

# Daily Global Forecast System (GFS) Precipitation

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## Introduction

The daily GFS precipitation processes are used in 2 regions: Global and Iraq (Iraq Tigris-Euphrates). The global region is the main region of the process because it used to download the source (raw) files to process geOBIL datasets are used for the other 9 regions.

## Source Data

The GFS precipitation dataset is provided on daily basis by the Africa desk of the NOAA Climate Prediction Center. The dataset contains 7 days forecasts of precipitation at 0.25 degree (25-km) resolution with a global extent. Each "day" is 00z to 00z. The 7 days corresponds to the current day + 6 forecast days.

The source data is available from the NOAA anonymous http site as follows:

Host	<a href="http://ftp.cpc.ncep.noaa.gov">http://ftp.cpc.ncep.noaa.gov</a>
Location	/International/gfs_00z_25km/for_usgs/YYYYMMDD
Filename	00z_gfs_xxx.bin.gz where xxx is 24, 48, 72, 96, 120, 144, 168 per day (7 days)
Usual time stamp	1000 (AM) hrs GMT
Usual file size	various (~700 Kb – 1250 Kb per file for 7 files)

**Important Note:** The 25-km (0.25) data is available since January 16, 2016 and unflipped. Before that date, the source data was 37-km (0.375) and flipped.

### Contacts for missing data:

- Primary Contact: Nick Novella ([nicholas.novella@noaa.gov](mailto:nicholas.novella@noaa.gov)) 301-763-8000 – x7513
- Secondary Contact: Vadlamani Kumar ([vadlamani.kumar@noaa.gov](mailto:vadlamani.kumar@noaa.gov)) 301-763-8000 – x7522

**Note:** these files have maximum retention of ~72 hours on the NOAA ftp site.

## Requirements

### Software

- ArcGIS Desktop 10.x with python (2.x)

### Access

- Python production server where python scripts run automatically using the windows scheduler task.
- Web location(s) connected from the python production server for data staging for the web site (e.g. D:\Stornext\scienceweb1\red\fews\web).
- FTP server for additional data distribution (Optional) (e.g. D:\Stornext\edcftp\outgoing\project\fews).

### ArcGIS Files

- For the global process  
Location: D:\FEWS\DataPortal\_iraq\data\Global\Daily\GFS\

global_daily_gfs.hdr	Header (HDR) file
global_daily_gfs.clr	Colormap (CLR) file

- ArcMap documents for each graphic region used as templates  
Location: D:\FEWS\DataPortal\_iraq\templates\

Iraq_6_v3.mxd	Iraq
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- Symbology files for the regions  
Location: D:\FEWS\DataPortal\_iraq\templates\sym\

daily_gfs_v3.lyr	Iraq
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- FEWS GeoDatabases used in the ArcMap templates  
Location: D:\FEWS\GeoDataBase\

Global_Vector.gdb	Global and Iraq
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- Shapefiles used in the ArcMap templates  
Location: D:\FEWS\DataPortal\_iraq\templates\shps

\middleeast\iraq\tebasn11_polygon.shp	Iraq (Tigris and Euphrates Basins)
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## Data Processing

### Scheduled processes

Setup:

- Each region has a main python script that runs on daily basis from the Windows task scheduler on the python production server. These scripts use the system date as input information.
- The region scheduled task runs using a windows (service) account and it is set up to run whether the user is logged or not and with highest privileges.
- The region process is documented in a log file located in  
D:\FEWS\DataPortal\_iraq\logs\YYYYMMDD\. The content of this file is sent via e-mail to a notification list showing if each step of the process was completed or not.

Windows Scheduled Task	Run Time	Actions
Daily GFS Prec and ClimPars	4:15 AM (CT)	D:\FEWS\DataPortal_iraq\bin\global\daily\gfs\ <b>global_daily_gfs.py</b>  D:\FEWS\DataPortal_iraq\bin\middleeast\iraq\daily\gfs\ <b>iraq_daily_gfs.py</b>

### Manual process for recovery

The batch python script runs the main script for each region. The batch script is useful when the source (raw) data has issues, such as bad data, internet connection, etc., during the scheduled task running.

