Developing an Experimental Week-2 Storm Track Outlook over North Pacific, North America, and North Atlantic

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1. Background

To support the NWS Alaska and other regional centers for storm track monitoring and forecast products, a suite of week-2 storm track forecast products is being developed at CPC based on the dynamical forecast of the NCEP Global Ensemble Forecast System (GEFS). The week-2 outlooks include storm tracks and track density, storm intensity and duration, precipitation, SLP and 10-m wind over North Pacific, North America, and North Atlantic, derived from the GEFS week-2 forecasts for both total and anomaly fields. The forecast skill is assessed using 17-year (1996–2012) GEFS hindcast data. Verifications for the real-time week-2 forecasts are also provided using the NCEP Climate Forecast System Reanalysis (CFSR). The week-2 storminess outlook is updated on a daily basis.

2. Data and Methods

2.1 Data

- Model forecasts (16-day, 6-hourly):
  - GEFSv11 global ensemble: 12Z, 18Z, 00Z, 06Z; 20x4=80 members
- Model hindcasts (16-day, 6-hourly):
  - GEFSv11 global ensemble: 00Z, once every 4 days; 5 members
  - Hindcast period: 1996–2012 (17 years)
- Observations:
  - CFSR real-time data
  - CFSR archive data: 1996–2012 (17 years)

2.2 Week-2 storm track outlook and CFSR verification

- Storm track detected based on the algorithm developed by Mark Serreze (1995), with a criteria of storm center SLP ≤ 1000 hPa
- Storm track density, storm intensity (center SLP) and duration
- Storm-related weekly total precipitation, weekly mean SLP and 10-m winds

2.3 Evaluation of GEFSv11 week-2 forecast

- Anomaly correlation between GEFSv11 17-year (1996-2012) hindcast and CFSR

3. Results

3.1 GEFSv11 week-2 storminess forecast

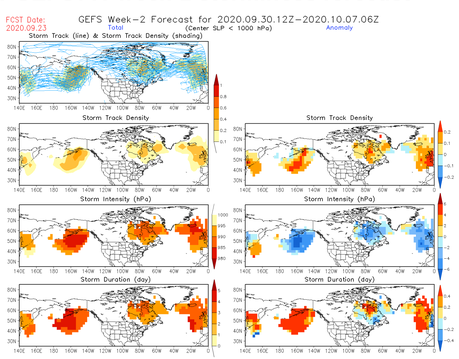

Fig.1. GEFSv11 week-2 forecast for storm tracks, track density, storm intensity and duration for both total (left) and anomaly fields (right). The forecast date is 2020.09.23.

- *Relatively large uncertainty in week-2 storm tracks.*

Fig. 1

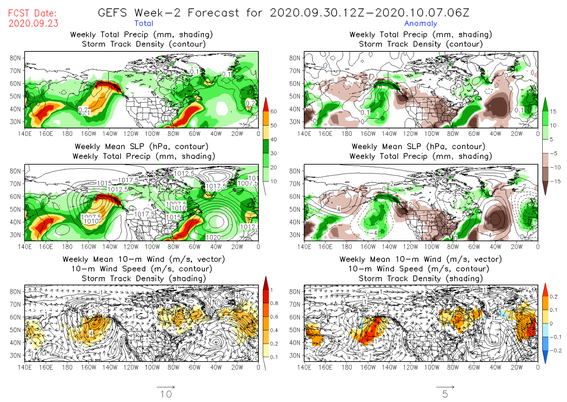

Fig.2. GEFSv11 week-2 forecast for 7-day precipitation, sea-level pressure, 10-m wind vector and 10-m wind speed for both total (left) and anomaly fields (right). The forecast date is 2020.09.23.

- *Regions of large precipitation and low SLP are consistent with the regions of high storm track density.*

Fig. 2

3.2 Verification of GEFSv11 week-2 forecast (16-day lag of real-time forecast)

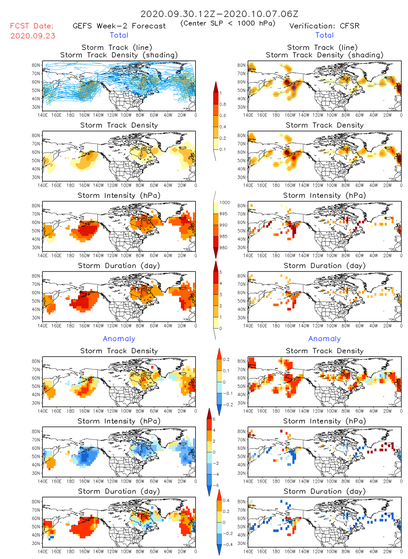

Fig.3. Verification (right) of GEFSv11 week-2 forecast (left) for storm tracks, track density, storm intensity and duration with total fields in top panels and anomaly fields in bottom panels. (Forecast date: 2020.09.23)

