Updated concept and recommended list of core-data products for GPCs LRF/SSF

Dr. Arun Kumar
Principal Scientist, Climate Prediction Center, NWS, USA
Chair, ET-OCPS

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM
World Meteorological Organization
Organisation météorologique mondiale

WMO/GDPFS infrastructure for extended-range forecasts

- Global numerical sub-seasonal forecasts
  - Global Producing Centers Sub-seasonal Forecasts (GPCs-SSF).
  - Lead Center for Sub-seasonal Forecast Multi-model Ensemble (LC-SSFMME).
- Global numerical long-range predictions (i.e., seasonal)
  - Global Producing Centers for Long-range Forecasts (GPCs-LRF).
  - Lead Center for Long-range Forecast Multi-model Ensemble (LC-LRF MME).

Global Producing Centers for Sub-seasonal Forecasts (GPCs-SSF): Mandatory functions

- With at least weekly frequency, generate SSF products with global coverage.
- Make available on WIS a range of mandatory and highly recommended products.
- Produce verification statistics.
- Provide an agreed set of forecast and hindcast variables to LC-SSFMME.

Lead Center for Sub-seasonal Forecast Multi-model Ensemble (LC-SSFMME): Mandatory functions

- Collect an agreed set of forecast data from GPCs-SSF participating in numerical sub-seasonal forecasting.
- Make available on a website appropriate minimum set of products.
- Redistribute digital forecast data for those GPCs-SSF that allow it.
- Maintain an archive of real-time GPC-SSF and multi-model ensemble forecasts.
- Verify the products.

Sub-seasonal forecasts: A summary of user requirements from the survey

- Higher horizontal resolution (0.5x0.5 lat/lon).
- Daily resolution.
- Variables
  - Soil moisture
  - 2-m dew point
  - 850, 200 hpa
    - Moisture
    - u,v
    - Heights
    - T_{min}, T_{max}
- Tropical cyclones.
- SST and circulation indices: ENSO, IOD.
- Additional atmospheric circulation indices: PNA, NAO, AO, AAO.

Sub-seasonal forecasts: Other suggestions

- Free access to data.
- Provision for user driven selection for domain etc.
- Climatology of tercile categories.
- Mailing list for updates.
- Training in the use of seasonal forecasts.

Global Producing Centers for Long-range Forecasts (GPCs-LRF): Mandatory functions

- Generate LRF products with global coverage (once a month).
- Make available on WIS a range of mandatory and highly recommended products.
- Produce verification statistics.
- Provide an agreed set of forecast and hindcast variables to LC-LRFMME.

Lead Center for Long-range Forecast Multi-model Ensemble (LC-LRFMME): Mandatory functions

- Collect an agreed set of forecast data from GPCs-LRF participating in numerical long-range forecasting.
- Make available on a website appropriate minimum set of products.
- Redistribute digital forecast data for those GPCs-LRF that allow it.
- Maintain an archive of real-time GPC-LRF and multi-model ensemble forecasts.
- Verify the products.
- (Make available on a website the Global Seasonal Climate Update (GSCU) and maintain its archive.

Long-range forecasts: A summary of user requirements from the survey

- Higher horizontal resolution (1x1 lat/lon).
- Variables
  - 10-m winds
  - 200 hPa u,v
  - Snow
- Additional graphical products to be provided by the LC-LRFMME
  - SST indices: Benguela Nino, East and West Mediterranean SST anomalies, Indian Ocean Basin Wide Index (IOBW).
  - Atmospheric circulation indices: PNA, NAO, AO, AAO.

Long-range forecasts: Other suggestions

- Easier access to data.
- Better data download interface.
- Instructions on how to download data from the LC-LRFMME.
- Provision for the same climatological period, e.g., 1991-2020, across different GPCs-LRF.
- Training in the use of seasonal forecasts.

Updated concept for GPCs SSF/LRF and recommendations for augmentation in core data products

The concept of the Core data (as part of WMO unified data policy)

- ...maintain a two-tiered approach to the international provision and exchange of Earth system data via the following practice:

- Members shall provide on a free and unrestricted basis the core data that are necessary for the provision of services in support of the protection of life and property and for the well-being of all nations,...
- Members should also provide the recommended data that are required to support Earth system monitoring and prediction activities at the global, regional and national levels and to further assist other Members with the provision of weather, climate, water and related environmental services...

Recommendations for changes in the mandatory variables

- Mandatory products for relevant GPCs and LCs will be treated as the core data products.
- Based on the requirements from the survey, list of products in the current version of the Manual on GDPFS will be augmented.
- Work towards the provision of providing free access to the digital data.