Location: D:\FEWS\DataPortal\_iraq\bin\allregions\_daily\_gfs.py

Steps:

1. Check if the source data is available from the NOAA http site.
2. If the data is not available, request information via e-mail to the NOAA contacts (primary and secondary)
3. When the data is available, run the batch process using inputs argument from the command prompt.

**Command Line**

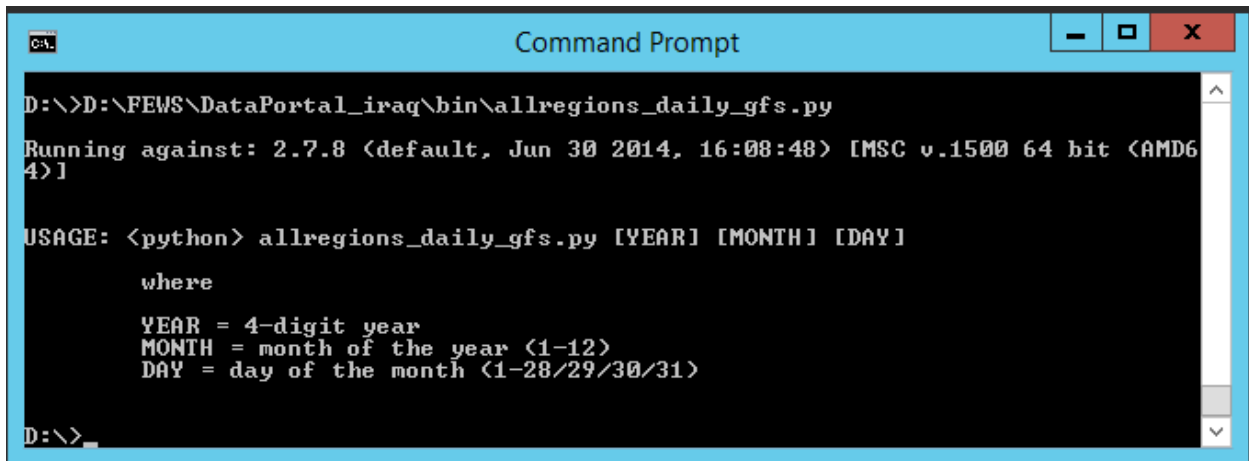
USAGE: <python> global\_daily\_gdas.py [YEAR] [MONTH] [DAY]

where

YEAR = 4-digit year

MONTH = month of the year (1-12)

DAY = day of the month (1-28/29/30/31)



**Python scripts description**

**Executable and configuration python scripts by region**

Each region has a configuration script and a main executable script. These scripts are in

D:\FEWS\DataPortal\_iraq\bin\.

**Global**

This is the first region that needs to be run because it downloads the source files of the GFS precipitation dataset.

Location: D:\FEWS\DataPortal\_iraq\bin\global\daily\gfs

global_daily_gfs_config.py	Configuration file
global_daily_gfs.py	Main script

**Main Script steps**

1. Downloads source data (1 file/day = 7 files) from NOAA
2. Creates a TAR.GZ file with the 7 BIL datasets converted from the source data and copy zip file to the FTP location (FTP copy is optional).

## Command Line

USAGE: global\_daily\_gfs.py YYYY M D

where YYYY is the 4 digit year .. M is the 1-2 digit of the month (1-12).. and D is the 1-2 digit of the day (1-31). YYYY M D is an optional input, so the default input information is today's date.

### Example

```
> global_daily_gfs.py 2013 9 9
```

## Iraq (Iraq Tigris-Euphrates)

Location: D:\FEWS\DataPortal\_iraq\bin\asia\middleeast\iraq\daily\gfs

iraq_daily_gfs_config.py	Configuration file
iraq_daily_gfs.py	Main script

## Main script process steps

1. Create a TAR.GZ file with the 7 BIL datasets
2. Create the 6-days graphic and copy graphic file to the web site location

## Command line

USAGE: iraq\_daily\_gfs.py YYYY M D

where YYYY is the 4 digit year .. M is the 1-2 digit of the month (1-12).. and D is the 1-2 digit of the day (1-31). YYYY M D is an optional input, so the default input information is today's date.

