



Emergency Investigation and Assessment 2022 Pakistan Flood

Investigation Briefing

China-Pakistan Joint Research
Centre on Earth Sciences

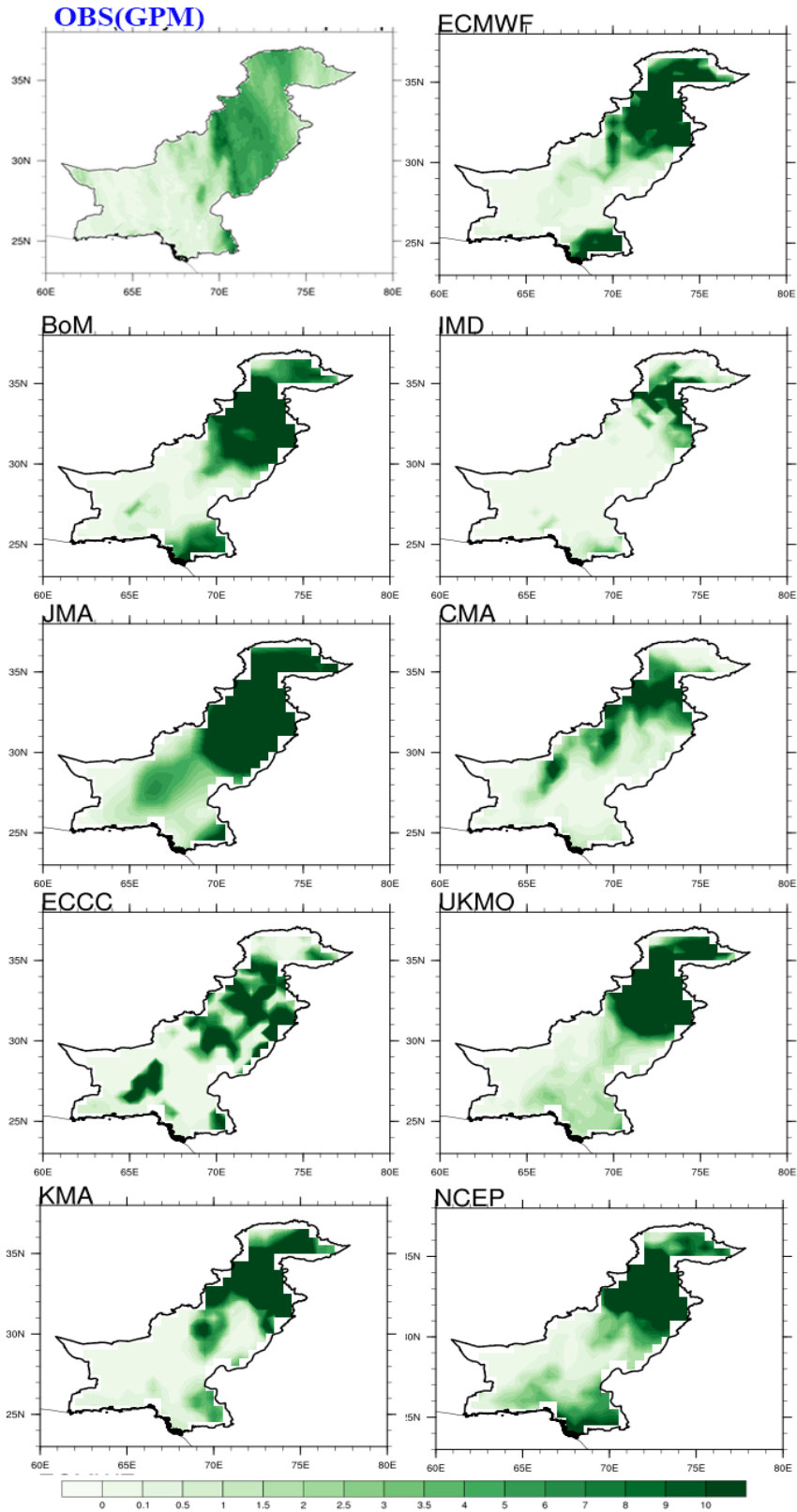
Issue No.5

9 September 2022

Analysis of the Pakistan Precipitation Development in September

According to historical meteorological data in Pakistan, the precipitation in September will drop significantly compared with July and August. In the past week, Pakistan's rainfall was mainly concentrated in the northern region, with relatively little in the southern part. To further analyze the precipitation trend from mid to late September, CPJRC used IMERG (The Integrated Multi-Satellite Retrievals for GPM) and compared the precipitation performance of multiple meteorological numerical forecasting models in Pakistan (**Fig 1**). Based on the latest satellite observation data, the precipitation in the past three days (5 to 7 September) is mainly distributed in the north of Pakistan, with maximum rainfall of less than 10mm. Most of Punjab Province was covered with precipitation; Sindh Province had little rain, and the accumulated precipitation in most areas for these three days was below 5mm.

