Global Extreme Precipitation Event Hazard Preview

TAOS^{tm} Real Time Operations System
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Abstract

TAOS^{tm} WX Global Analysis extreme precipitation events based the 20230918000000 00z forecast. This analysis was run using proc:gfs TAOS Version 24.1:ROCKY9:GCC11:2023:249:10 and includes precipitation hazards from tropical cyclones, winter storms, mid latitude cyclones, and other synoptic scale weather systems.

Return Periods in this report are based on climatology derived from the 2001-2022 NASA GPM/IMERG Level 3 data sets.

Report generated Mon Sep 18 08:54:07 AM UTC 2023 on cortex2 using GFS data downloaded on Mon Sep 18 03:31:24 AM UTC 2023.

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Chapter 1

Extreme Rain Forecast Day 1: 2023-09-18

Rainfall events with an expected return period of over 10 years based on the 00Z 20230918000000 forecast run.

Table 1.1: Extreme Rain Events forecast for 2023-09-18

admin1_name	*country*	*return_period*
Chittagong	BGD	31.1
Bas-Sassandra	CIV	39.3
Montagnes	CIV	39.3
Sassandra-Marahoué	CIV	58.1
Gujarat	IND	500.0
Mizoram	IND	31.1
Rajasthan	IND	11.9
Gbapolu	LBR	17.0
Kayin	MMR	67.0
Mon	MMR	67.0
Sind	PAK	12.1
Kanchanaburi	THA	67.0

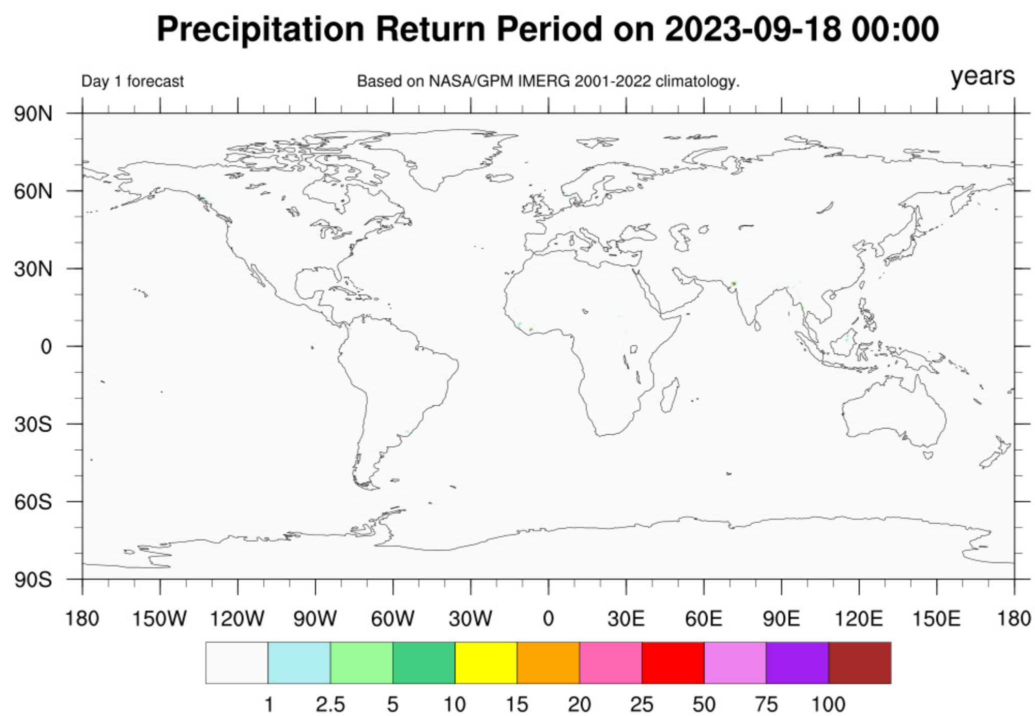

Figure 1.1: Extreme Rain Events for 2023-09-18

Chapter 2

Extreme Rain Forecast Day 2: 2023-09-19

Rainfall events with an expected return period of over 10 years based on the 00Z 20230918000000 forecast run.

