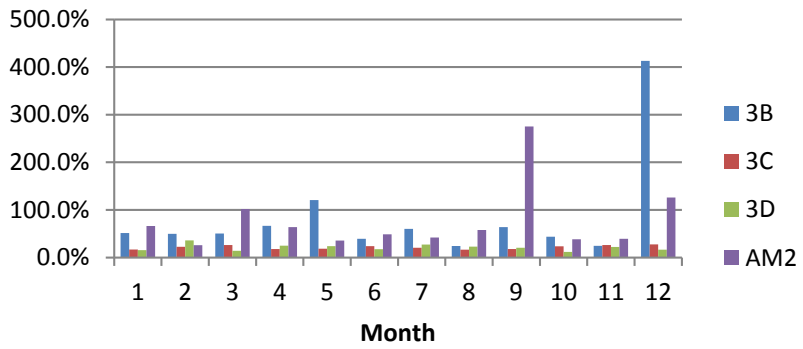
Coefficient



Bias



Rms



1) The number of AMSR2 matchable samples is more than others

2) Scores of 3C MRR and 3D MRR > others

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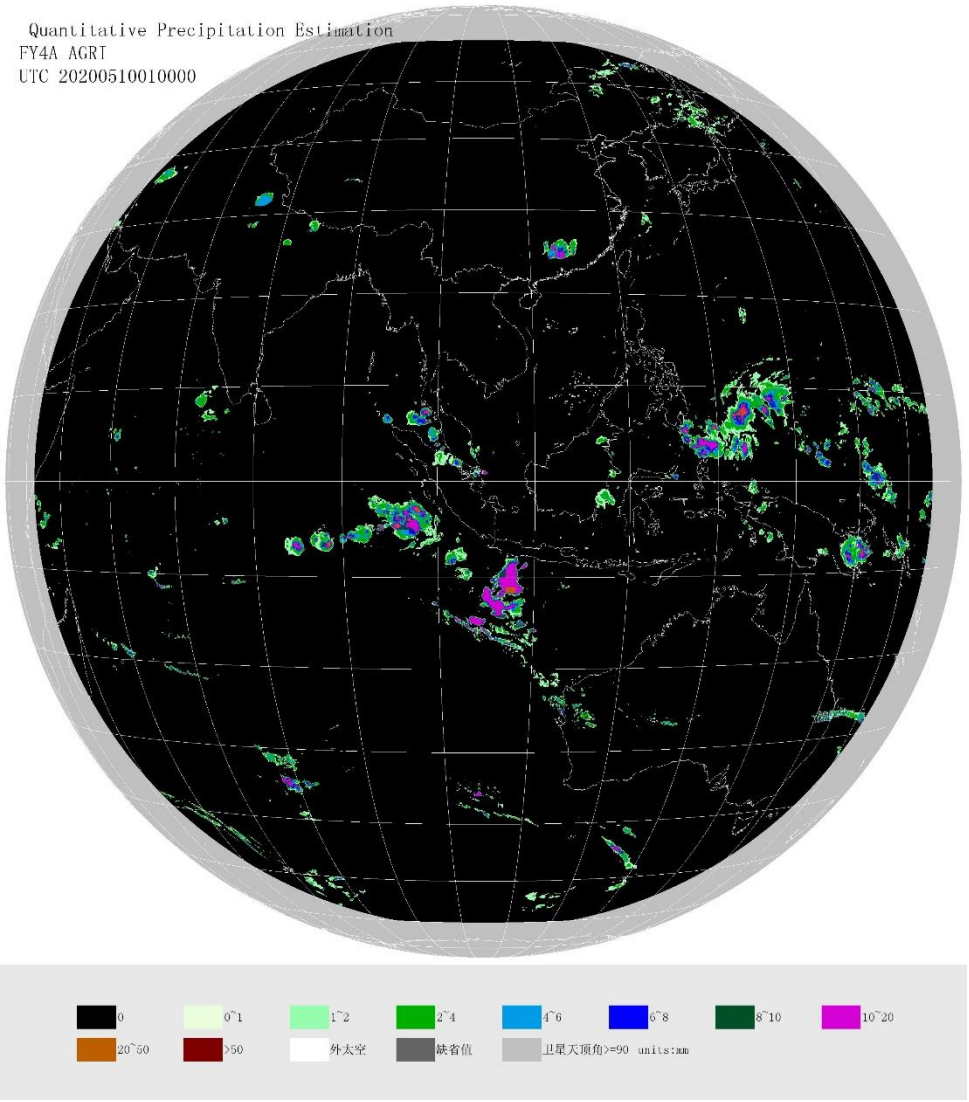
3. FY-4A infrared QPE product