GPCs-SSF

- Augment graphical products

2-m temperature 2-m dewpoint temperature 2-m daily minimum and maximum temperatures Relative humidity at 850 hPa and 200 hPa Wind zonal velocity (u) and meridional velocity (v) at 850 hPa and 200 hPa Height at 850 hPa and 200 hPa Total precipitation	Global	Any forecast range (lead time) between zero and four weeks	Averages over periods (one day-four weeks)	(1) Ensemble mean anomaly (2) Probabilities for tercile forecast categories (where applicable)	Weekly
SST Tropical cyclone activity and genesis	Global oceans				
Soil moisture	Global lands				

GPCs-SSF

- Add SST indices

Niño 1+2	Region off coasts of Peru and Chile	90°W–80°W, 10°S–0°
Niño 3	Eastern/central tropical Pacific	150°W–90°W, 5°S–5°N
Niño 3.4	Central tropical Pacific	170°W–120°W, 5°S–5°N
Niño 4	Western/central tropical Pacific	160°E–150°W, 5°S–5°N
Indian Ocean		
WTIO	Western tropical Indian Ocean	50°E–70°E, 10°S–10°N
SETIO	South-eastern tropical Indian Ocean	90°E–110°E, 10°S–0°
IOD (DMI)	Indian Ocean Dipole (Dipole Mode Index)	WTIO–SETIO

GPCs-SSF

- Add atmospheric indices

Pacific/North American pattern (PNA)
North Atlantic Oscillation (NAO)
Arctic Oscillation (AO)
Antarctic Oscillation (AAO)

LC-SSFMME

(a) Surface (2-m) temperature;
(b) 2-m daily minimum and maximum temperatures;
(c) 2-m dewpoint temperature;
(d) SST;
(e) Total precipitation rate;
(f) MSLP;
(g) 850 hPa temperature;
(h) 850, 500 and 200 hPa geopotential height;
(i) 850 and 200 hPa wind (zonal and meridional);
(j) 850 and 200 hPa relative humidity;
(k) Outgoing long-wave radiation at the top of the atmosphere;
(l) 10 hPa zonal wind;
(m) Tropical cyclone activity and genesis;
(n) Soil moisture.

WMO OMM

GPCs-LRF

- Augment graphical products

Global Producing Centre mandatory products (maps)

TABLE: Table with lines

Variable	*Coverage*	*Forecast range or lead time*	*Temporal resolution*	*Output type*	*Issuance frequency*
2-m temperature Wind zonal velocity (u) and meridional velocity (v) at 10 m and 200 hPa Total precipitation Snow Water Equivalent (SWE)	Global	Any forecast range (lead time) between zero and four months	Averages over one month or longer periods (seasons)	(1) Ensemble mean anomaly (2) Probabilities for tercile forecast categories (where applicable)	Monthly
SST	Global oceans				

GPCs-LRF

- Augment existing SST indices

IOD (DMI)	Indian Ocean Dipole (Dipole Mode Index)	WTIO–SETIO
Indian Ocean Basin Wide Index (IOBW)		
Mediterranean		
East and west Mediterranean sea SST anomalies		

- Add atmospheric indices

Pacific/North American pattern (PNA)
North Atlantic Oscillation (NAO)
Arctic Oscillation (AO)
Antarctic Oscillation (AAO)

LC-LRFMME

- Augment the list of digital data for variables collected from GPCs-LRF

(a) Surface (2-m) temperature;
(b) SST;
(c) Total precipitation rate;
(d) MSLP;
(e) 850 hPa temperature;
(f) 500 hPa geopotential height;
(g) 850 hPa zonal and meridional velocity;
(h) Sea ice extent;
(i) Wind zonal velocity (u) and meridional velocity (v) at 10 m and 200 hPa;
(j) Snow Water Equivalent.

Next steps

- Gather input of requirements via survey (done)
- Based on the survey, present a draft list of amended variable in the GDPFS Symposium (this meeting).
- Discuss the draft list during the ET-OCPS meeting and make changes as necessary (Sep 2022)
- Present the draft proposal to the INFCOM-2 (October 2022; draft version needs to the submitted by 7 Sep)
- Present the draft proposal to the Cg/EC (2023)
- ET-OCPS to finalize the amendment to the list of mandatory products (2023)
- Submit for approval to the INFCOM-3 (2024)
- Submit to Cg/EC for final approval (2024)
- Include in the GDPFS (2024)

A note on the implementation of new core variables

- The update cycle of sub-seasonal and seasonal forecast systems is ~ 2 to 5 years.
- For each update cycles, the hindcast data must be submitted to the Lead Center.
- Modeling centers prefer not to "re-submit" the hindcast data if requirements for core variables changes.
- To maintain compliance, initially the changes in the variables may be included as recommended variables.

Thank you

WEATHER CLIMATE WATER
TEMPS CLIMAT EAU

WMO OMM

World Meteorological Organization
Organisation météorologique mondiale