جمهوری اسلامی ایران
وزارت نیرو

Regional Centre on Urban Water Management (RCUWM - Tehran)

InthNameofGod

unesco Centre Under the auspices of UNESCO

Exceptional El Niño Demands Exceptional Preparedness and Response

Water Research Institute of Iran

Ministry of Energy

مؤسسه تحقیقات آب

Regional Training Workshop on "Teleconnections, Forecasting and Early Warning Systems

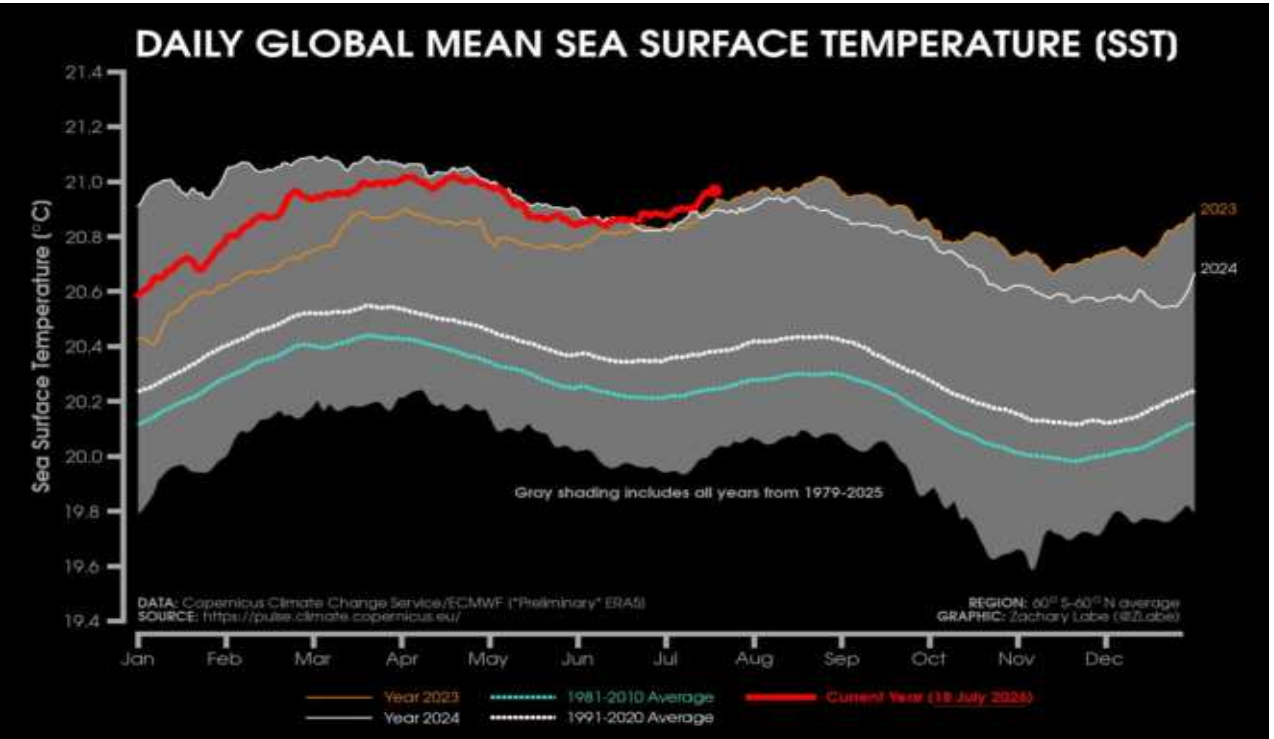
Sep2026-Shahrivar1405

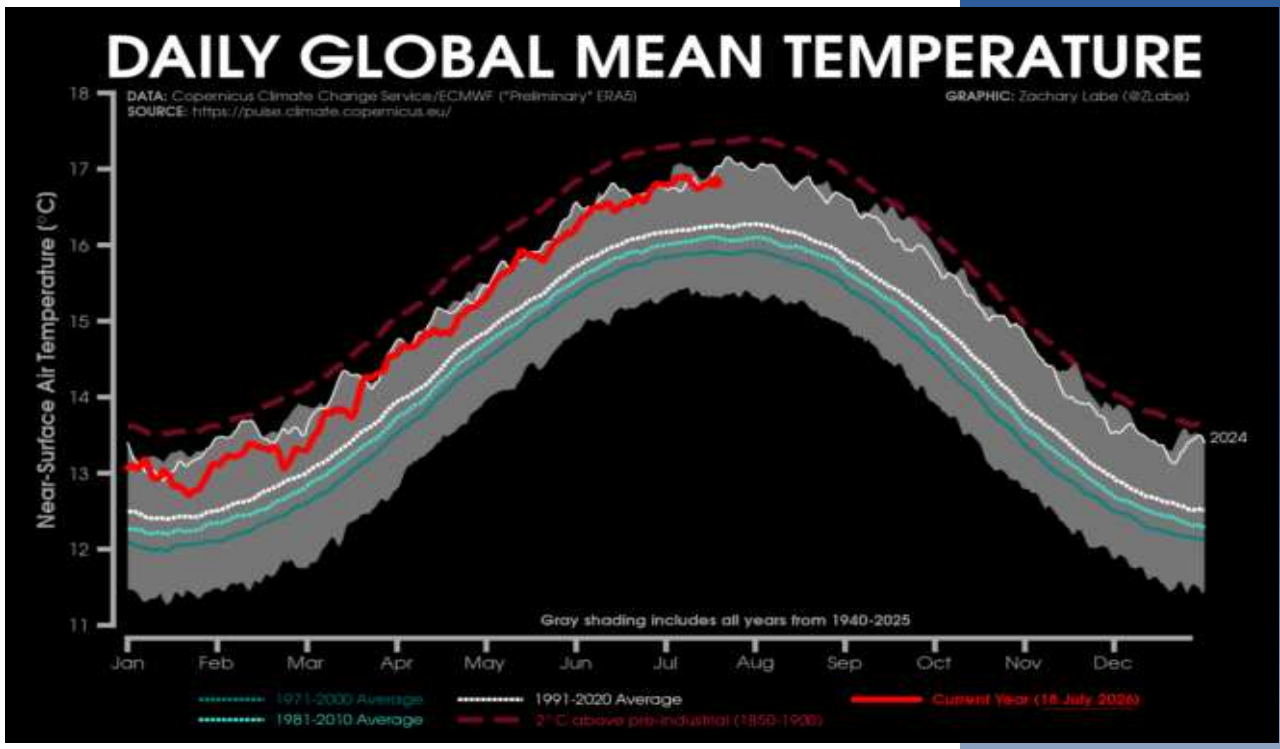
Climate Change

Climate Change- Changes in Global Patterns

- **The unusually powerful climate event reveals on a planet already significantly warmer because of greenhouse gas emissions. So, the oceans are already exceptionally warm, providing a hotter baseline for the natural climate cycle.**

Changes in daily Mean Sea temperatures over time across the world for each year from 1976 to 2026 (last El Niño event, occurred from June 2023 to April 2024.)

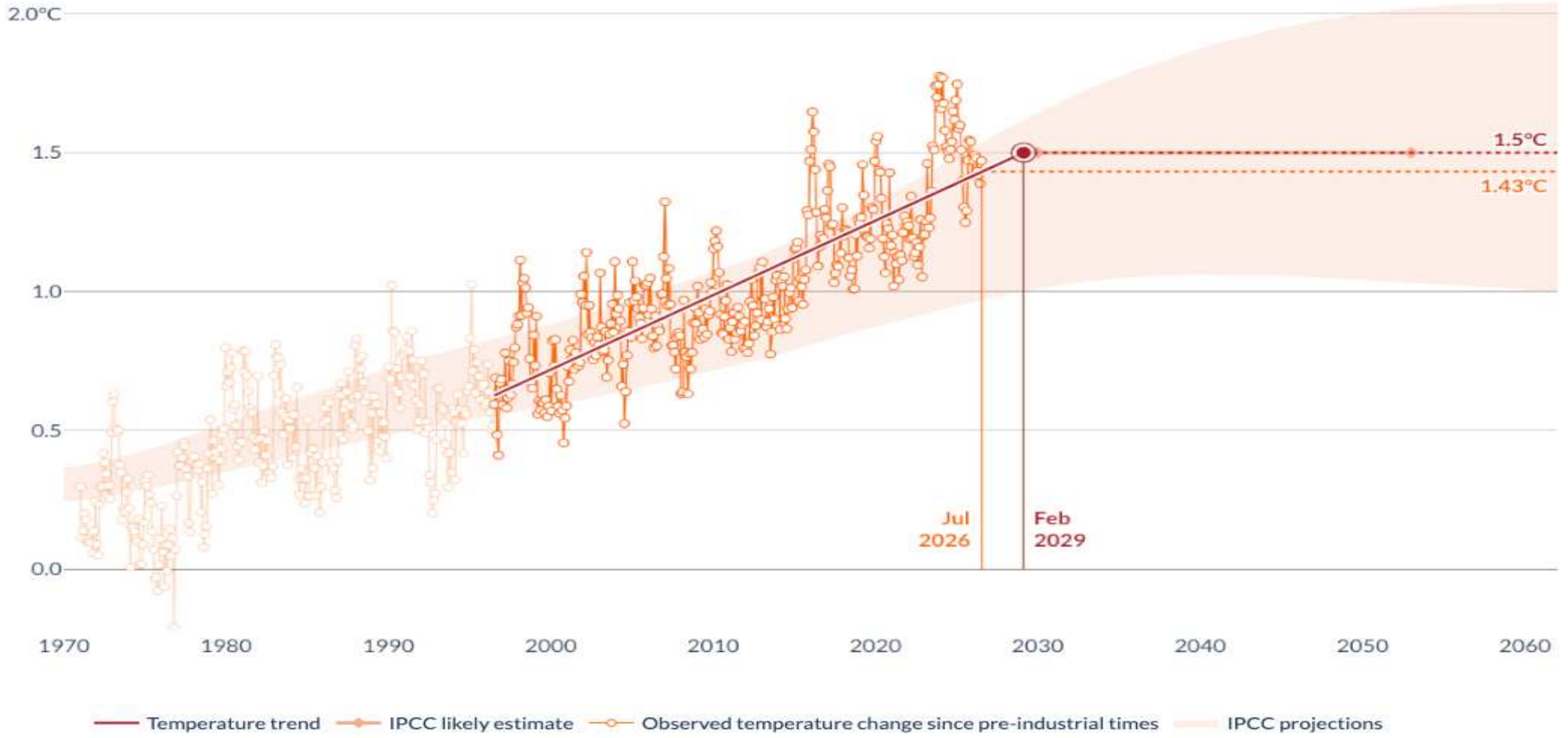




Changes in daily near-surface (within 2m of the surface) Mean air temperatures over time across the world for each year from 1940 to 2026

Global warming reached an estimated **1.43°C** in **July 2026**.

If the 30-year warming trend leading up to then continued, global warming would reach **1.5°C** by **February 2029**.



PROGRAMME OF THE EUROPEAN UNION

Copernicus Europe's eyes on Earth

Climate Change Service climate.copernicus.eu

IMPLEMENTED BY ECMWF

El Niño, Evolution and Impacts

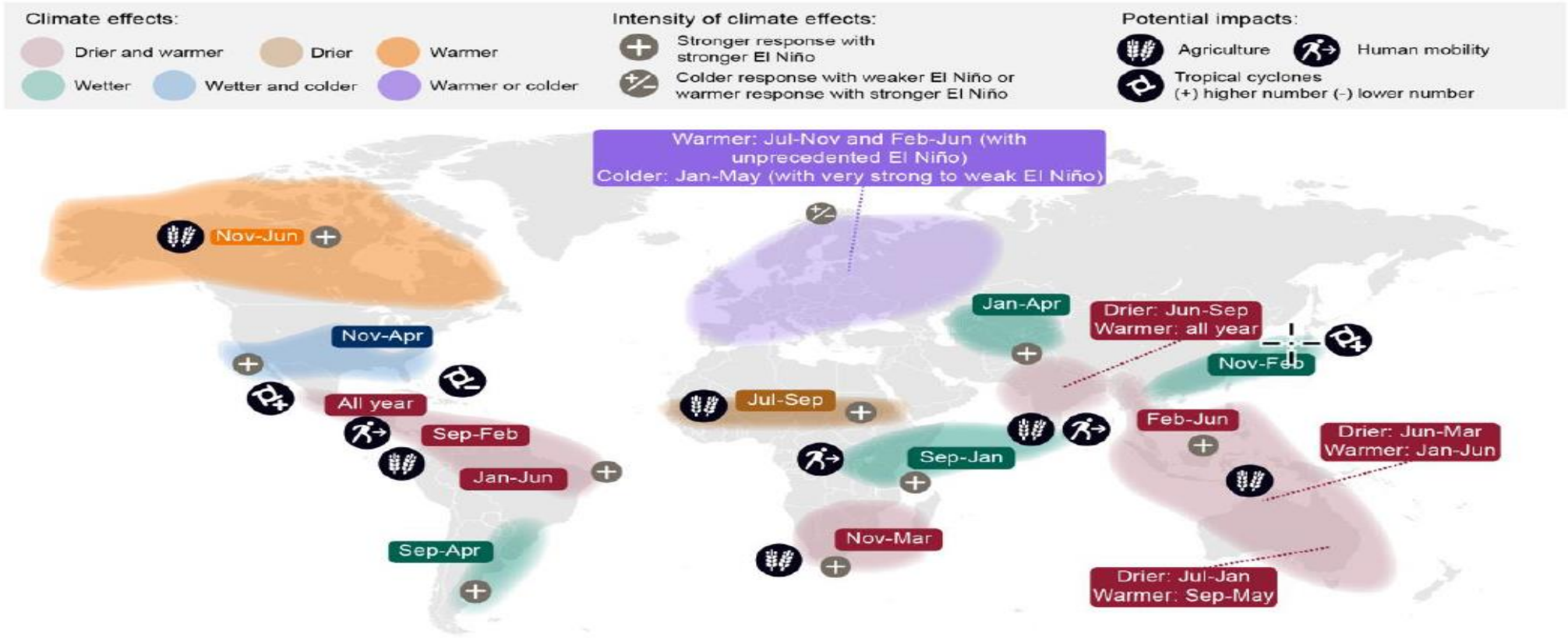
El Niño is being supersized before our eyes

- El Niño is a naturally occurring climate pattern that typically develops every two to seven years, when waters in the central and eastern equatorial Pacific become unusually warm. That warming can alter atmospheric circulation thousands of miles away, shifting rainfall and temperature patterns everywhere.
- Beneath the surface of the tropical Pacific lies an enormous reservoir of unusually warm water that continue feeding El Niño in the months ahead.
- In some parts of the Pacific, subsurface temperatures in July and early August were more than 8 degrees Celsius (~ 14 degrees Fahrenheit) above normal.
- UN Secretary-General António Guterres said in a press release recently, "The science leaves no room for doubt: the planet is in uncharted waters, and those waters are heating up."
- **Forecasters are certain that it persist through February 2027 – with unusually warm conditions expected across much of the world.**

Some of Historical Global Flood and Drought Impacts Associated with El Niño Events

Major Impacts of El Niño

- According to the World Meteorological Organization (WMO), the phenomenon, is expected to become “very strong”, peak around the end of the year and persists till Feb 2027.
- A very strong El Niño does not brings disasters of the same magnitude for every region.
- However, forecasters expect above-normal temperatures across nearly the entire Earth’s surface. Rainfall patterns are also important, with greater chances of heavy rain and flooding in some places and drought in others.
- Other forces (i.e. a positive phase of the Indian Ocean Dipole) is also expected to develop and complicate the patterns and make it impossible to forecast the strength and impact of El Niño for individual countries. But, a period of heightened risk is expected.



Sources: JRC analysis and Lenssen et al. (2020).

Some of Historical Global Flood and Drought Impacts Associated with El Niño Events

El Niño Event	Country/ Region	Impact Type	Brief Description
1957–1958	Peru & Ecuador	Flood	Heavy rainfall along the Pacific coast
	Indonesia	Drought	Reduced rainfall
	Australia	Drought	Dry conditions in parts of the country
1965–1966	Australia	Drought	Reduced rainfall, particularly in eastern and southeastern areas
	Indonesia	Drought	Reduced precipitation
1972–1973	Australia	Drought	Reduced rainfall
	Peru	Flood	Increased coastal rainfall
1982–1983	Peru	Flood	Extremely heavy rainfall in northern Peru
	Ecuador	Flood	Widespread flooding and landslides
	Bolivia	Drought	Reduced precipitation
	Australia	Drought	Severe drought conditions
	Indonesia	Drought	Reduced rainfall and wildfires
	Southern Africa	Drought	Reduced precipitation
	Philippines	Drought	Reduced rainfall
1991–1992	Southern Africa	Drought	Severe drought and food shortages
	Peru & Ecuador	Flood	Heavy coastal rainfall

Some of Historical Global Flood and Drought Impacts Associated with El Niño Events

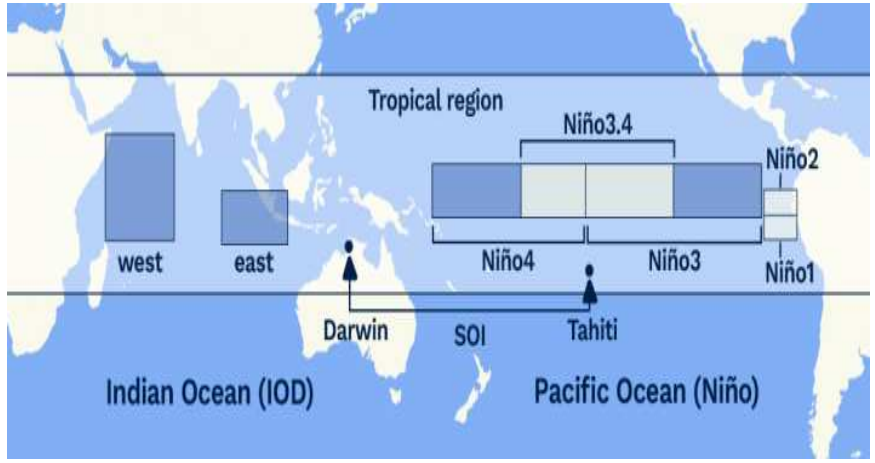
El Niño Event	Country/ Region	Impact Type	Brief Description
1997–1998	Ecuador	Flood	Extremely heavy rainfall and severe flooding
	Northern Peru	Flood	Exceptional rainfall and flooding
	East Africa	Flood	Exceptionally heavy rainfall and flooding
	China	Flood	Widespread flooding
	Indonesia	Drought	Severe drought and wildfires
	Amazon Basin	Drought	Reduced rainfall
	Mexico	Drought	Drought in several regions
2002–2003	Australia	Drought	Reduced rainfall
	South Asia	Drought	Reduced precipitation in some areas
2009–2010	Brazil	Drought	Severe drought and exceptionally low river levels
	Southeast Asia	Drought	Reduced rainfall in some areas
2015–2016	Ethiopia	Drought	Severe rainfall deficits and food crisis
	Southern Africa	Drought	Major regional drought
	Caribbean	Drought	Severe water shortages
	Central America	Drought	Reduced rainfall
	Indonesia	Drought	Drought and wildfires
	Peru & Ecuador	Flood / Heavy Rainfall	Increased rainfall in some areas
	Paraguay & Southern	Flood	Heavy rainfall and flooding