- FY-4A satellite
  - the 2nd generation FengYun Geostationary meteorological satellite, with operational location of 104.7°E
- Algorithm: Statistical estimation method
  - Using matched MW-IR dataset as training dataset. MW rain rate data are from IMERG HQ precipitation dataset. IR brightness temperature is from FY-4A AGRI IR band.
  - LUT is created by matching CDF of infrared TBs and that of MW precipitation data
  - Rain rate estimation is corrected with the rain gauge data.



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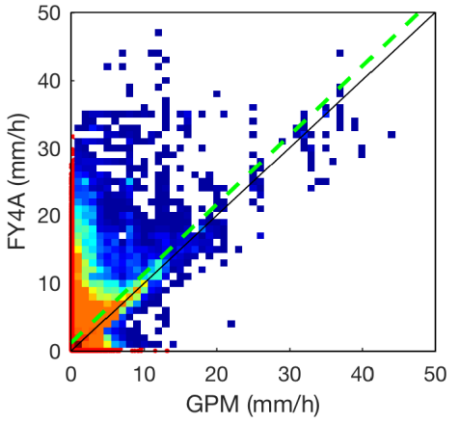
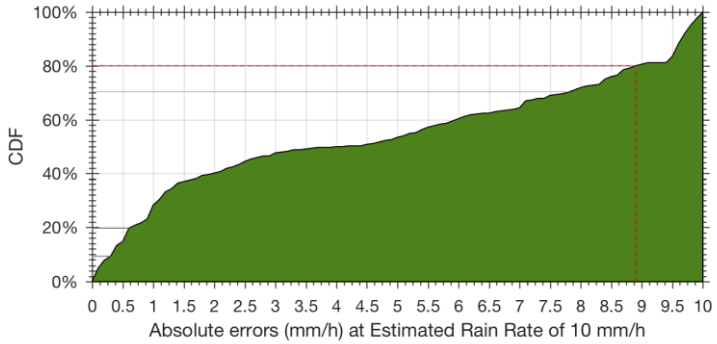
- Quality assessment using GPM DPR rain rate





The test period chosen was the 14th through the 18th of July, 2018.

The Rainfall Rate product displays a significant wet bias, but the best-fit line still corresponds quite well with the 1:1 line (the left figure).

The dashed line indicates that 79% CDF of errors of Rainfall Rate product with rates of 9.5-10.5 mm/h vs. GPM are below 8.9 mm/h (the right figure).

POD	0.8506
FAR	0.4492
ETS	0.4867
bias(fy4a-DPR)	0.85 mm/h
RMS	3.17 mm/h
correlation coefficient	0.67
relative error	71.4 %