Table 2.1: Extreme Rain Events forecast for 2023-09-19

admin1_name	*country*	*return_period*
Chongqing	CHN	22.4
Henan	CHN	125.1
Hubei	CHN	125.1
Jiangsu	CHN	19.0
Shandong	CHN	11.4
Sichuan	CHN	22.4
Gujarat	IND	500.0
Sind	PAK	362.1
Îles Australes	PYF	18.2
Eastern	SLE	78.3
Southern	SLE	78.3
Western	SLE	71.7

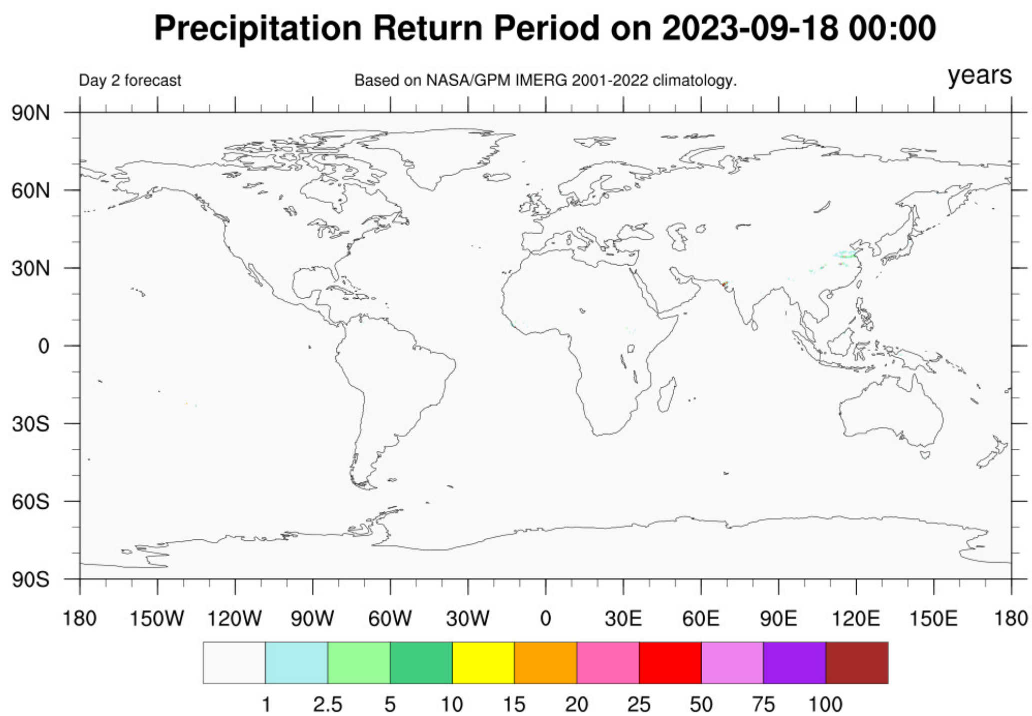

Figure 2.1: Extreme Rain Events for 2023-09-19

Chapter 3

Extreme Rain Forecast Day 3: 2023-09-20

Rainfall events with an expected return period of over 10 years based on the 00Z 20230918000000 forecast run.