### Example

```
> iraq_daily_gfs.py 2013 9 9
```

## Library python script

The executable scripts call different methods from a library python script. This library python script includes the main functions of a datasets by periodicity, so these functions can be reused by the dataset regions. Also, it includes calls to common functions used by each periodicity dataset process(es).

D:\FEWS\DataPortal\_iraq\lib\daily\_gfs\_process.py

Common library scripts required:

- D:\FEWS\DataPortal\_iraq\lib\constants.py
- D:\FEWS\DataPortal\_iraq\lib\dates.py
- D:\FEWS\DataPortal\_iraq\lib\email\_file.py
- D:\FEWS\DataPortal\_iraq\lib\desc\_raster.py
- D:\FEWS\DataPortal\_iraq\lib\folder\_utilities.py
- D:\FEWS\DataPortal\_iraq\lib\file\_utilities.py
- D:\FEWS\DataPortal\_iraq\lib\geodatabase\_utilities.py
- D:\FEWS\DataPortal\_iraq\lib\print\_msg.py
- D:\FEWS\DataPortal\_iraq\lib\temp\_workspaces.py
- D:\FEWS\DataPortal\_iraq\lib\transfer.py
- D:\FEWS\DataPortal\_iraq\lib\zips.py

Python method	Summary description
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<code>__init__()</code>	Initializes all the variables based on the configuration script information and run date for the different methods (all regions).
<code>dataDownload()</code>	Download the global GFS precipitation source files (1 file/day = 7 files) from NOAA for the 7 forecast days (Global).
<code>createBil()</code>	Creates a zip (Tar.GZ) file with the 7 geoBILs (a-g) with a defined colormap (CLR file) for each region (all regions).
<code>makeSix()</code>	Creates a 6 days graphic for a region and copy it to the web location (all regions except Global).

### [\\_\\_init\\_\\_\(\)](#)

Method to initialize all the variables based on the configuration script information and run date to set base portal, log, lib, template, and data paths; region data information (region, type, periodicity, name, ftp, etc.) for the different methods defined in the python script.

### [dataDownload\(\)](#)

Method to download the global daily GFS precipitation GZ files (1 file/day = 7 files) from NOAA for the 7 forecast days. This method is just called from the global executable scripts.

Steps:

1. Create folder for the source (raw) data path and a subfolder with format YYYYMMDD
2. Loop each forecast day in hour format to download the corresponding GZ file and add in a list information of the remote and local file size information and its comparison.
3. Print number of files downloaded and the list information gathered in the loop.
4. If the number of downloaded files is equal to the number of forecast days, a zip file with the 7 GZ files is created as `gfsYYYYMMDDr.tar.gz`

### [createBIL\(\)](#)

Method to create a tar.gz file with 7 geoBIL raster datasets (a-g) corresponding to the 7 days forecast.

Steps:

1. Run the process for the global region. The method for this region follows these steps:
  - a) Check if the zip file of the downloaded files exists.
  - b) Creates a folder as YYYYMMDD in the raw path and unzip the downloaded files.
  - c) Loop through each GZ file and unzip the zip file containing a bin file.
    - i. Rename the bin file as `raw1.bin`
    - ii. Copied HDR file as `raw1.hdr`
    - iii. Convert raw1 geoBIL dataset to a Float ArcGrid and save it as `gfsYYYYMMDDHf`
    - iv. Flip `gfsYYYYMMDDHf` and save it as `gfsYYYYMMDDH`
    - v. Define environment extent with the data extent information from the configuration file
    - vi. Extract by rectangle from the flipped raster with the extent `0.0, -90.125, 180.0, 90.125` and save it as `left`
    - vii. Extract by rectangle from the flipped raster with the extent `180.0, -90.125, 360.0, 90.125` and save it as `right`
    - viii. Shift the raster right and save it as `right1`