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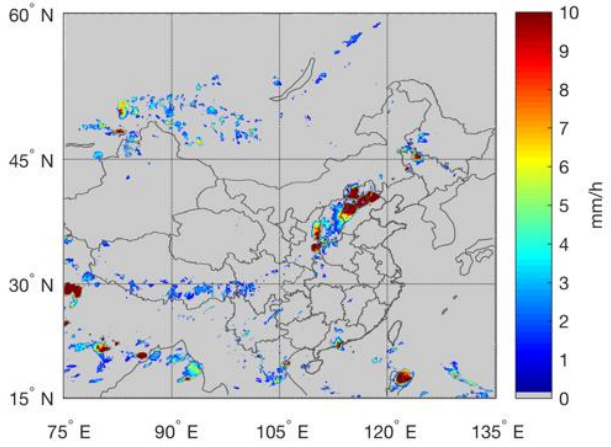
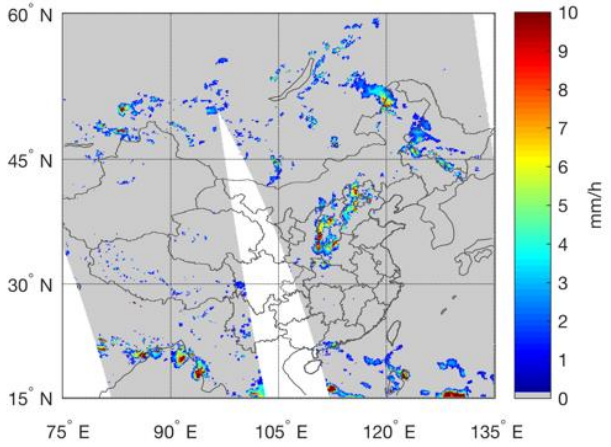
- Case compared with IMERG-HQ precipitation

FY-4A Precipitation



IMERG HQ precipitation

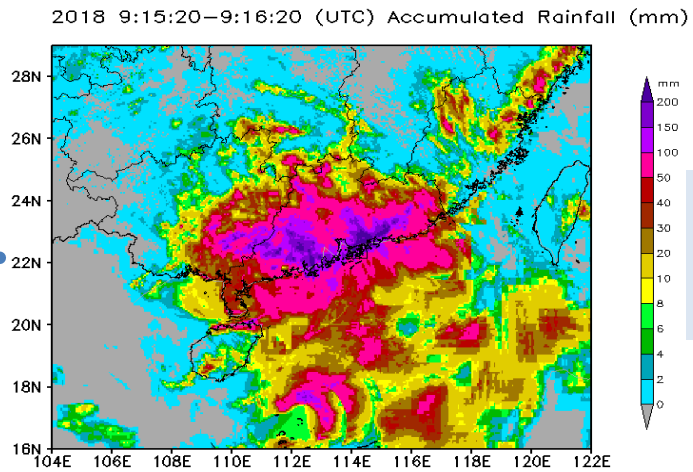


4. Applications

FY precipitation estimation product

Rain gauge （CMA， about 60,000 ）

Radar precipitation estimation product



CMPA (CMA Merge precipitation Analysis)

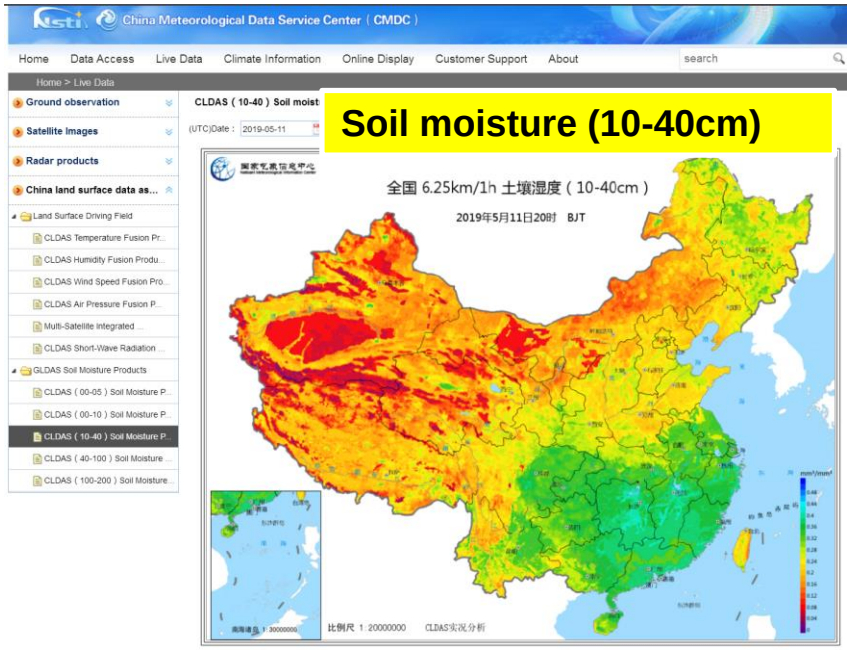
- **Gridded weather forecast** (real time run in NMC/CMA)
- **CMA Land Data Assimilation System(CLDAS),**) (real time run in NMIC/CMA
- **other weather service application**

