CMA 40-year GSI-based Reanalysis (CRA-40)
Plan & Progress

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Present for
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Background

• Initiated from late 2013 by CMA high-level management.
• Newly formed a reanalysis branch at CMA/NMIC in early 2014 and project preparation
• More formally started from 2015 with dedicated project funding for next 4 years.
• Partnership with 8 institutes
  – National Meteorological Information Center (CMA/NMIC, lead institute)
  – National Meteorological Center (CMA/NMC)
  – National Satellite Meteorological Center (CMA/NSMC)
  – National Climate Center (CMA/NCC)
  – Institute of Atmospheric Physics, Chinese Academy of Sciences (CAS/IAP)
  – Beijing Normal University (BNU)
  – Nanjing University of Information Science & Technology (NUIST)
  – US NCAR

• Goal: produce a 40-year (1979-2018) global atmospheric reanalysis at ~30-km resolution by 2019 and then continue production in near real-time.

• Will also produce a 40-year global land-surface reanalysis.
Why another reanalysis?

- Prompt data service capability of NMIC (part of its function like NOAA/NCDC) by collecting more historical observations via reanalysis project

- Improve NCC’s capability for climate monitoring/prediction with more timely reanalysis product

- Foster the optimal assimilation of observations at NMC, especially from Chinese observing networks.
Technical Approach

• CMA “GRAPES” global model is still under development, not yet in operation.

• Current global NWP operation is T639 (based on an old version of IFS model from ECMWF) plus an old GSI-3DVAR (2006 version)

• Proposed strategy is to use operational T639 model, but upgrade DA system to the latest dual-resolution (T639/T213) GSI-hybrid/EnKF
  – Facilitate the assimilation of historical observations

• Land surface component plans to adopt NCAR DART system

• Technical plan may be subject to adjustments during execution of the project.
Project Timeline

Preparatory Stage
- CRA_Obs_Conventional_V0.1
  - surface & radiosonde (2008-2014)
- CRA_Obs_Conventional_V1.0
  - surface & radiosonde (1979-2015)
- CRA_Obs_Sat_V0.1
  - ATOVS & cloud-derived wind (2008-2014)
- CRA_Obs_Sat_V 1.0
  - satellite radiance, cloud-derived wind, sea surface wind (1979-2015)

Implementation Stage
- CRA_Obs_Conventional_V2.0
  - surface (land/sea) & radiosonde & aircraft observations (1979-2018)
- CRA_Obs_Sat_V 2.0
  - More satellite radiance, cloud-derived wind, sea surface wind (1979-2018)

CRA-System Development
- T639+ GSI Hybrid/EnKF

CRA-EXP
- Experimental Results

CRA-System Improvement & Production
- T639+GSI Hybrid/EnKF

CRA-interim
- CRA Interim Products (10-20 yr)

CRA-40
- CRA-40 (1979-2018)
Progress

- Collection of conventional and satellite observations
- Began work in conversion of conventional data collected from various sources into PrepBufr format used in GSI
- Conversion of TOVS/ATOVS Level-1B radiance data into BUFR format used in GSI.
- Development of pre-evaluation system of historical data based on GSI and ERA-Interim reanalysis.
- Upgraded GSI to the community release version V3.3.
Data collection

- AMVs from NOAA, MetOp, Terra & Aqua
- AMVs from GMS & MTSAT
- SST, Seaice, Snow
- GPSRO
- Ocean wind-ERS & QuikSCAT & MetOp
- Radiances from GOES & METEOSAT
- Radiances from GOES & MTSAT
- Radiances from AIRS & IASA
- Radiances from METEOSAT
- Radiance-TOVS/ATOVS, AMSR, ATMS, CrIS
- Field campaigns
- Buoy/Ship
- Aircraft
- Sounding
- SYNOP/Metar

Green: done
Blue: ongoing
Red: to do

Radiosonde data over China from different sources

Now able to merge data from different sources
Conventional data format conversion

- Directly convert ascii format obs into prepbufr format
- Then pass QC steps in NCEP’s prepbufr package
- Made some process, but slow.
### TOVS/ATOVS Level-1B BUFR conversion

Use publically available NCEP/NCO conversion utilities

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**NMIC converted**

![Map of NMIC converted data](image1)

**NCEP GDAS**

![Map of NCEP GDAS data](image2)
Pre-evaluation of historical obs

- Ingest the model-level ERA-Interim reanalysis into GSI to calculate its departure from various observations

- Departure datasets can serve as the basis for QC/blacklisting/bias-correction

Obs in Bufr/PrepBufr → GSI → Departure files
- Upgraded GSI to the latest community version (V3.3).
- Short-period T639/GSI-V3.3 3DVAR experiments using NCEP GDAS Obs.
Plan in 2015

• Continue collection of observations

• Solve issues on prepbufr format conversion and QC procedures

• Produce 1~2 years experimental analysis for 2014-2015 using GSI-3DVAR (on CMA/NMIC IBM Power7 Cluster)

• Evaluate analysis/forecast results using independent data, e.g., 3rd Tibetan plateau field campaign in summer time of 2014 and 2015.