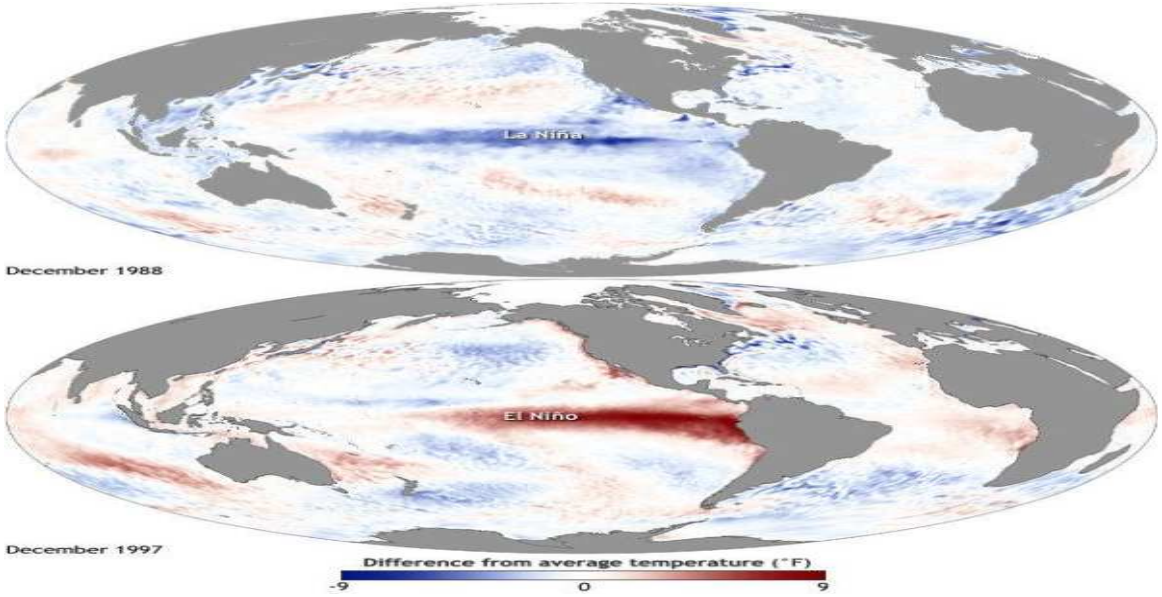
El Niño Impacts and Key Outlook

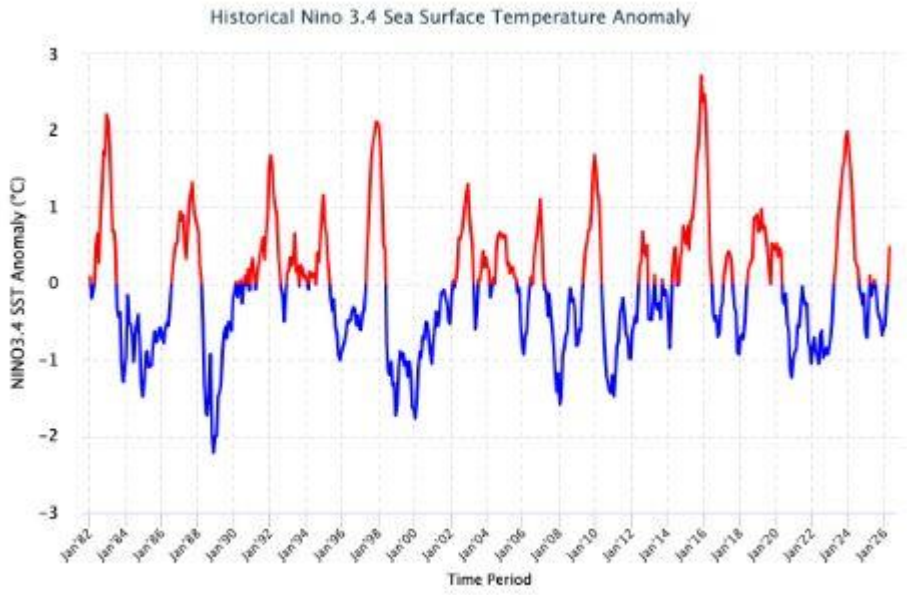
- Drought patterns are highly regional and may persist beyond the duration of the El Niño event.
- Agricultural drought, water stress and food insecurity may continue for several months after the peak of El Niño.
- Australia and Southeast Asia may experience multi-season droughts, with impacts becoming more severe during stronger El Niño events.
- Southern Africa, Central America, northern South America, the Sahel, and the Indian Ocean region may face significant drought conditions during their respective rainy seasons.
- East Africa, the Middle East, and Central Asia may experience above-normal precipitation, increasing the potential risk of flooding and water-related hazards.
- Southeastern South America (including Argentina, Uruguay, and southern Brazil) as well as the western United States, may experience increased precipitation from autumn through spring.
- Global agricultural commodity prices remain highly uncertain. Wheat and maize prices are generally expected to increase slightly across most El Niño categories, although projections for an unprecedented event should be interpreted with caution due to model limitations.
- 2026/27 Outlook: The high probability of El Niño highlights the need for early warning, anticipatory action, and proactive water and climate-risk management.

Niño 3.4 index

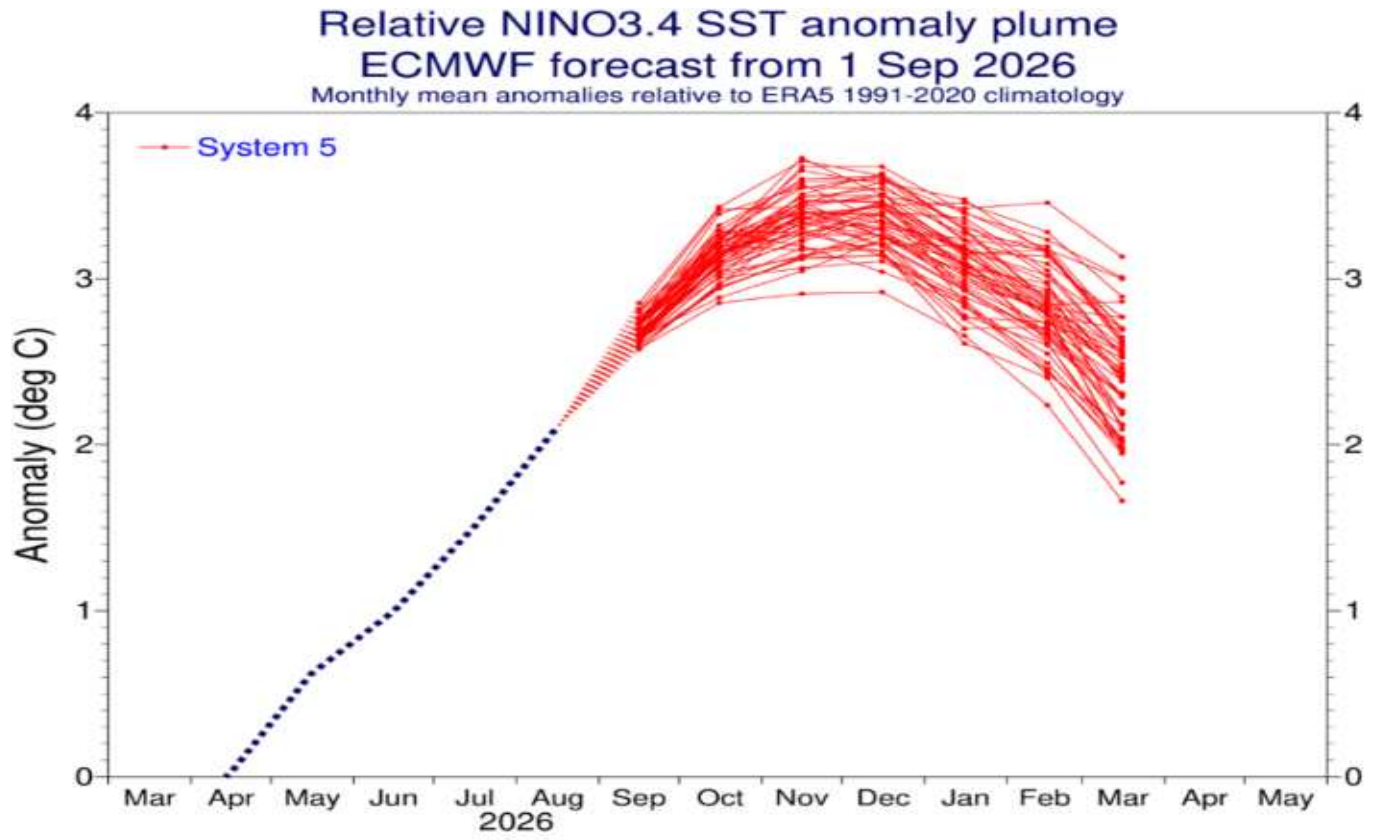
- **It is still not clear that man-made climate change is intensifying El Niño**. However, a warmer atmosphere and ocean can increase the heat and moisture for extreme weather.
- The Niño 3.4 index, is a closely measure of ocean temperatures in the central tropical Pacific.
- An averaged 1.5°C above normal was measured from May through July.
- By July, it had reached 2°C, and from late July through mid-August it reached as high as 2.6 degrees.

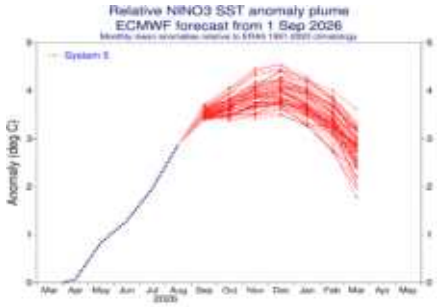


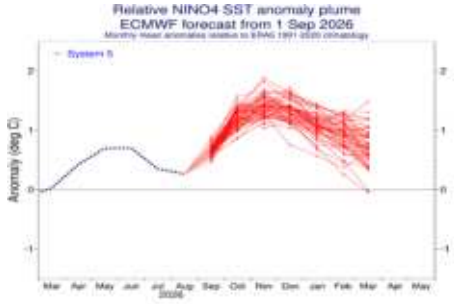


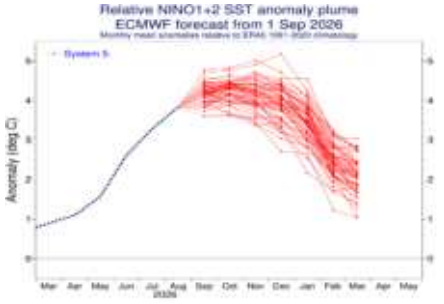


Sea Surface Temperature Forecasts in the Southern Oscillation–El Niño (ENSO) Index Regions (ECMWF Model) – September





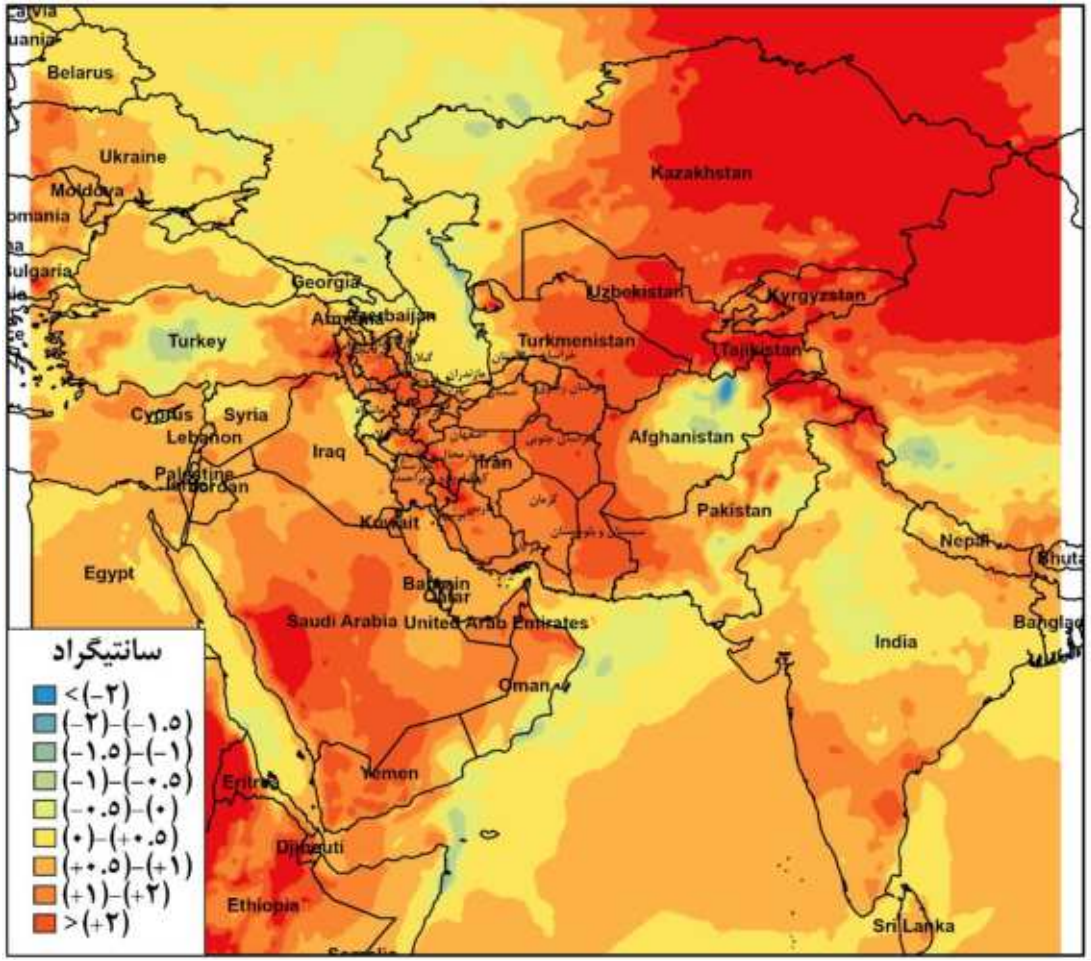




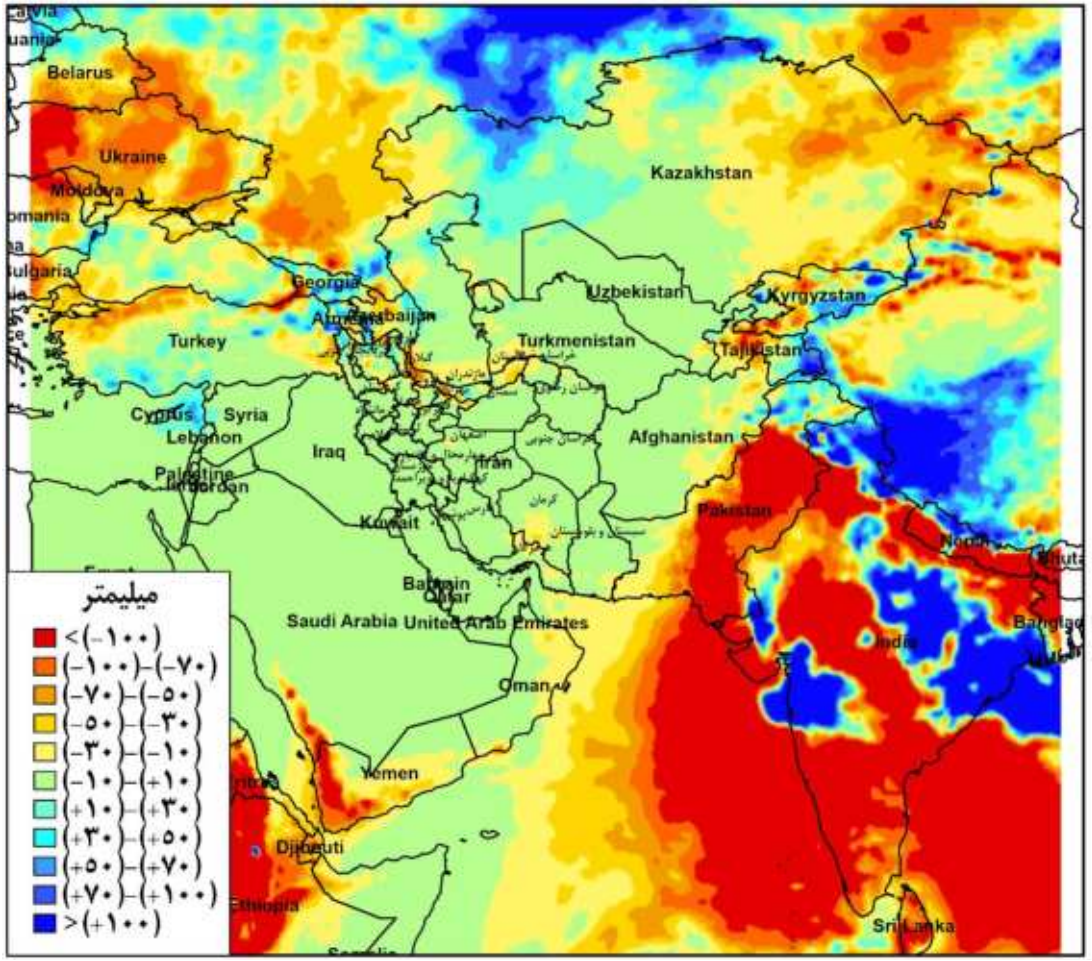
Spatial Patterns and Anomalies for JJA 2026 Relative to Long-Term (1980–2026 ERA5)

JJA 2026 Temperature and Precipitation Anomalies Relative to Long-Term Mean

Temperature Anomalies (C^0)