Table 3.1: Extreme Rain Events forecast for 2023-09-20

admin1_name	*country*	*return_period*
Rangpur	BGD	39.7
Chongqing	CHN	66.4
Sichuan	CHN	66.4
Sumatera Barat	IDN	32.7
Sumatera Utara	IDN	32.7
Bihar	IND	39.7
Chhattisgarh	IND	29.8
Gujarat	IND	31.2
Jharkhand	IND	32.6
Odisha	IND	32.6
West Bengal	IND	39.7
Jeollabuk-do	KOR	111.9
Sagaing	MMR	28.2
East	NPL	39.7
Otago	NZL	16.9
Southland	NZL	16.9

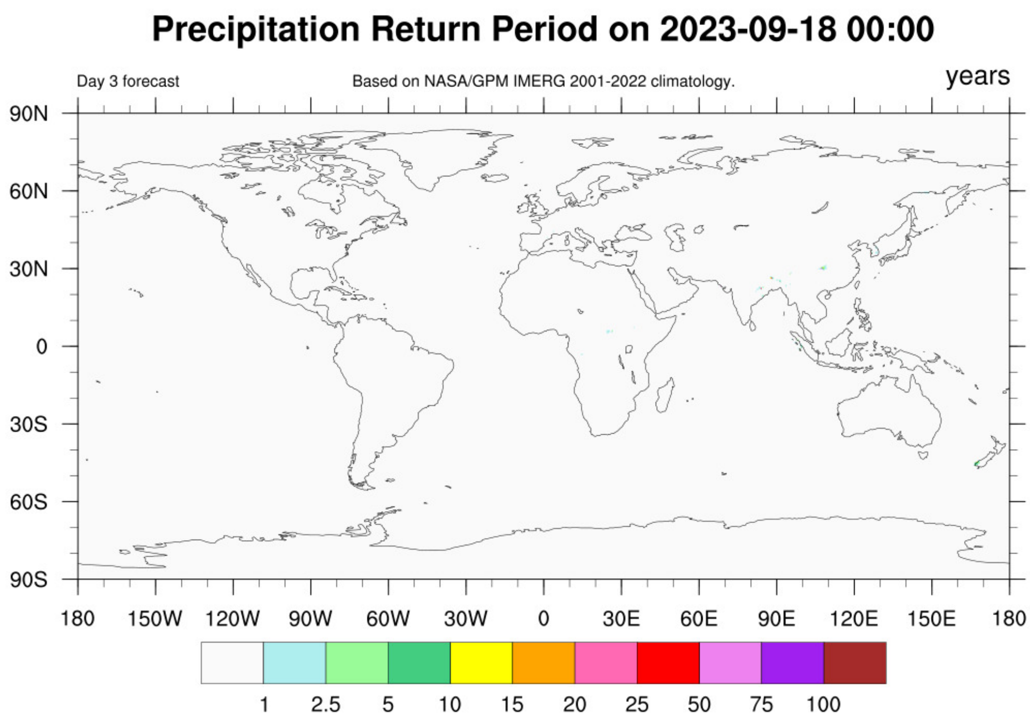

Figure 3.1: Extreme Rain Events for 2023-09-20

Chapter 4

Extreme Rain Forecast Day 4: 2023-09-21

Rainfall events with an expected return period of over 10 years based on the 00Z 20230918000000 forecast run.