Using forecast systems that participated in the TIGGE Global Ensemble Numerical Forecast Program from 9 countries, including BoM (Australian Bureau of Meteorology), CMA (China Meteorological Administration), ECCO (Canada Meteorological Agency), JMA (Japan Meteorological Agency), KMA (Korea Meteorological Administration) Precipitation data from numerical models provided by the Bureau of



**Figure 1. GPM Satellite monitoring and multi-mode precipitation forecasting
(Unit: mm, 3-day accumulated rainfall in 05-07 Sep 2022)**

Meteorology), IMD (India Meteorological Department), NCEP (United States Centre for Environmental Prediction), UKMO (UK Met Office), and ECMWF (European Centre for Medium-Range Weather Forecasts). Compared with satellite observations, the predicted precipitations provide the spatial distribution of rainfall with "more in the north and less in the south". However, the prediction of the rainfall center and intensity has a large deviation. Several models predict the rainfall intensity at the center to be stronger. IMD predicted that the precipitation range in the north was small; CMA, JMA and ECCC predicted false heavy precipitation centers in southern Balochistan. The ECMWF model generally provided the closest precipitation forecasting compared to GPM satellite observations.

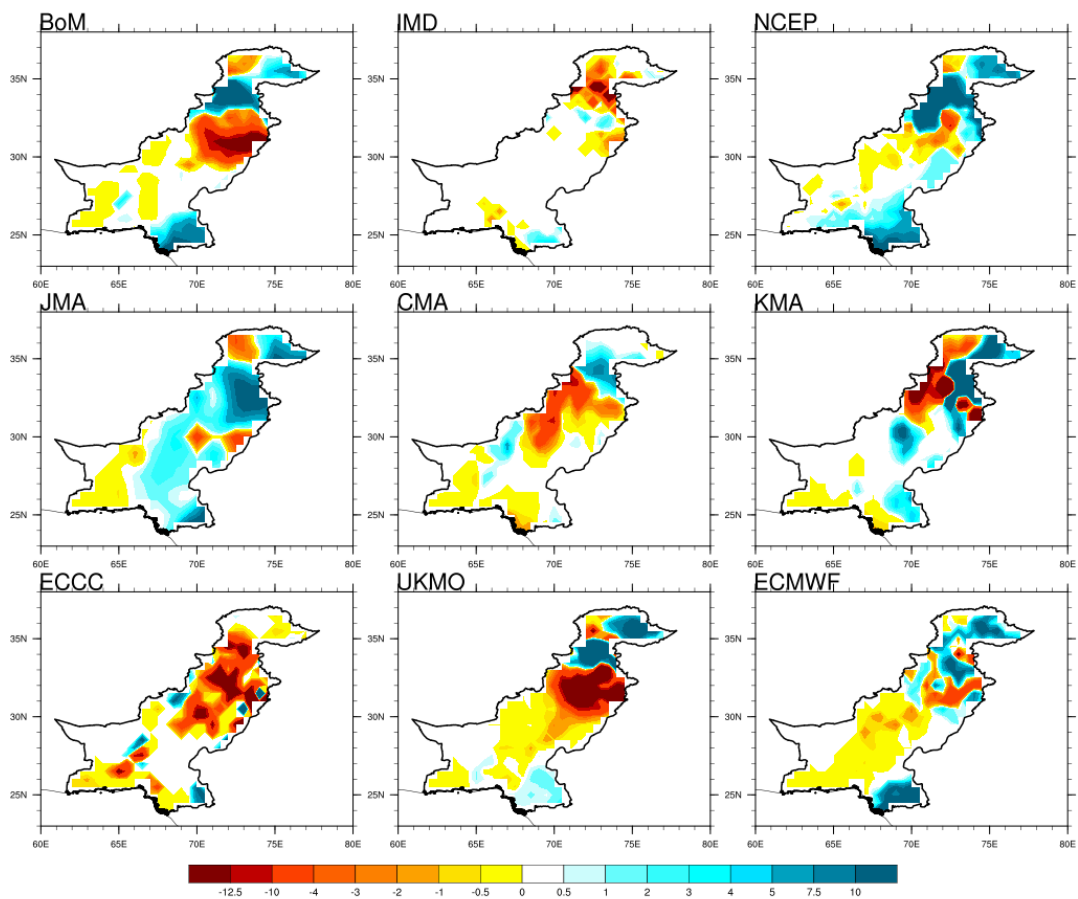


Figure 2. 3-day accumulative precipitation (10 to 12 September 2022)