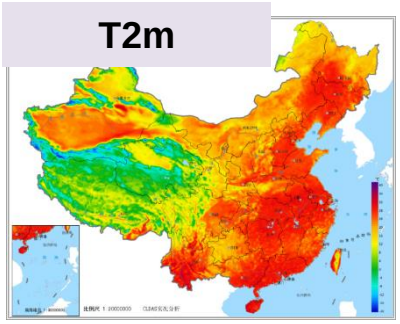
Provided by Shi Chunxiang, NMIC/CMA

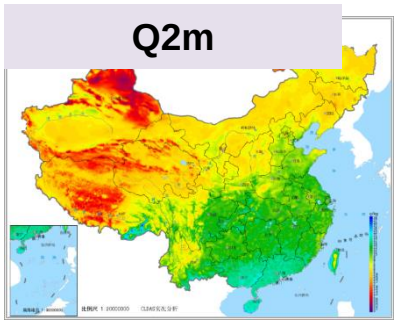
CMA Land Surface Assimilation System(CLDAS)

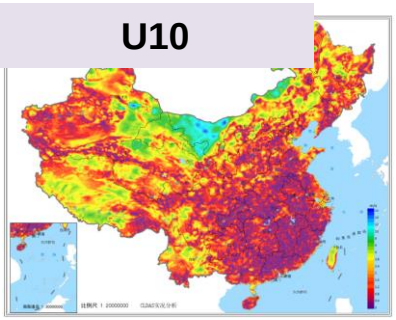
Provided by Shi Chunxiang, NMIC/CMA

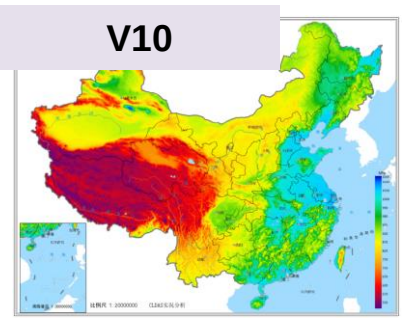
- Resolution： 1h/6.25km
- Spatial coverage: 0-65°N 60-160°E

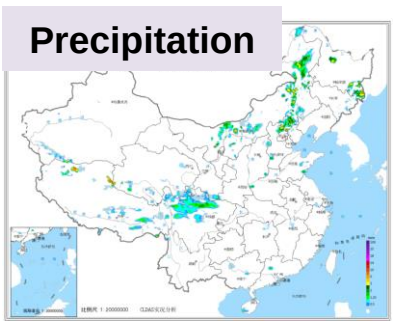


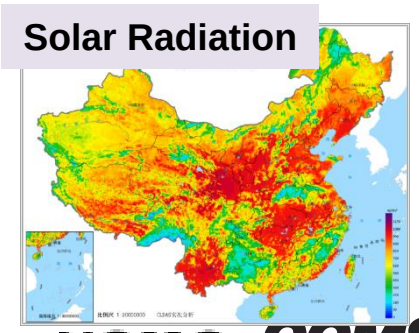












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Thank you for your attention.