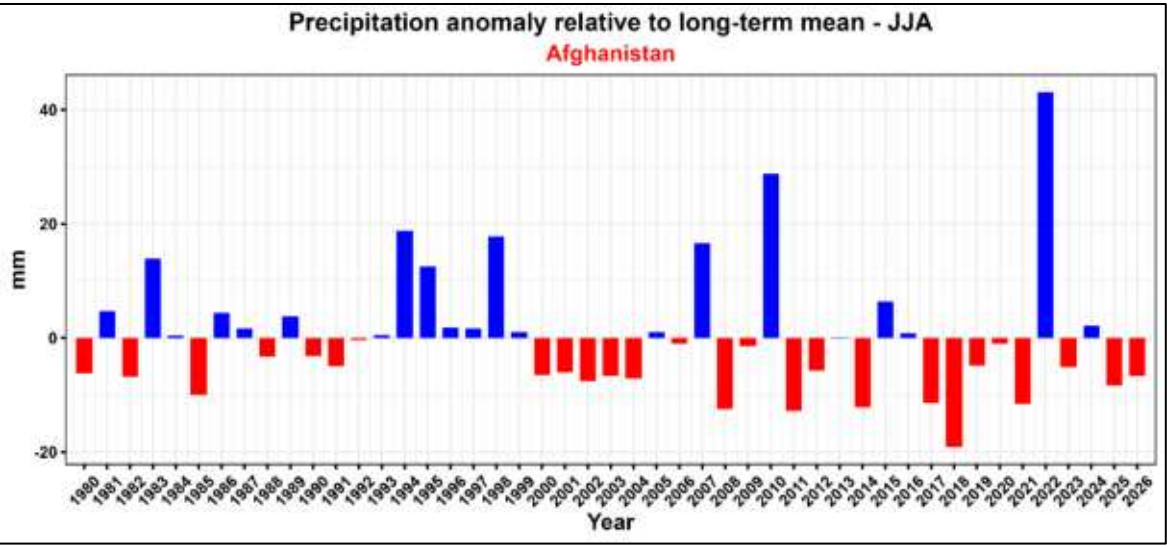


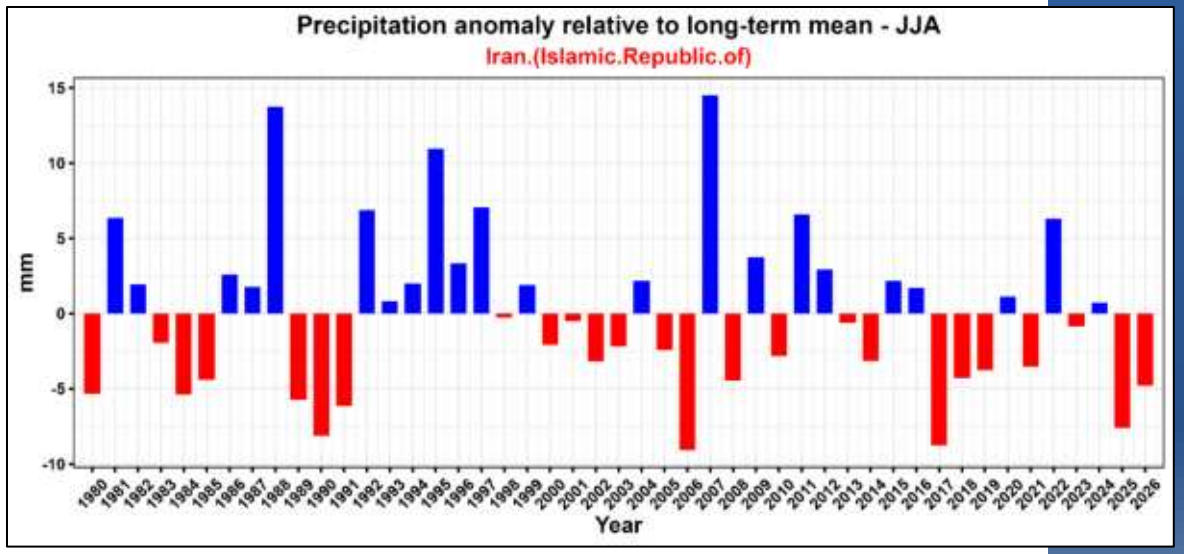
Precipitation Anomalies (mm)

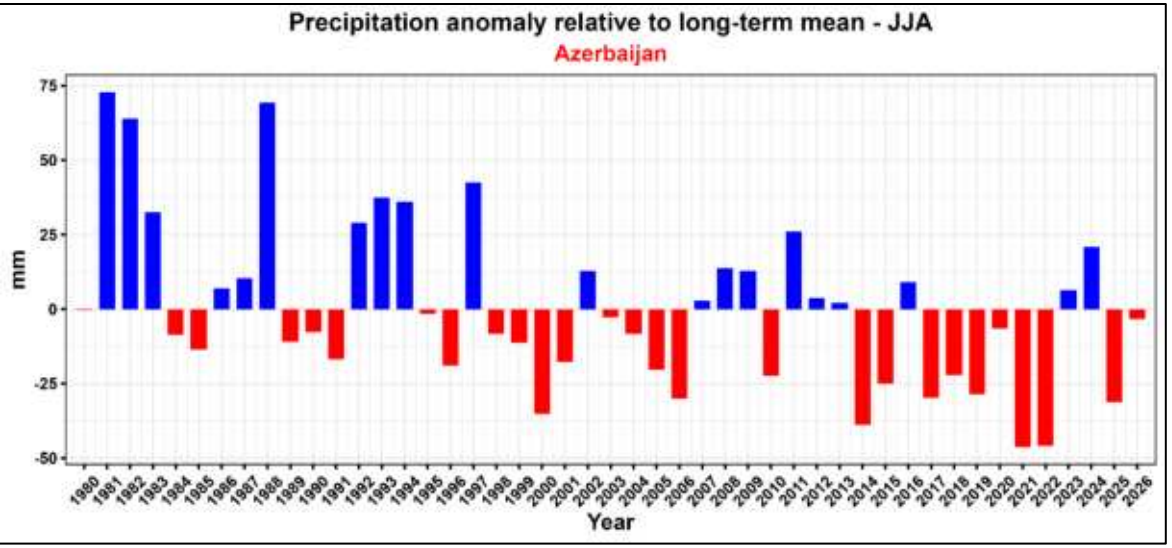


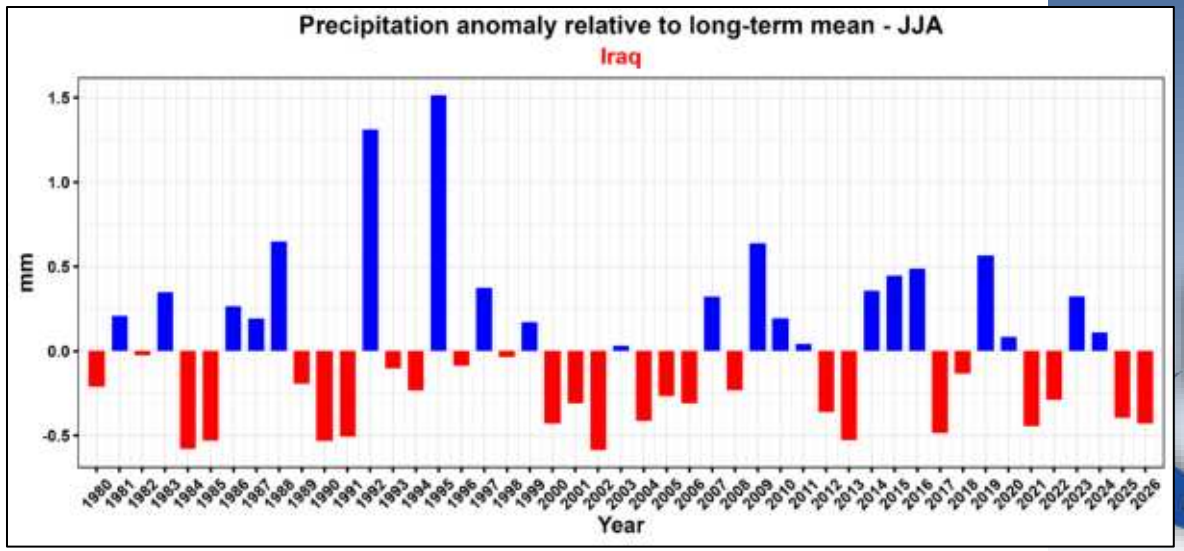
Time series of precipitation anomalies relative to the long-term mean

June–July–August (JJA)



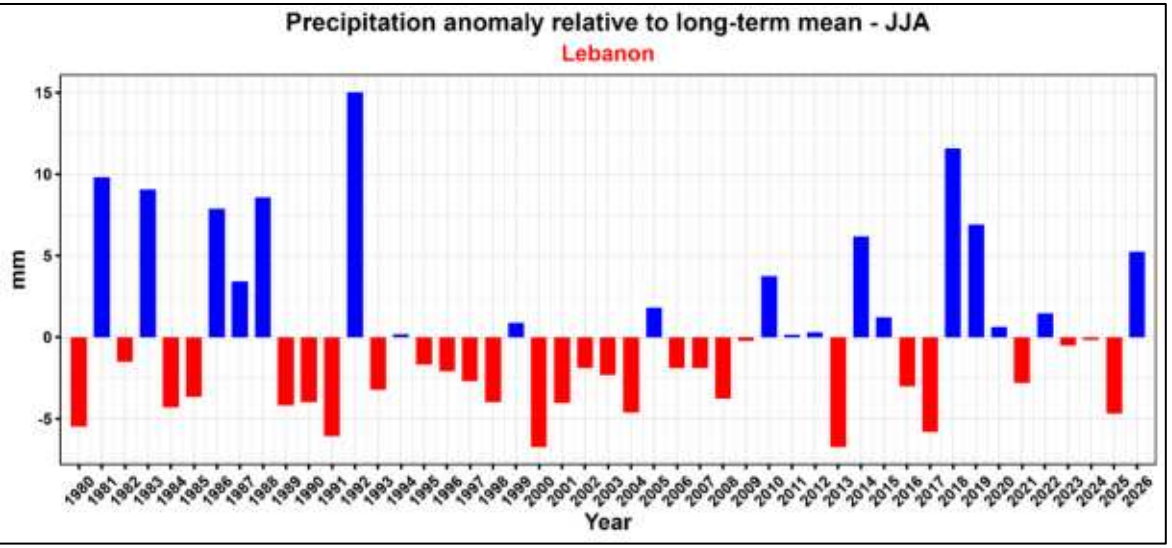


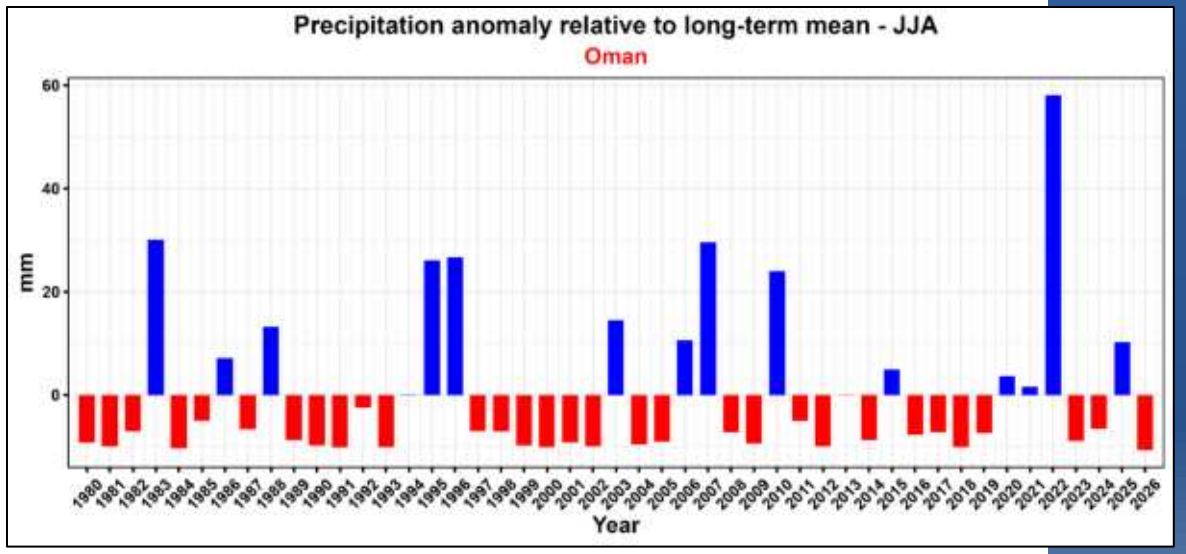


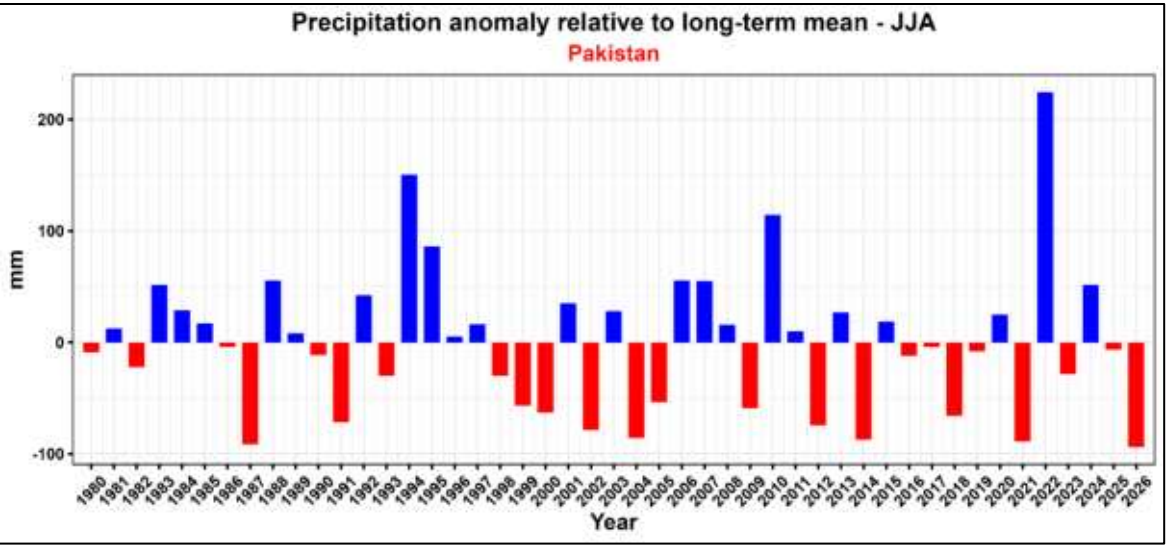


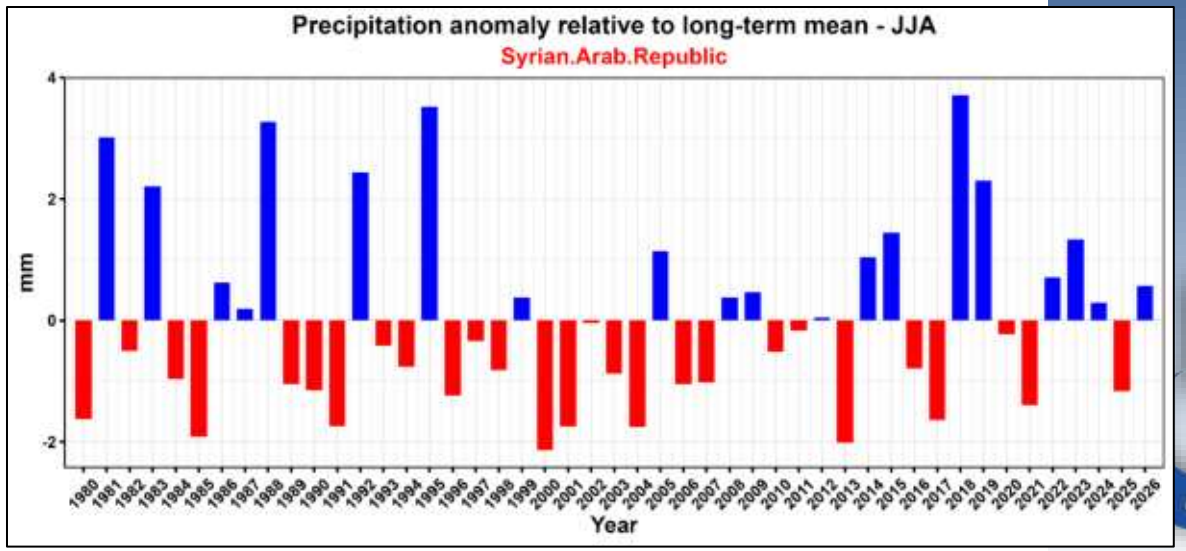
Time series of precipitation anomalies relative to the long-term mean

June–July–August (JJA)