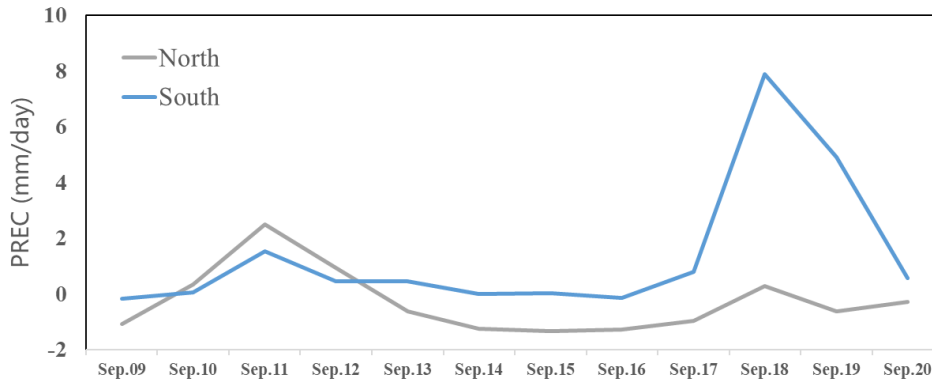
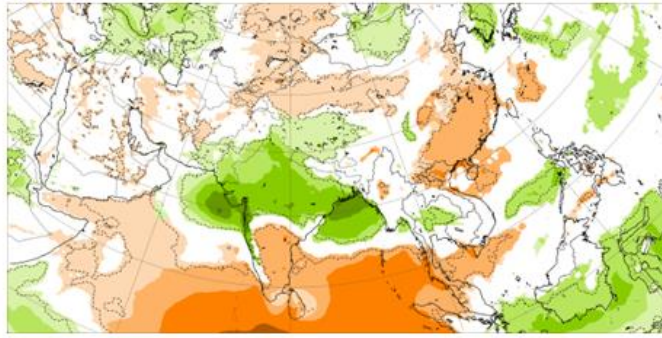


Figure 3. ECMWF precipitation forecasting from 9 to 20 September in the south and north of Pakistan bounded by 32°N (Unit: mm/day, Compared with the average daily precipitation from 5 to 7 September)

As shown in **Figure 2**, precipitation data in Pakistan for the next three days (10 to 12 September) was calculated based on nine models. Several models show the precipitation will increase in northern Pakistan and the southeast part of Sindh Province. Rain in most of Balochistan Province will decrease (**Fig 2**). In addition, based on the ECMWF simulation, using 32°N as the boundary, the precipitation in northern and southern Pakistan in the next ten days indicates that from 11 September, affected by the eastward moving of low-pressure trough, there will be a low intensity precipitation in the northern Pakistan (**Fig 3**). The forecast also shows a tropical depression moving from east to west in the Indian Ocean, resulting in strong precipitation in the southern Pakistan on 18 September. The rainfall situation in the north Pakistan remains.

According to the weekly precipitation forecast of ECMWF, the eastern region of Pakistan receives rainfall slightly higher than average from 12 to 26 September. From 12 to 19 September, precipitation is mainly concentrated in the southern parts of Sindh and Punjab, while from 19 to 26 September, the rainfall area remains in the eastern part of Pakistan, with the rain extending northwards to most of Punjab (**Fig 4**).

(a)2022.09.12-19



(b)2022.09.19-26

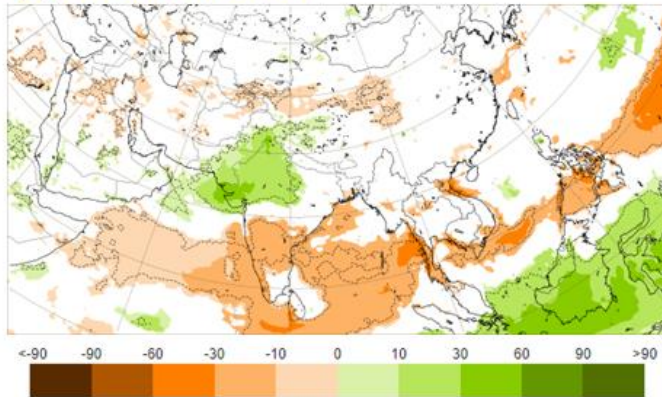


Figure 4. ECMWF forecast of anomalous weekly precipitation in South Asia (unit: mm, warm colors indicate less rainfall, and cool colors show more precipitation)

Prepared by: WANG Yan, LIN Chaohui, Peng Jingbei

Translated by: LEI Yu, LI Wanhong, ZENG Qin

Reviewed by: GE Yonggang, LEI yu

Contact: HONG Tianhua, hongth@aircas.ac.cn
+92-318 5001269; +86-13717995928

Issued by: SU Lijun

Date: 9 September 2022