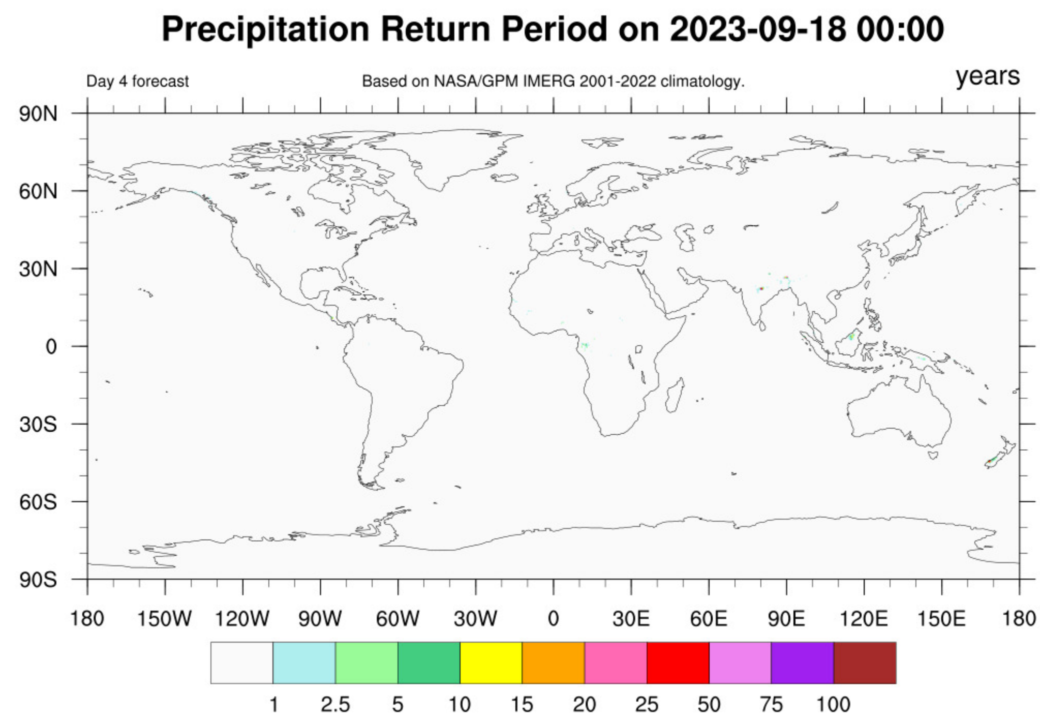

Figure 4.1: Extreme Rain Events for 2023-09-21

Table 4.1: Extreme Rain Events forecast for 2023-09-21

admin1_name	*country*	*return_period*
Chittagong	BGD	16.0
Dhaka	BGD	16.0
Dagana	BTN	11.9
Sarpang	BTN	21.1
Tsirang	BTN	21.1
Alajuela	CRI	10.3
Guanacaste	CRI	10.3
Aceh	IDN	479.9
Kalimantan Timur	IDN	14.3
Assam	IND	34.1
Chhattisgarh	IND	168.4
Madhya Pradesh	IND	299.5
West Bengal	IND	34.1
Trarza	MRT	10.0
Sabah	MYS	10.9
Sarawak	MYS	17.9
Lago Nicaragua	NIC	10.3
Río San Juan	NIC	10.3
Rivas	NIC	10.3
Canterbury	NZL	21.1
Otago	NZL	500.0
Southland	NZL	37.7
West Coast	NZL	500.0

Chapter 5

Extreme Rain Forecast Day 5: 2023-09-22

Rainfall events with an expected return period of over 10 years based on the 00Z 20230918000000 forecast run.

Table 5.1: Extreme Rain Events forecast for 2023-09-22

admin1_name	*country*	*return_period*
Riau	IDN	500.0
Sumatera Utara	IDN	34.4
Bihar	IND	74.3
Madhya Pradesh	IND	30.8
Maharashtra	IND	11.1
Kedah	MYS	161.8
Choiseul	SLB	30.9
Isabel	SLB	51.7

5.1 Climatology Sources

Two main sources of precipitation climatology are analyzed here. The first is the NASA Global Precipitation Mission (GPM) Level 3 Late (IMERG) data set that is also used for near real time analysis. It is called “late” because it is the last real time integration, delayed to include data downloaded by low