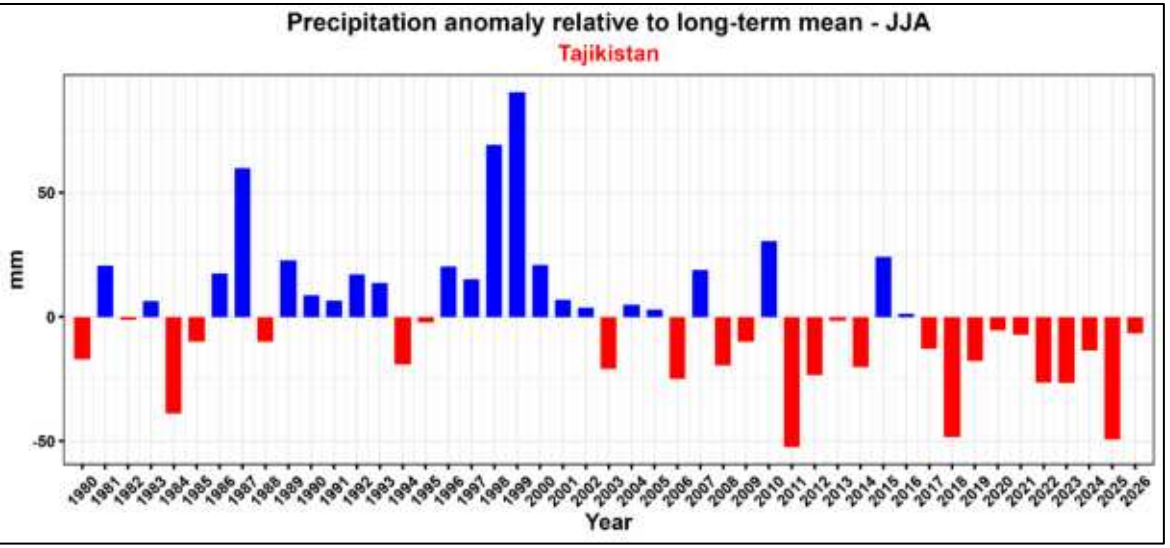


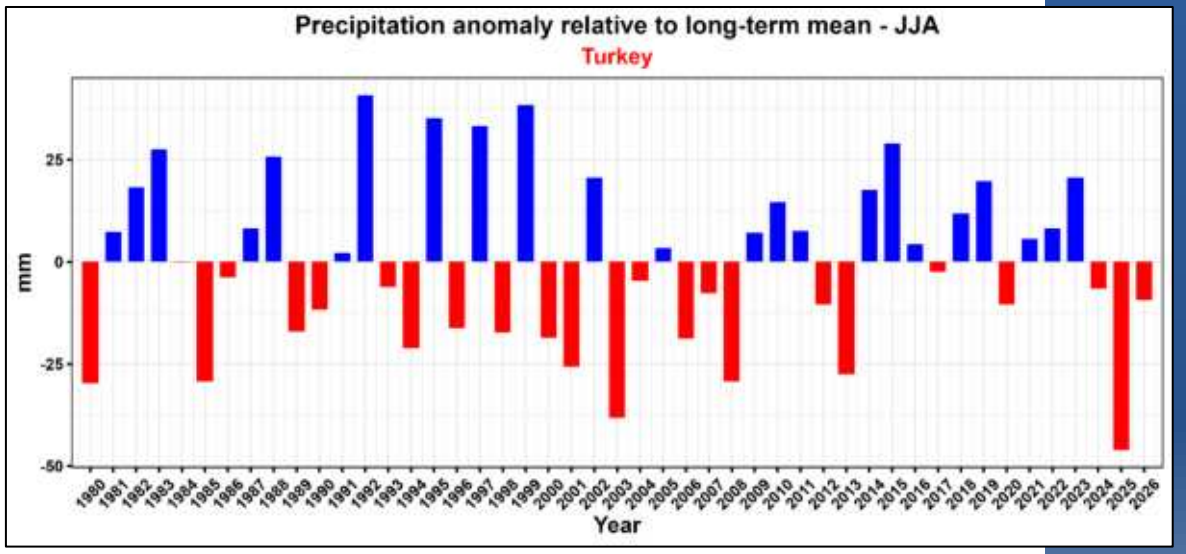




Time series of precipitation anomalies relative to the long-term mean

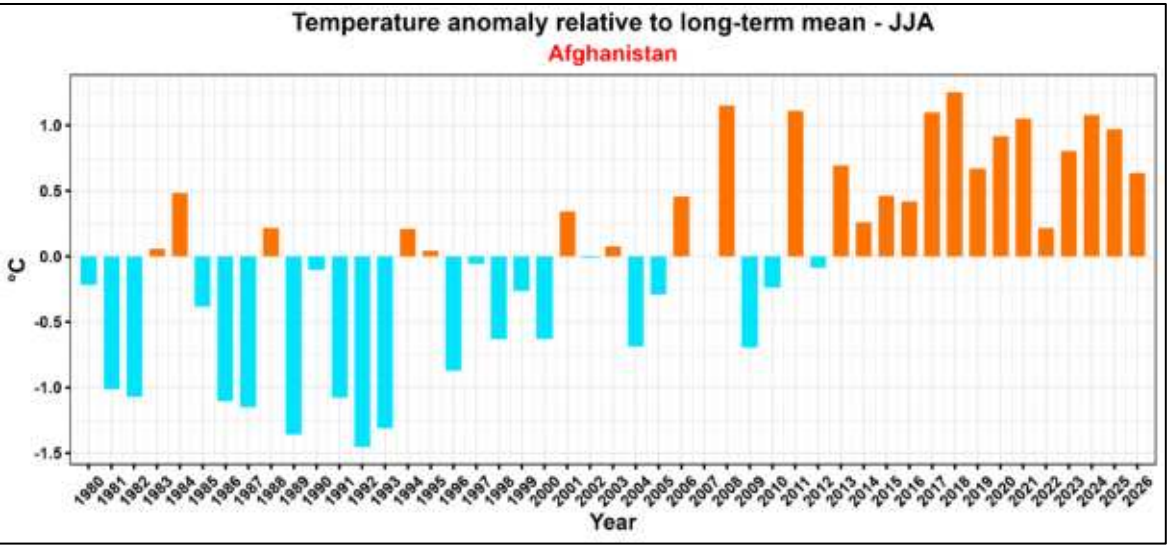
June–July–August (JJA)

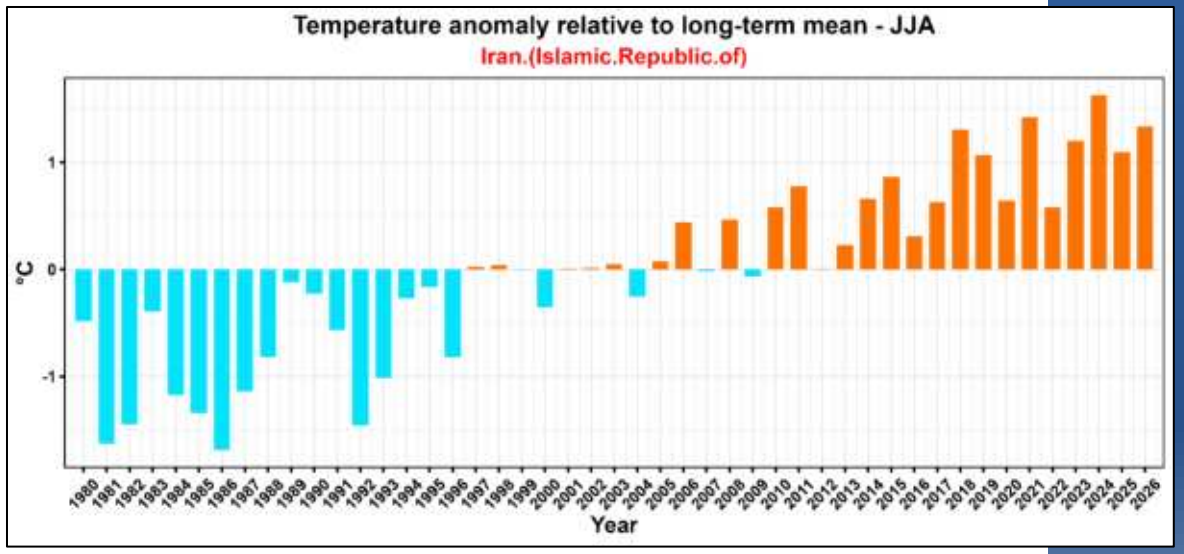


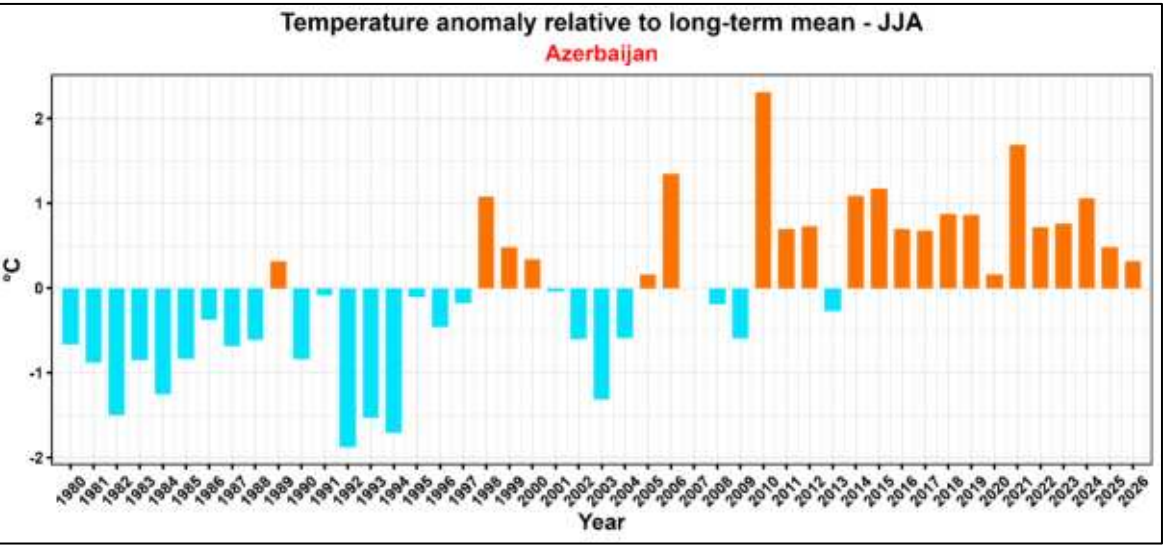


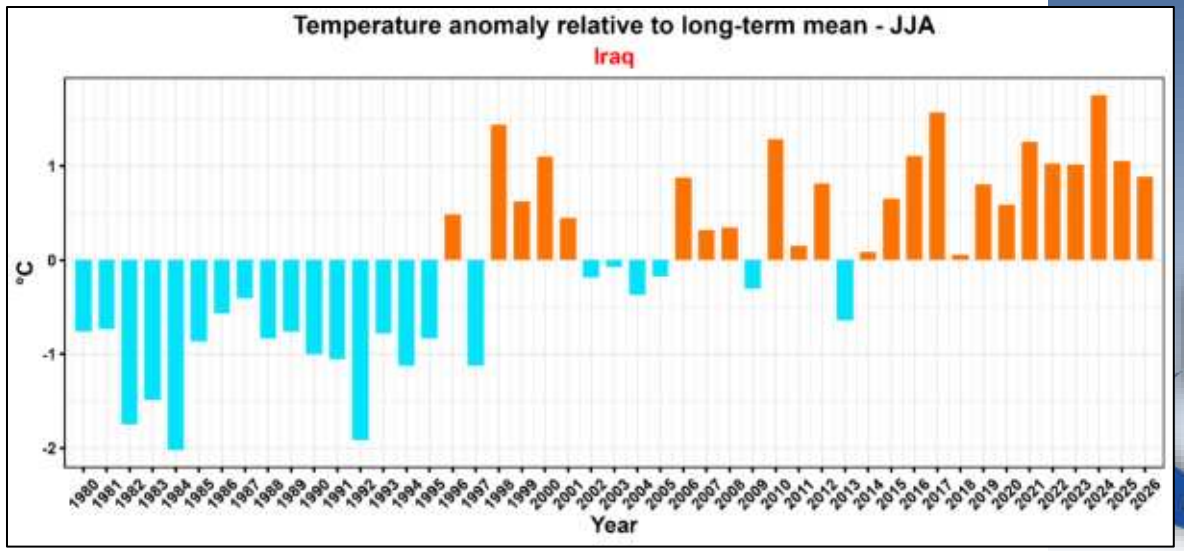
Time series of temperature anomalies relative to the long-term mean

June–July–August (JJA)



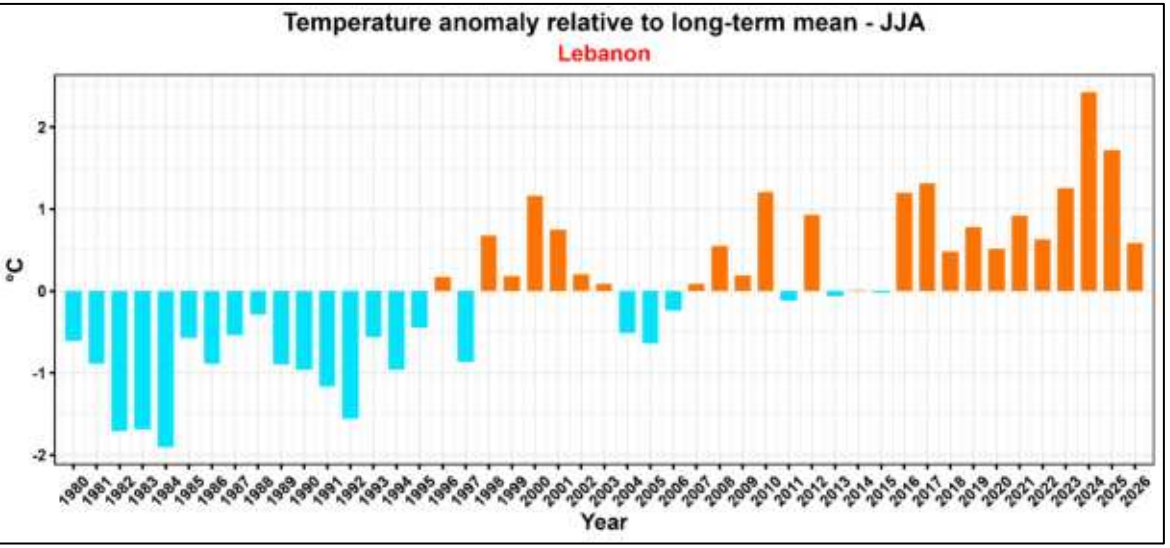


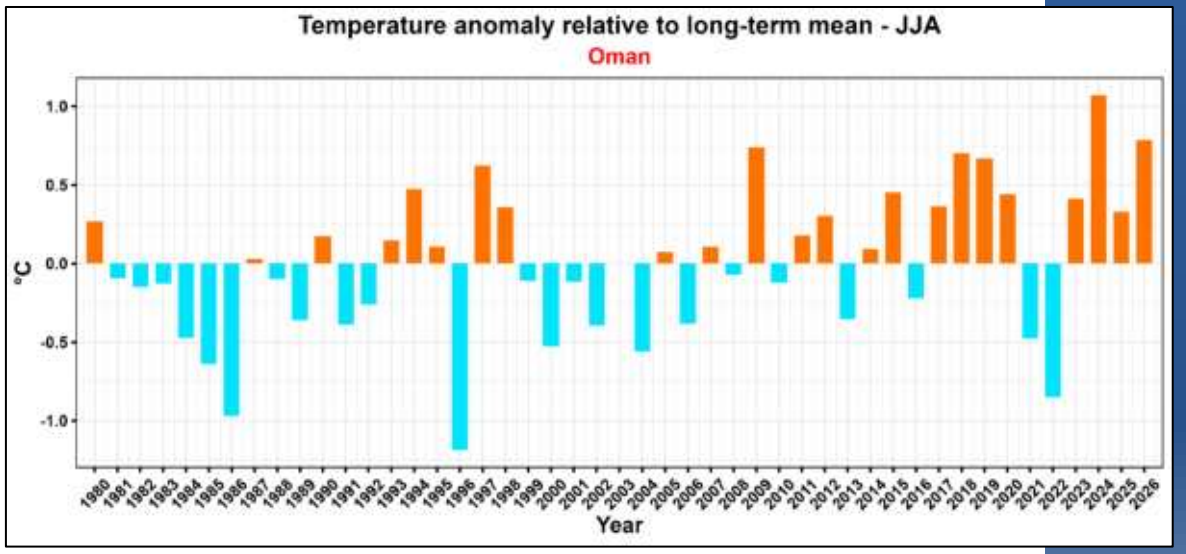


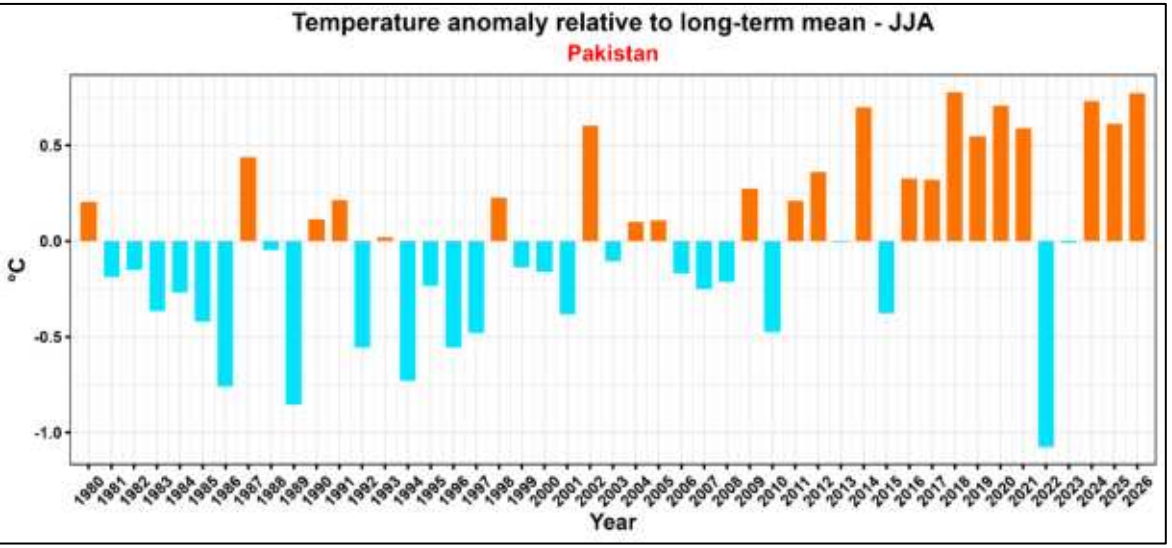


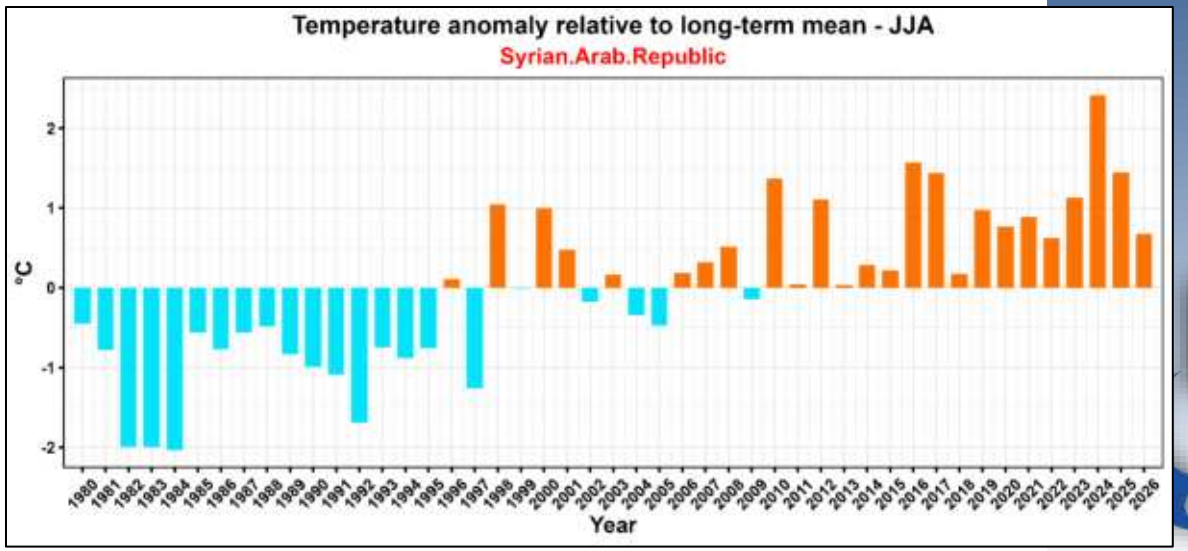
Time series of temperature anomalies relative to the long-term mean