- ix. Mosaic `right1` and left raster to a new raster called `mosaic` with pixel type `16_BIT_UNSIGNED`
  - x. Apply scale factor of 0.5 to the `mosaic`, convert it to integer, and save it as `summed`. This step provides the correct information to match results with the web products.
  - xi. Copy `summed` as a geoBIL dataset with pixel type `16_BIT_UNSIGNED` with filename as `gfsYYMMDDs.bil` where `s` is the suffix filename as a letter corresponding to the forecast day (a-g)
  - xii. Add CLR file to the new geoBIL dataset
  - xiii. Delete the intermediate data used to create the geoBIL dataset (
- d) When the loop is completed, define a zip file name as `gfsYYMMDD.tar.gz`
  - e) Create a list with all the 7 geoBIL files and its associated files (colormap (CLR), projection (PRJ), etc.).
  - f) Create zip file and save it in the geoBIL year folder.
  - g) Copy the zip file in the FTP distribution site.
  - h) Send e-mail with the log file content from the region process.
2. Run process for remaining regions
- a) Check if the global geoBIL zip files exists and unzip file.
  - b) Loop through each unzipped geoBIL dataset and clip global raster using the extent of the region.
  - c) When the loop is completed, define a zip file name as `gfsYYMMDD.tar.gz`
  - d) Create a list with all the 7 geoBIL files and its associated files (colormap (CLR), projection (PRJ), etc.).
  - e) Create zip file and save it in the geoBIL year folder.
  - f) Copy the zip file in the EROS FTP distribution site if region has a folder directory structure defined in the region config file.

### *makeSix()*

Method to creates a 6 days graphic for a region and copy it to the web location (all regions except Global).

Steps:

1. Create a dictionary of the 6 forecast days that will be used in the map graphic. The dictionary includes the date, month name, Julian day, geoBIL name, geoBIL path, and the ArcGrid name.
2. Define zip geoBIL filename, map template (ArcMap document, MXD) and legend/symbology (LYR) files will be used in this process.
3. If the BIL zip file exists, unzip it.
4. Get a list of the unzipped files and sort it.
5. Loop through the data frame and list of geoBILs to add data with symbology in the map template. The legend is only displayed using the first data frame.
6. Apply legend and elements (title, subtitle, description, etc.) settings.
7. Export edited map template as a PNG file.
8. Copy the PNG or PDF files to the web location.
9. Send e-mail with the log file content from the region complete process(es) for Iraq.



## Products

### Global

Source (raw) data (GZ files)	D:\FEWS\DataPortal_iraq\data\Global\Daily\GFS\raw\YYYY\ <b>gfsYYMMDDr.tar.gz</b>
BIL zip (TAR.GZ files)	D:\FEWS\DataPortal_iraq\data\Global\Daily\GFS\geobil\YYYY\ <b>gfsYYMMDD.tar.gz</b>

### Iraq (Iraq Tigris-Euphrates)

BIL product (TAR.GZ files)	D:\FEWS\DataPortal_iraq\data\MiddleEast\Iraq\Daily\GFS\geobil\YYYY \ <b>gfsiraqYYMMDD.tar.gz</b>
Graphics (PNG files)	D:\FEWS\DataPortal_iraq\data\MiddleEast\Iraq\Daily\GFS\graphics\ <b>gfsiraqYYMMDD.png</b>

## Product Distribution locations

### Iraq (Iraq Tigris-Euphrates)

Graphics	Website	D:\Stornext\scienceweb1\shared\feWS\web\asia\middleeast\iraq\daily\gfs-prec\graphics
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## Product pages with documentation

Iraq	<a href="http://earlywarning.usgs.gov/feWS/product/74">http://earlywarning.usgs.gov/feWS/product/74</a>
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## Definitions

YYYY	4-digit year
MM	2 digit month
DD	2-digit hour
YY	2-digit year
H	hour
s	filename suffix

## Revision History

Revision	Date	Description of changes	Requested By
1.0.0	Apr 14, 2016	Initial Version for FEWS PPG op	
2.0.0	Sep 06, 2019	Initial Version based on the FEWS PPG op full documentation	Iraq PPG training
2.1.0	Sep 25, 2019	Updated to just include the temperature parameter	



## Annex A

### Graphic Products

#### Iraq (Iraq Tigris-Euphrates)

<http://earlywarning.usgs.gov/fews/product/74>