- *The verifications indicate certain degree of agreement between the week-2 outlook and CFSR.*

Fig. 3

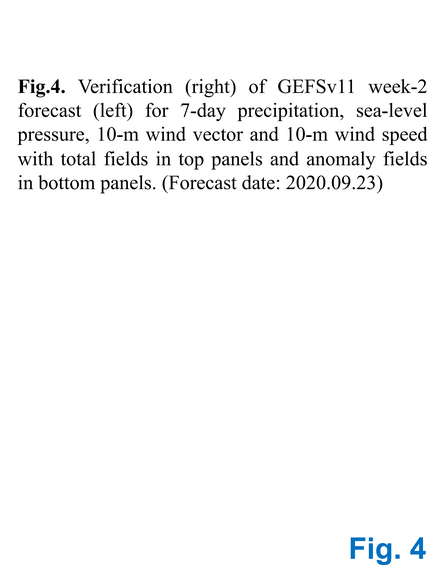

Fig.4. Verification (right) of GEFSv11 week-2 forecast (left) for 7-day precipitation, sea-level pressure, 10-m wind vector and 10-m wind speed with total fields in top panels and anomaly fields in bottom panels. (Forecast date: 2020.09.23)

Fig. 4

3.3 AC skill of GEFSv11 week-2 forecast

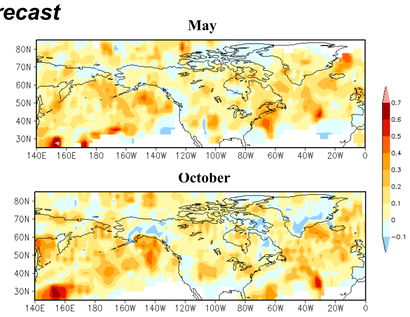

Fig.5. Anomaly correlation (AC) of week-2 storm track density between GEFSv11 hindcast and CFSR over the 17-year (1996–2012) hindcast period for May and October.

- *A certain level of skills is found for week-2 storm track density over the mid- and high-latitudes.*

Fig. 5

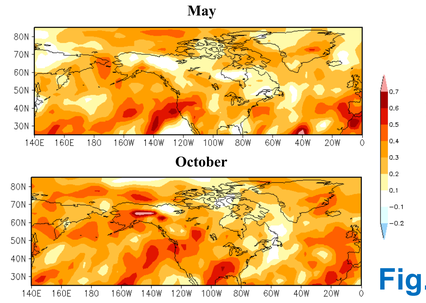

Fig.6. Anomaly correlation of week-2 precipitation between GEFSv11 hindcast and CFSR over the 17-year hindcast period for May and October.

- *Better skills for week-2 precipitation.*

Fig. 6

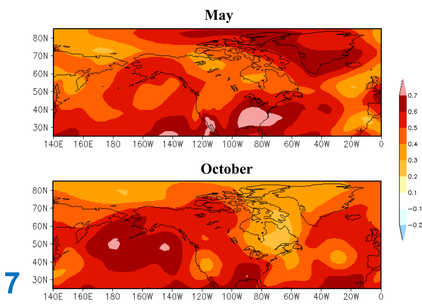

Fig.7. Anomaly correlation of week-2 sea-level pressure between GEFSv11 hindcast and CFSR over the 17-year hindcast period for May and October.

- *High skills for large-scale circulation.*

Fig. 7

4. Summary

- A real-time GEFS-based week-2 storminess outlook was developed at NWS/CPC, with a daily update and the CFSR verification.
- Assessment of week-2 forecast skill shows a certain level of skills for week-2 storm track density over the mid- and high-latitudes and better skills for week-2 precipitation, and the large-scale SLP.
- Starting from September 24, 2020, the real-time week-2 outlooks were upgraded to GEFSv12 with 124 ensemble members. Anomaly fields are derived based on 21-year (1999-2019) climatology from the GEFSv12 hindcast data.
- Probabilistic forecasts based on the distribution of the 124 members are being implemented in real time.
- Real-time Week-2 Storm Track Outlook is available at:

  https://ftp.cpc.ncep.noaa.gov/hwang/YP/week2/