June–July–August (JJA)









Time series of temperature anomalies relative to the long-term mean

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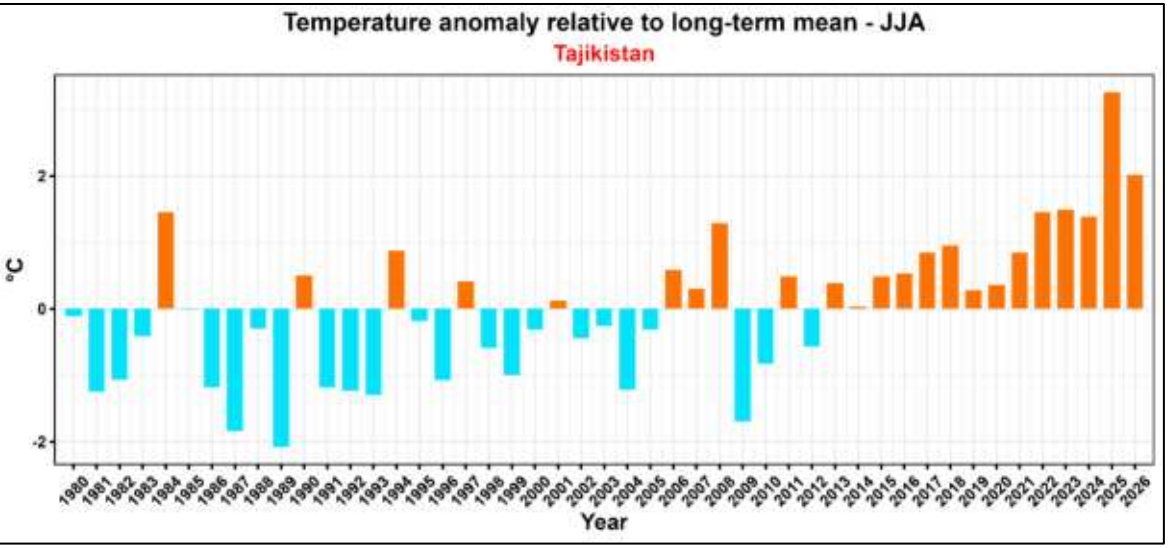
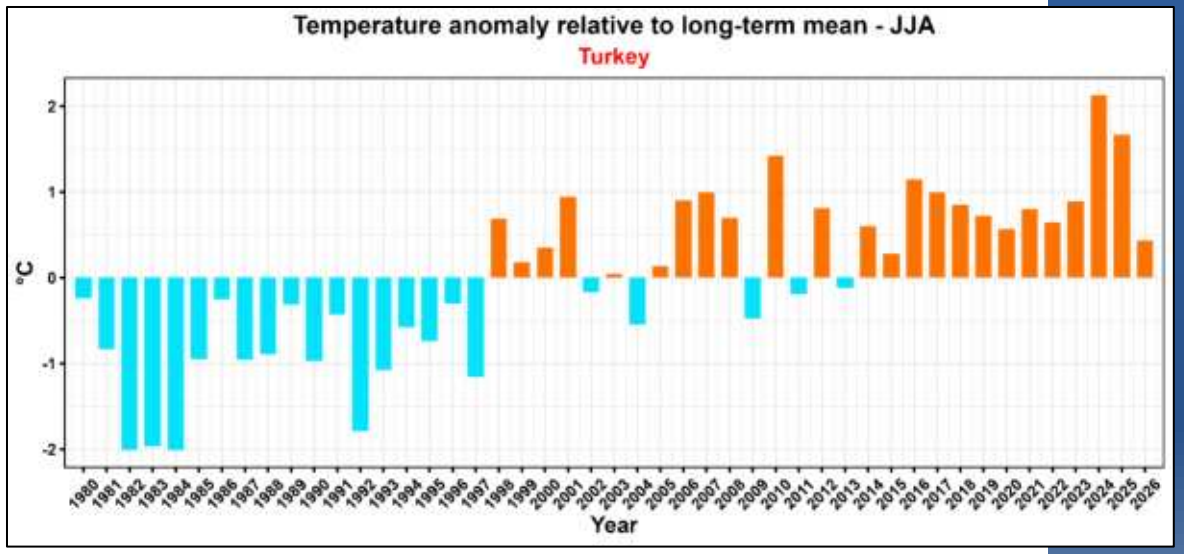




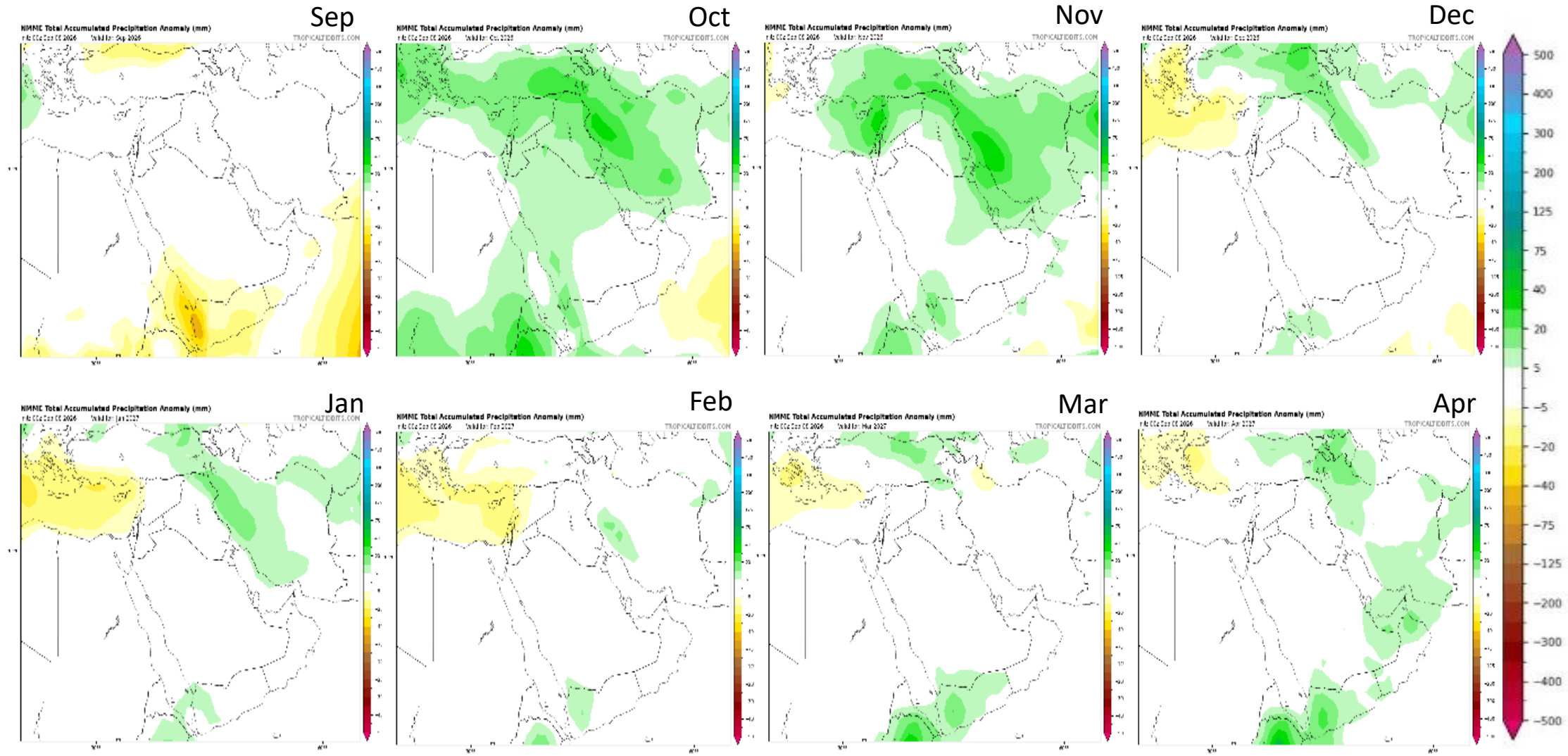
Fall

Comparison of Models Predictions

Rainfall Anomaly Sep 2026-Apr 2027 (NMME Model North America)

Rain is expected mostly in Oct 2026 and Nov 2026, in Iran, Iraq, Syria and Turkey

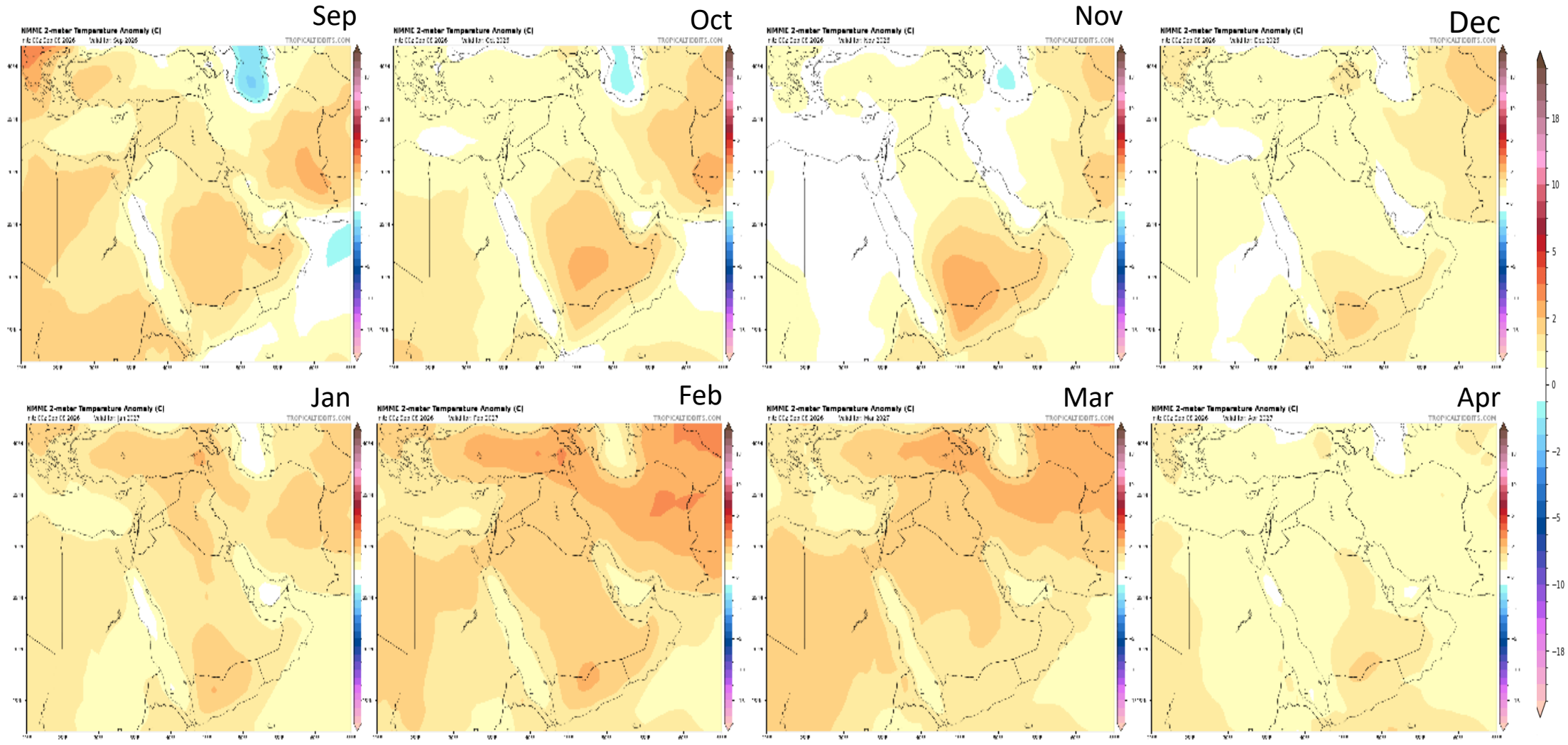
Initial: Sep 2026



Temperature Anomaly Sep 2026-Apr 2027 (NMME Model North America)

Temperature is expected to rise between 1-2 degrees Celsius, mostly expected in Feb and March 2027

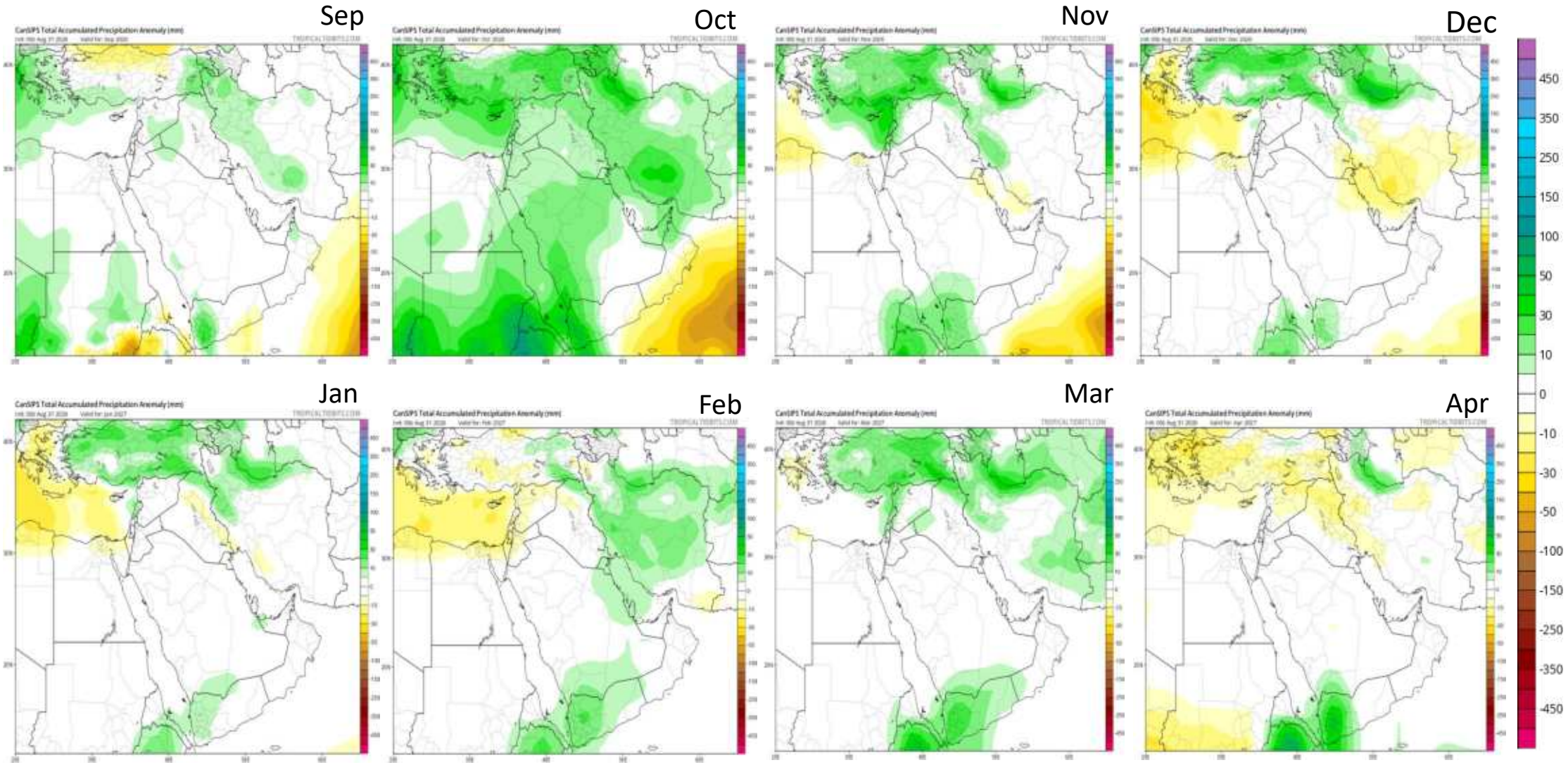
Initial: Sep 2026



Rainfall Anomaly Sep 2026-Apr 2027 (CanCIPS Model Canada)

Rain is expected in Oct 2026 and Nov 2026 and March 2027, in Iran, West and South Contries and Turkey

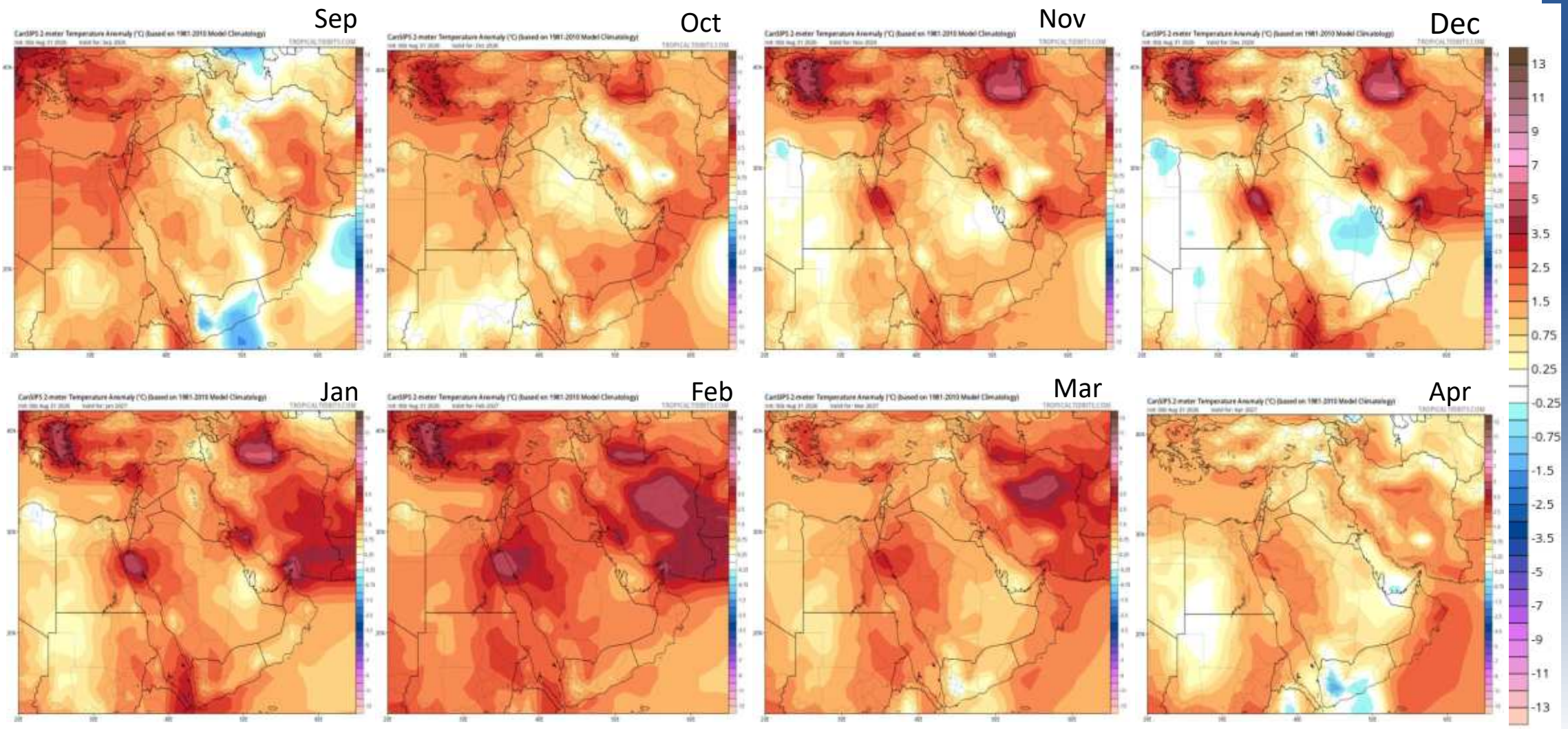
Initial: Sep 2026



Temperature Anomaly Sep 2026-Apr 2027 (CanCIPS Model Canada)