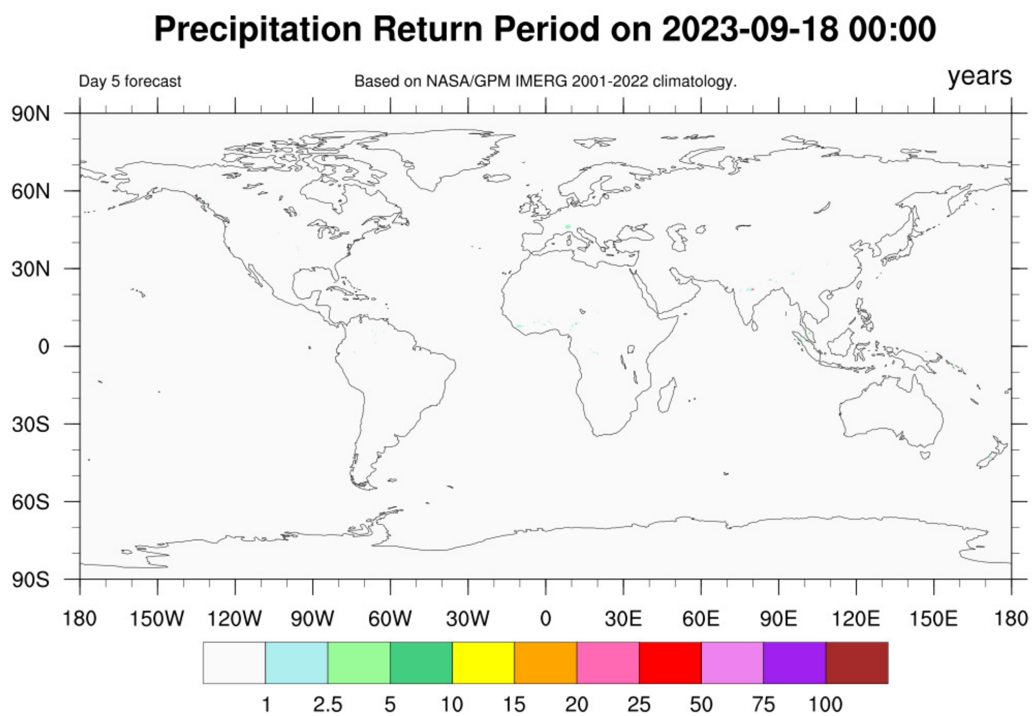

Figure 5.1: Extreme Rain Events for 2023-09-22

earth orbiting satellites after then pass over ground stations the next day. Note that the GPM/IMERG data is considered to be a model rather than a direct observation, since it is a rainfall estimate based on various algorithms using microwave radar data and InfraRed satellite data to compute rainfall. However, it is often closer to model rainfall because it is an aerial average rather than a point source such as a rain gauge.

For longer term climatology reanalysis data sets are used. Several are available within the TAOS^{tm} system. The primary climatology is derived from the NCEP Climate Forecast System Version 2 (CFSv2). Other data sets available for analysis are from the European Centre for Medium Range Forecasting, and the Japan Meteorological Agency. These data sets are at different resolutions than either the underlying GFS or NASA GPM data. In all cases the data sets are resampled and scaled as appropriate to use the same 0.1 degree (6 nautical mile, 11.1 km) grid that the NASA GPM data uses.

5.2 Return Period Analysis

Here the return period is defined as the reciprocal of the probability of observing a specific more extreme effect in a single year. In these analysis the distribution of choice is the Weibull distribution, since it was found to have the best goodnes-of-fit across multiple sites. In brief, the steps are as follows:

1. Compute the maximum likelihood estimates (MLE) of the shape (alpha) and scale (beta) parameters.

2. Point estimates of return period values are computed by evaluating the inverse distribution function at the MLEs. For an n-year value, take p = 1 – (1/n)

3. Compute the asymptotic variances and covariances of the MLEs using the observed Fisher information matrix.

4. Compute the observed Fisher information matrix D as the inverse of the symmetric 2x2 matrix

5. Deconvolve the matrix to obtain the parameter estimates.

Reported return periods in most reports are limited to approximately four times the historical record. Therefore, the GPM data set is limited to 100 years, the CFS2 and JRA55 based climatologies are limited to 200 years. The raw output tables and data sets are not limited, however, caution is used in interpreting values beyond the reasonable limits of the analysis.