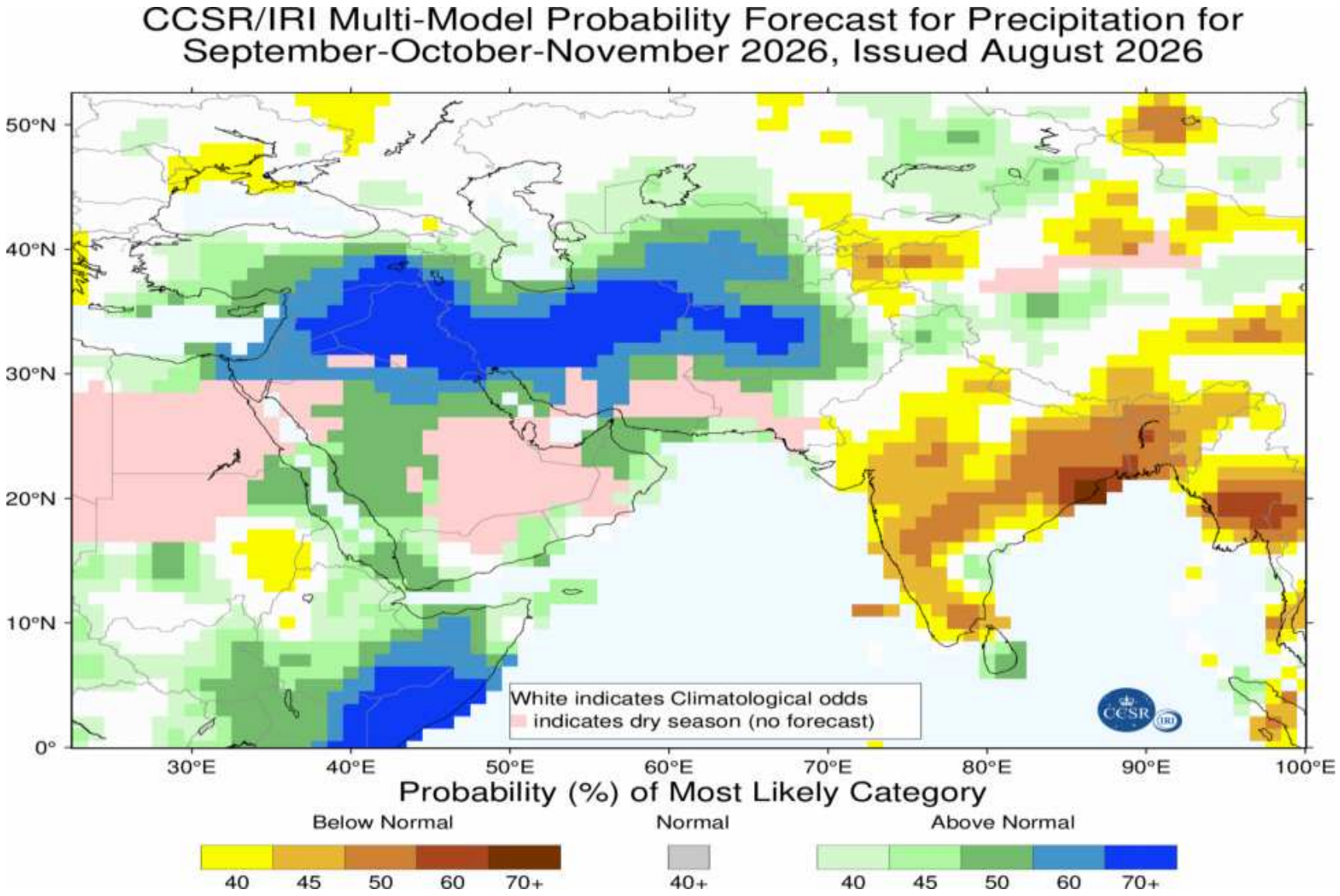
Temperature is expected to rise between 1-2 degrees Celsius, mostly expected in Dec 2026 to Mar 2027
In Iran, Afghanistan and Turkey

Initial: Sep 2026

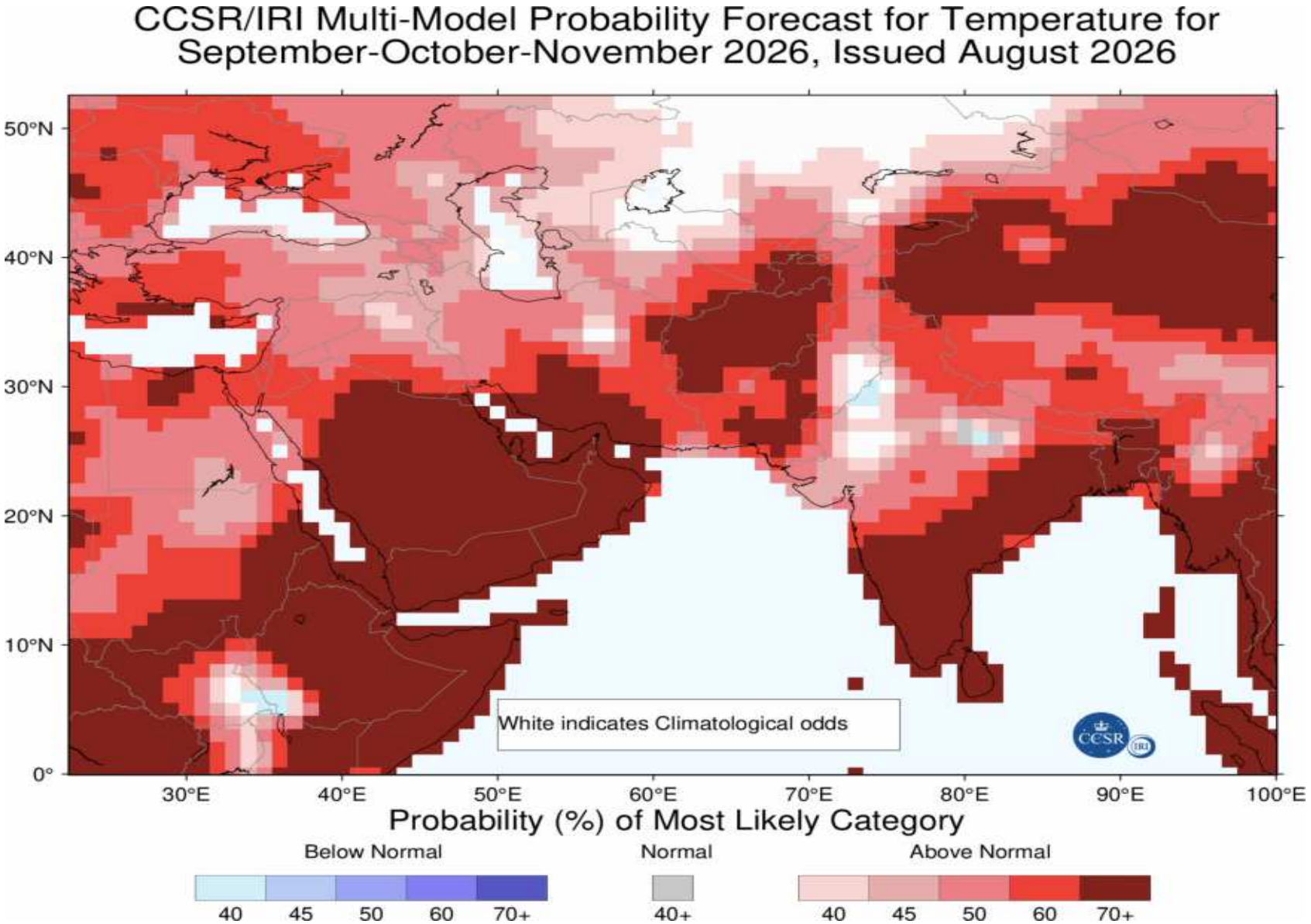


Rainfall Seasonal Anomaly Sep to Nov 2026 (IRI Multi-Model Ensemble)

Rain is expected from Afghanistan to Iraq

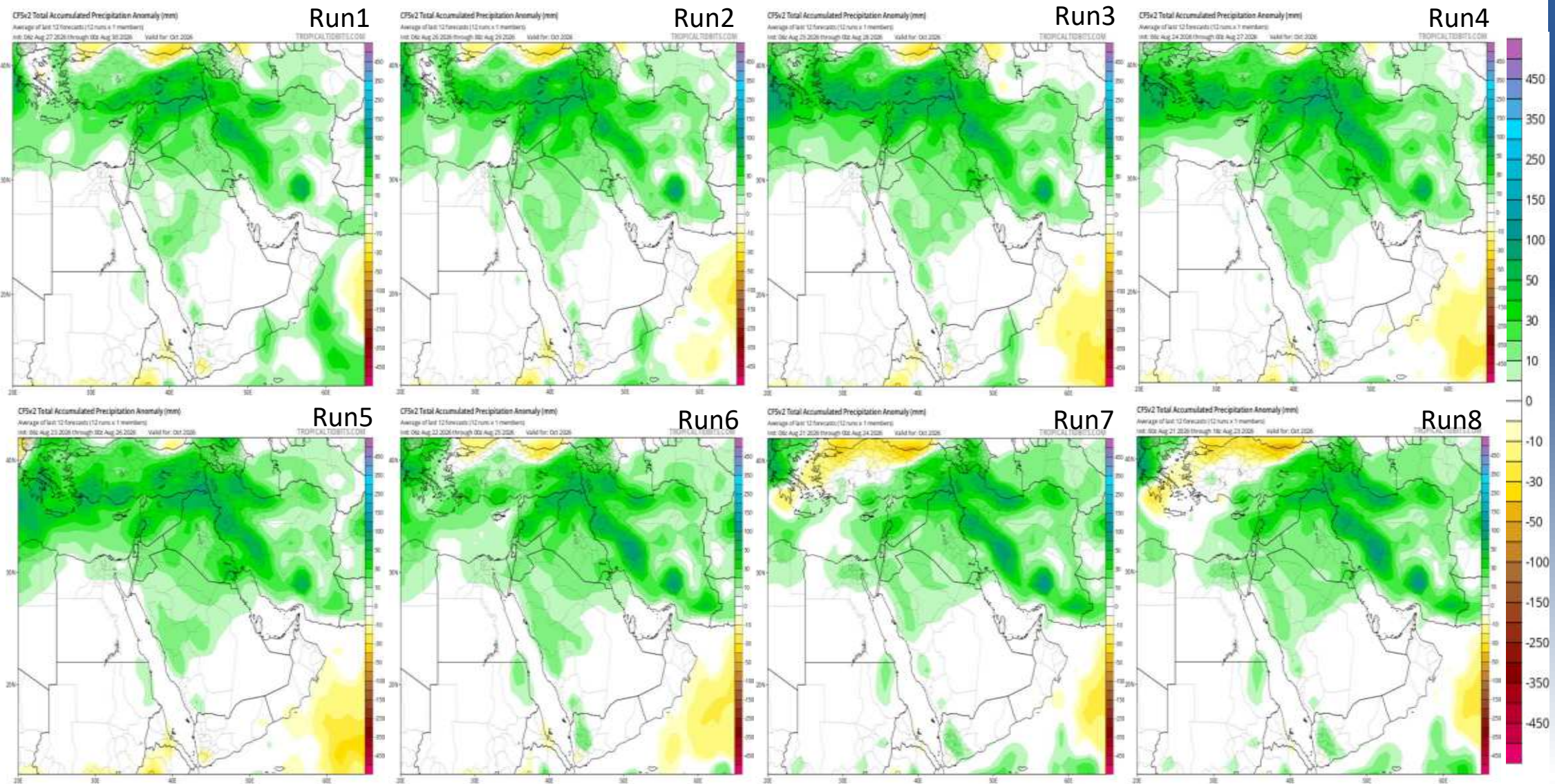


پیش بینی مدل فصلی دانشگاه کلمبیا برای دما در پاییز سال جاری
(سپتامبر، اکتبر، نوامبر) سامانه IRI Multi-Model Ensemble – صادره Jul



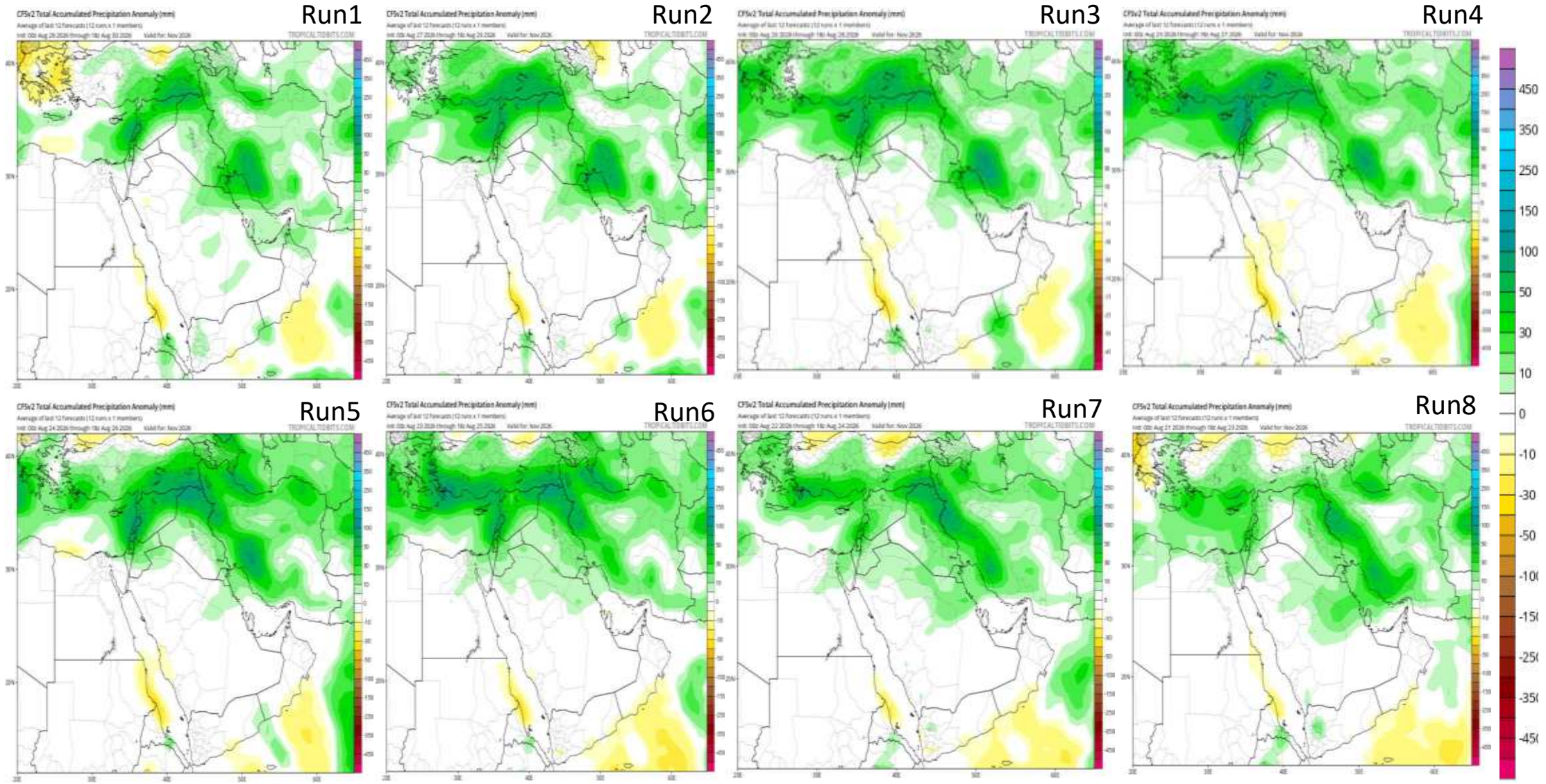
Rainfall Sasonal Anomaly Oct 2026 (CFSv2-America)

Rain is expected in Oct 2026, from Afghanistan to Mediterranean



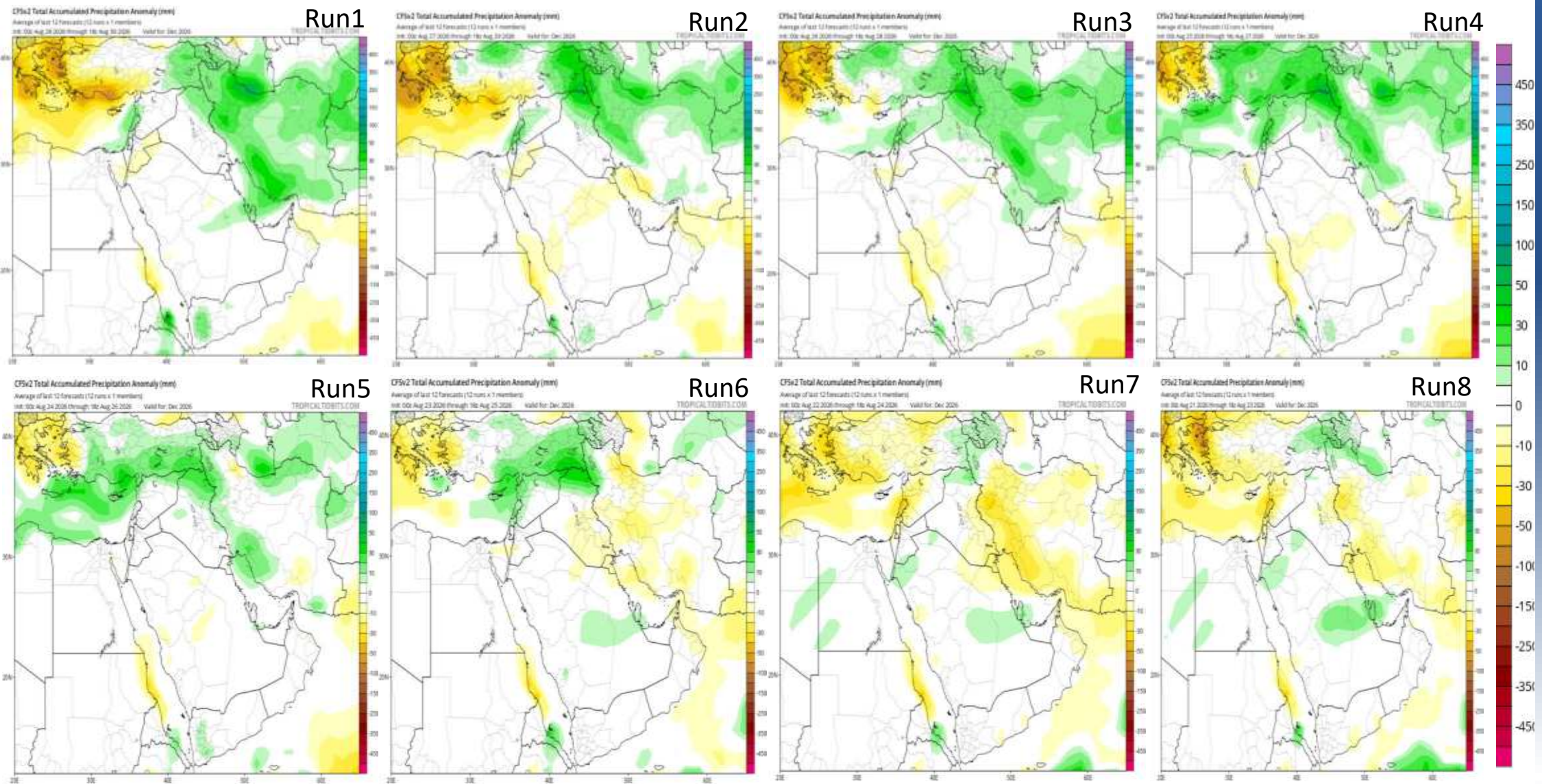
Rainfall Sasonal Anomaly Nov 2026 (CFSv2-America)

Rain is expected in Nov 2026, from Afghanistan to Mediterranean

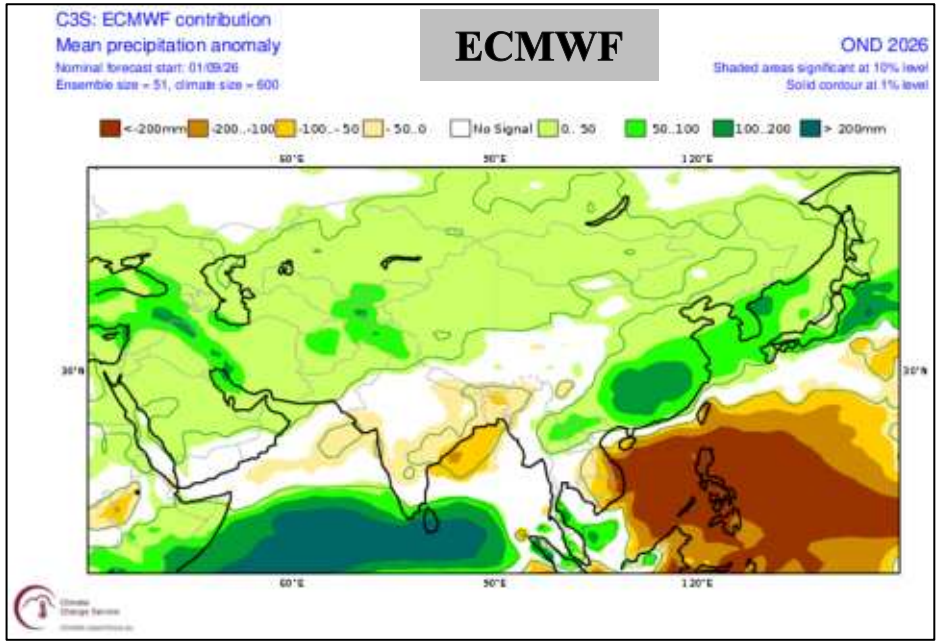


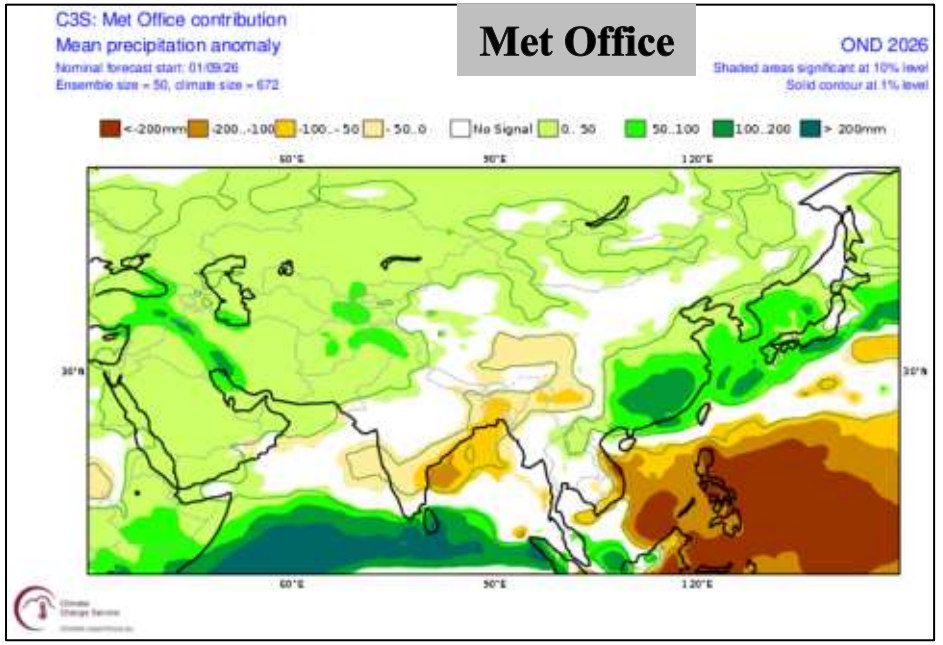
Rainfall Sasonal Anomaly Dec 2026 (CFSv2-America)

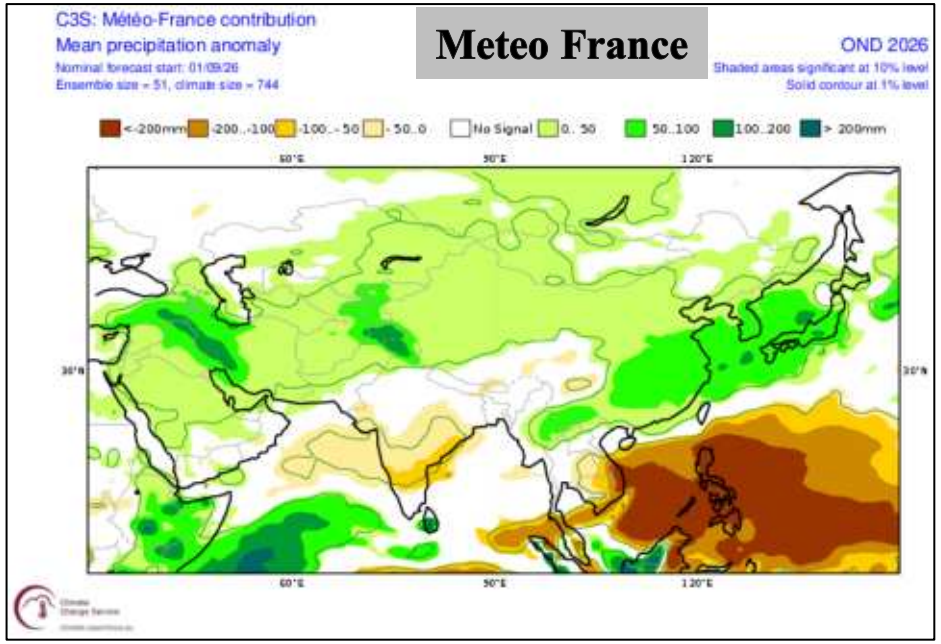
Rain in some models is expected in Dec 2026, in Afghanistan, Turkey and Iran

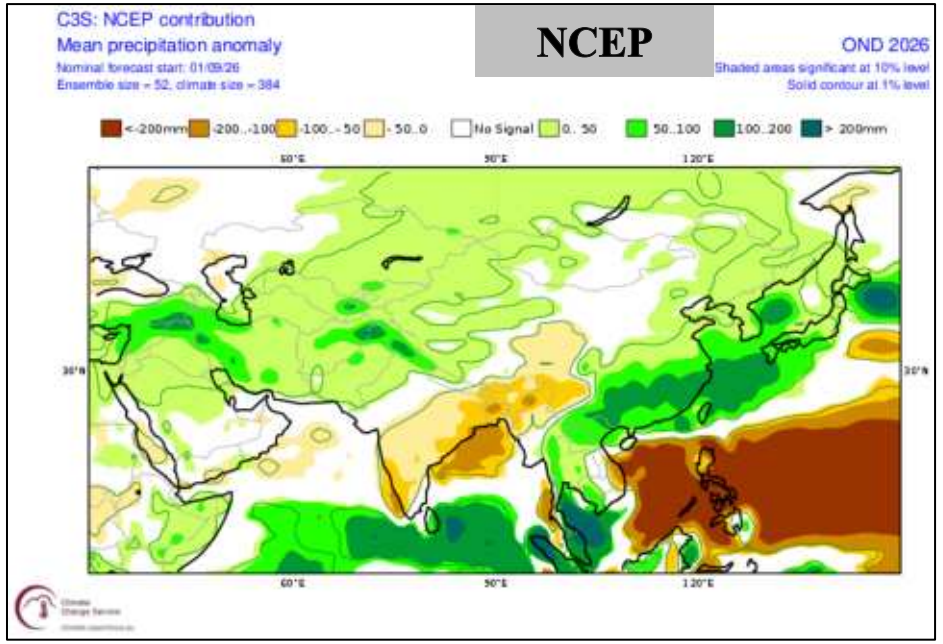


Mean Precipitation Anomaly-Model Prediction from Sep to Nov 2026

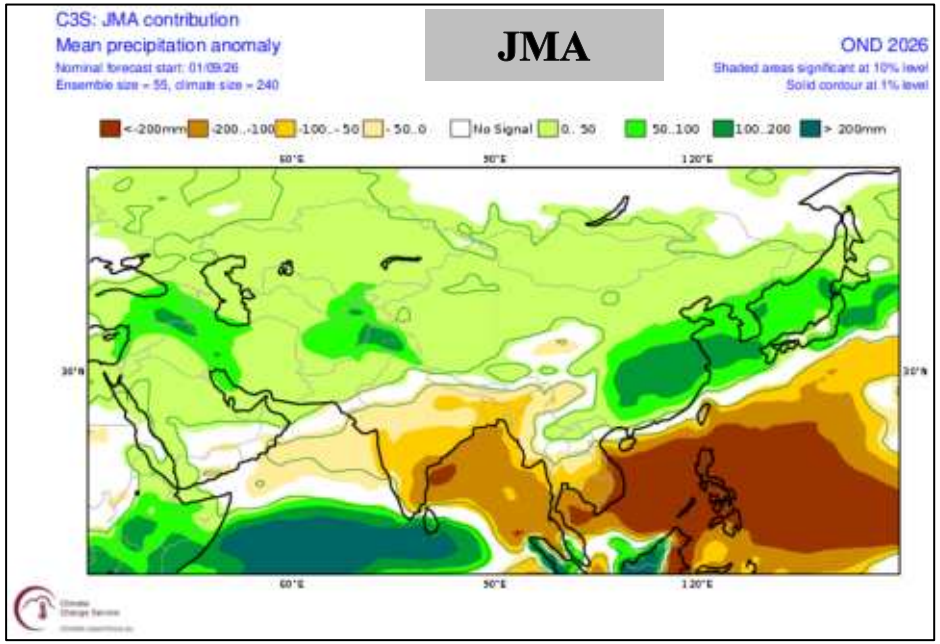


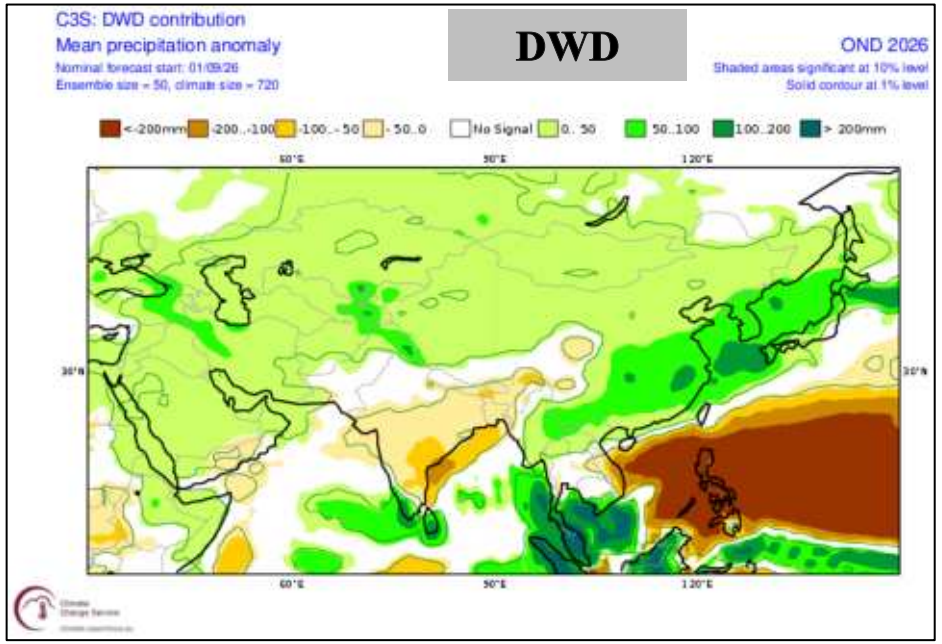




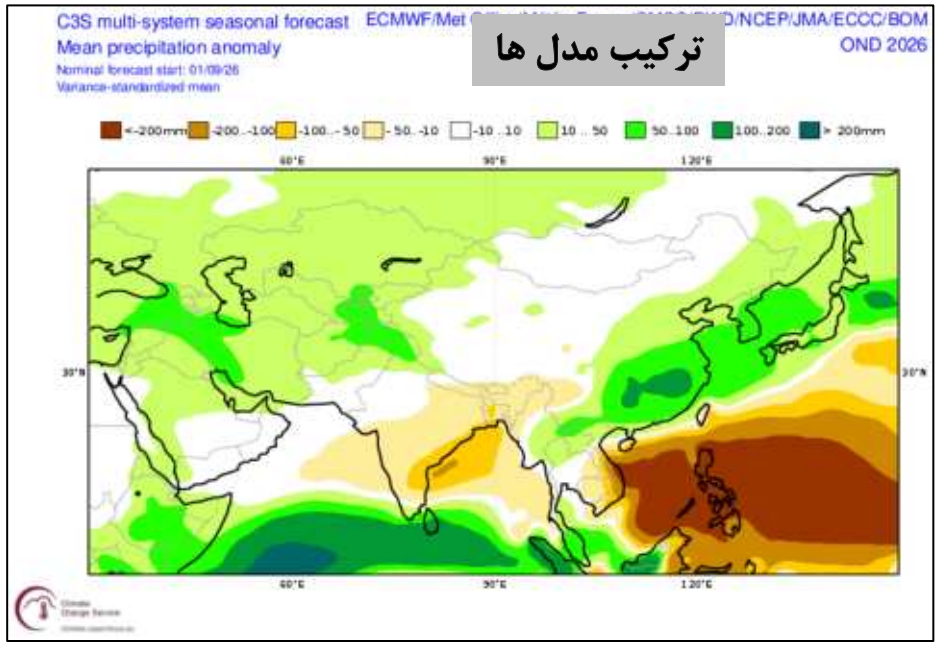


Mean Precipation Anomaly-Model Predictiond from Sep to Nov 2026

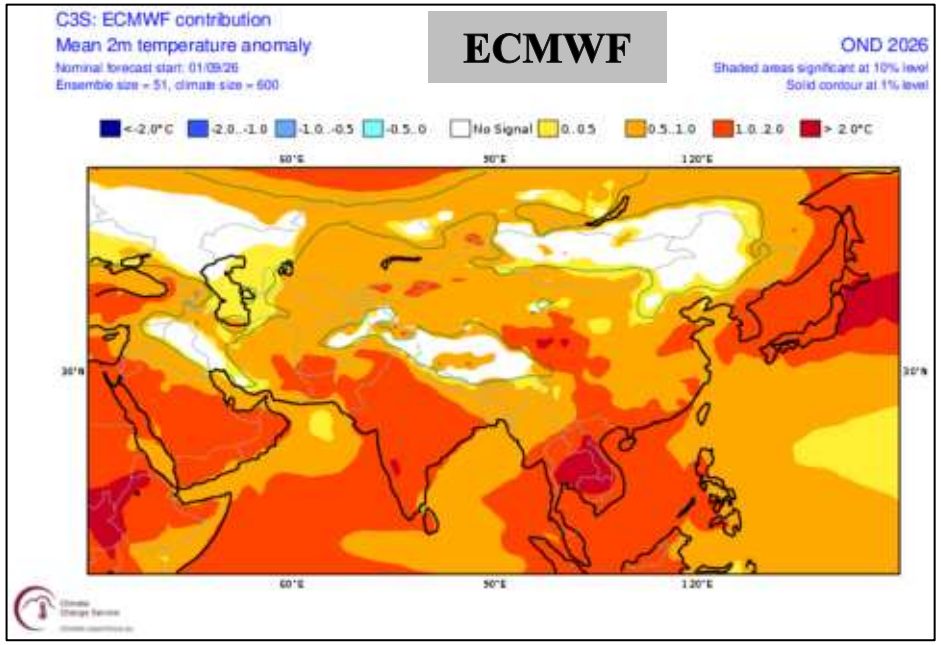


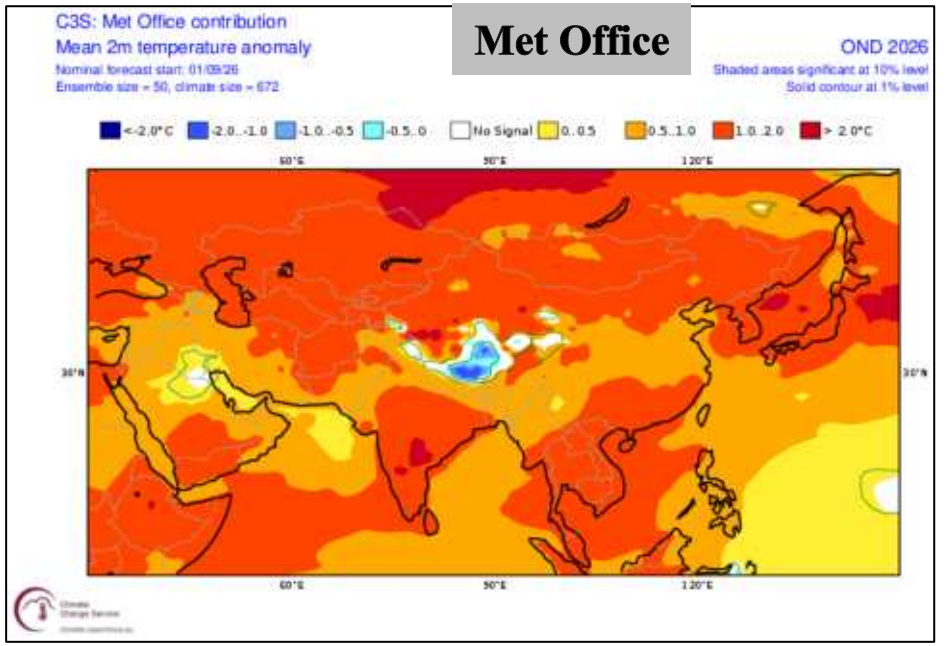


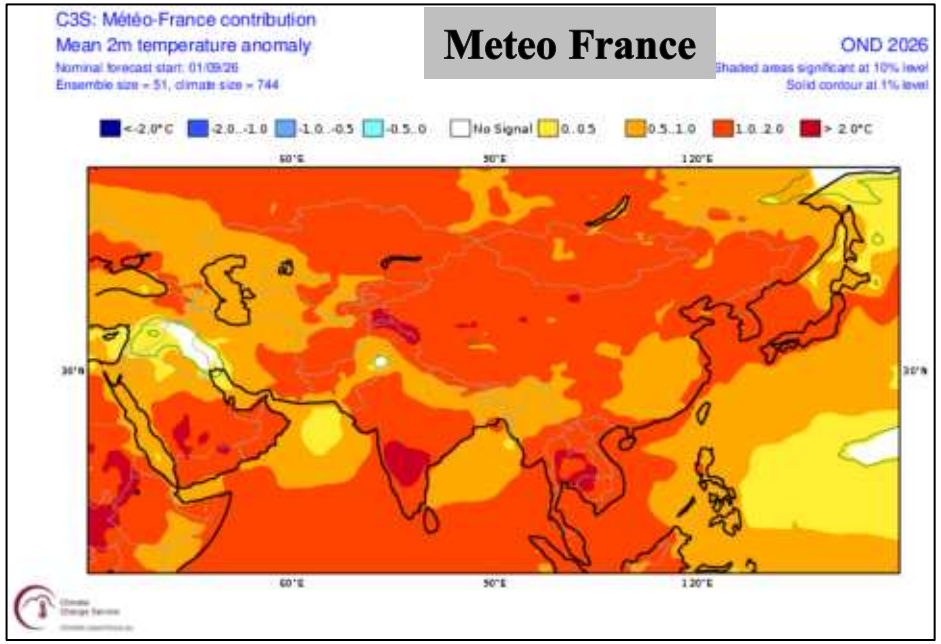
نام مدل	کشور
Met Office	England
ECMWF	Euro
NCEP	USA
Meteo France	France
DWD	Germany
JMA	Japan

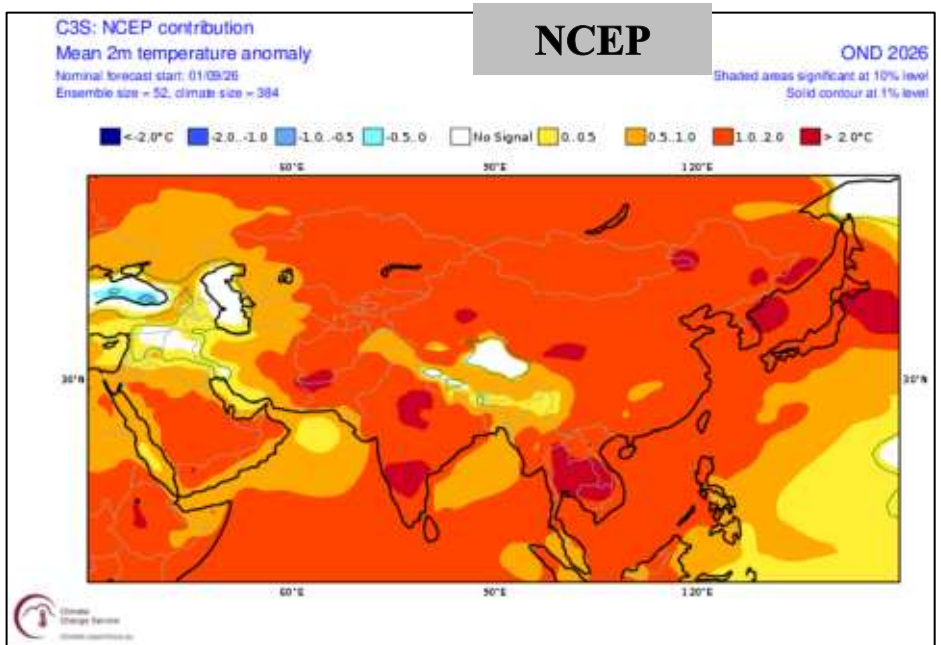


Mean 2m Temerature Anomaly-Model Predictiond from Sep to Nov 2026

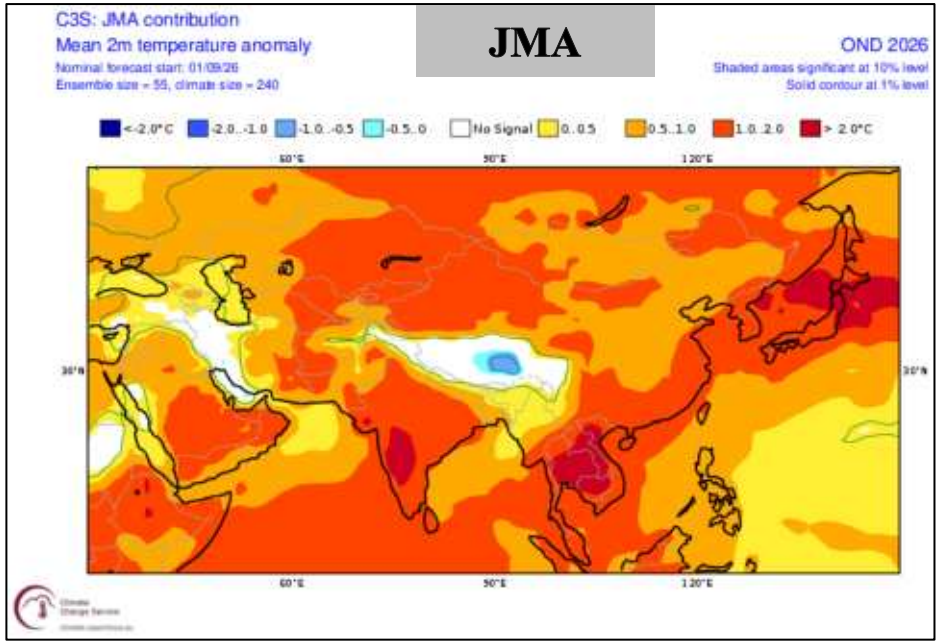


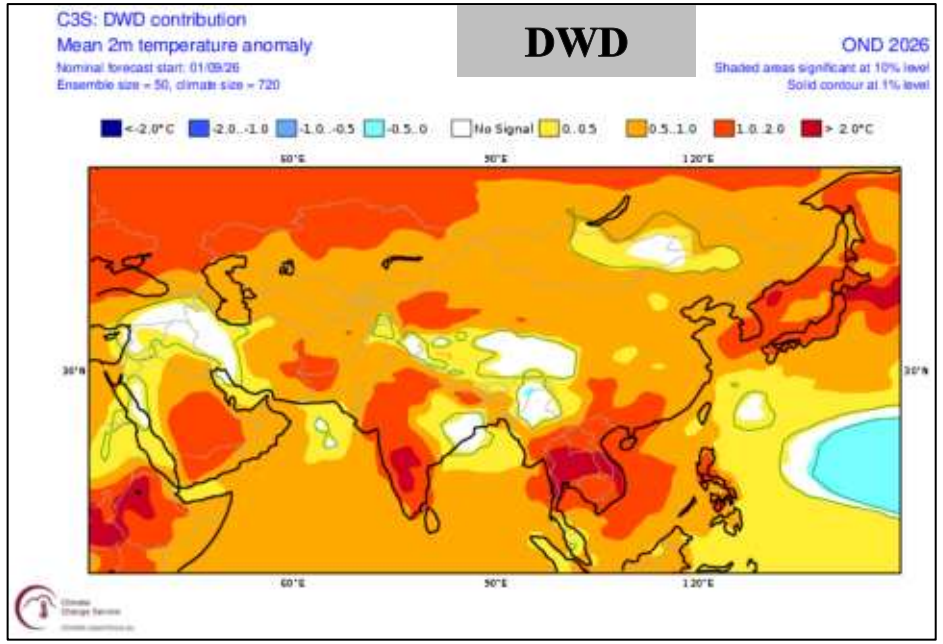






Mean 2m Temerature Anomaly-Model Predictiond from Sep to Nov 2026





نام مدل	کشور
Met Office	England
ECMWF	Euro
NCEP	USA
Meteo France	France
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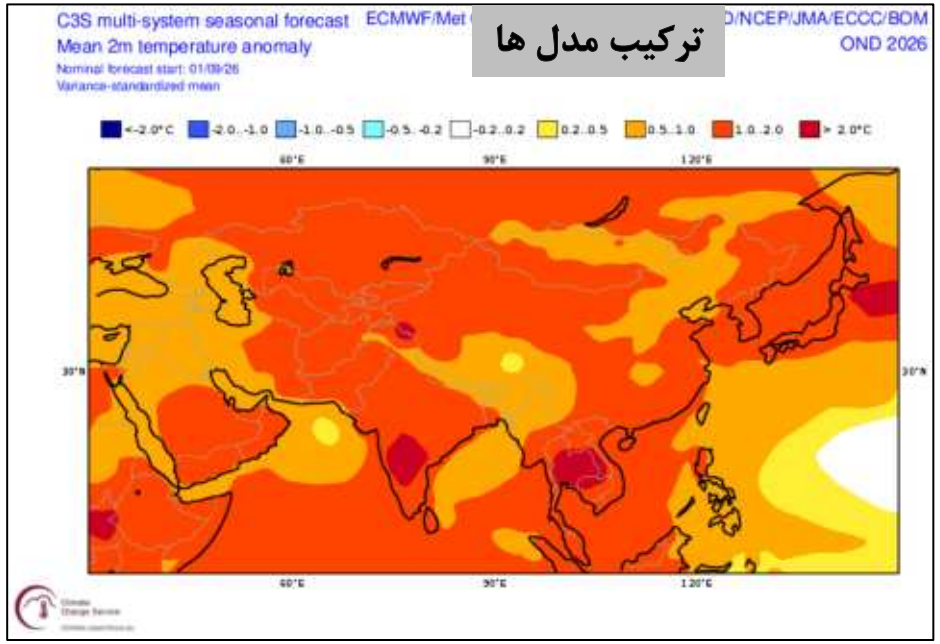
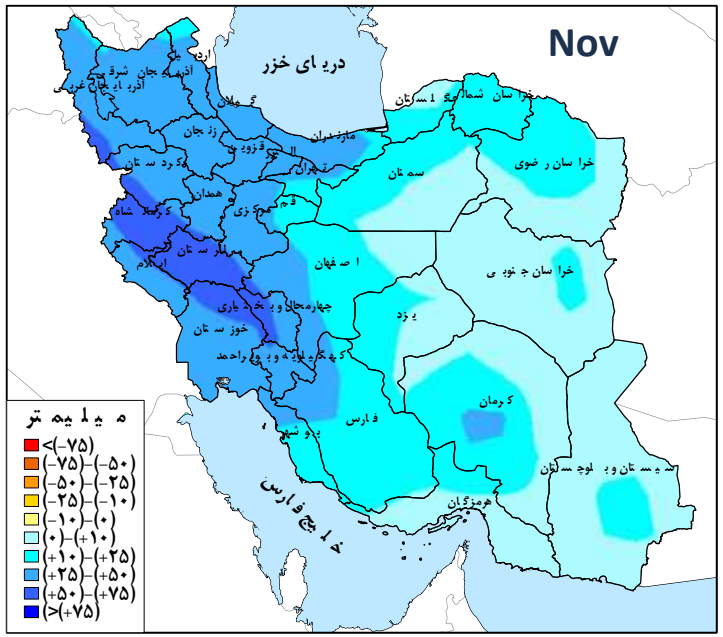
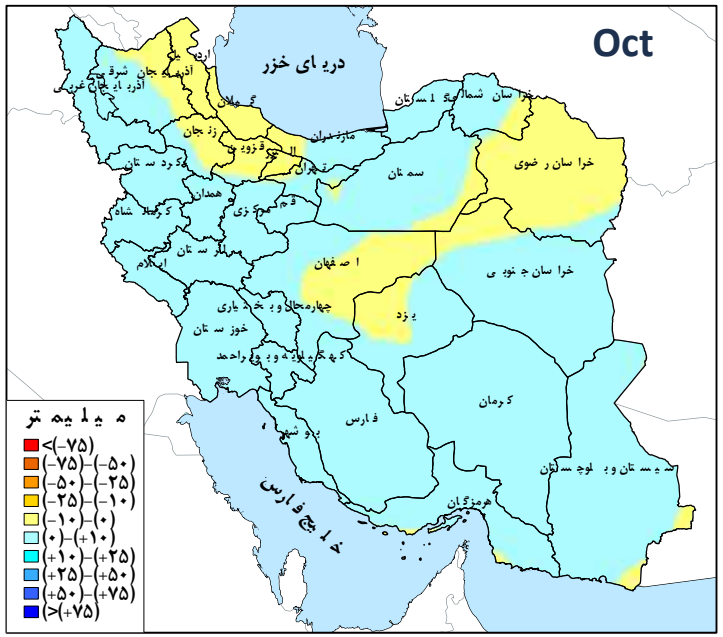


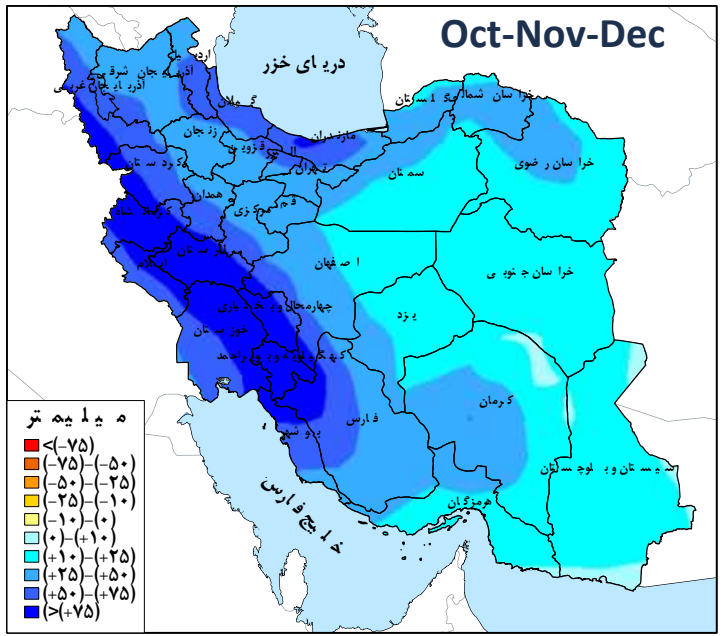
Precipitation and Temperature Anomaly

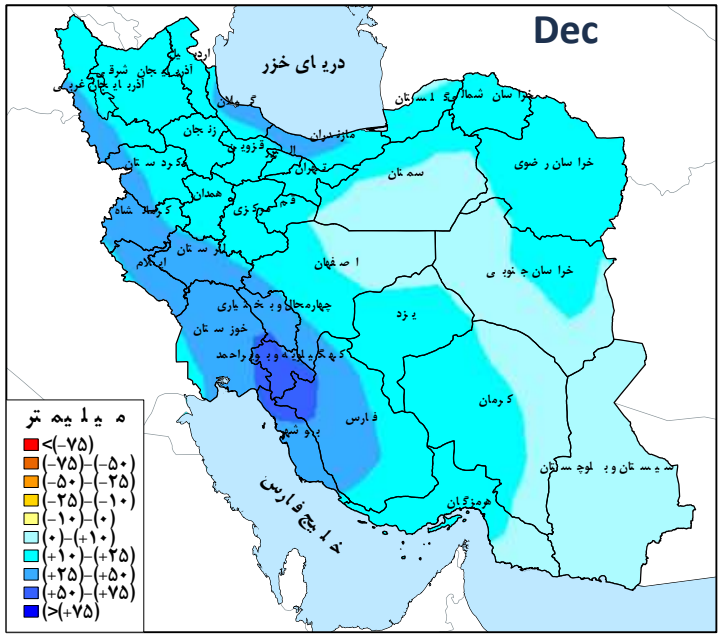
(Water Research Institute Iran, Sep 2026)

Mean Precipation Anomaly-Model Predictiond from Oct to 31 Dec 2026

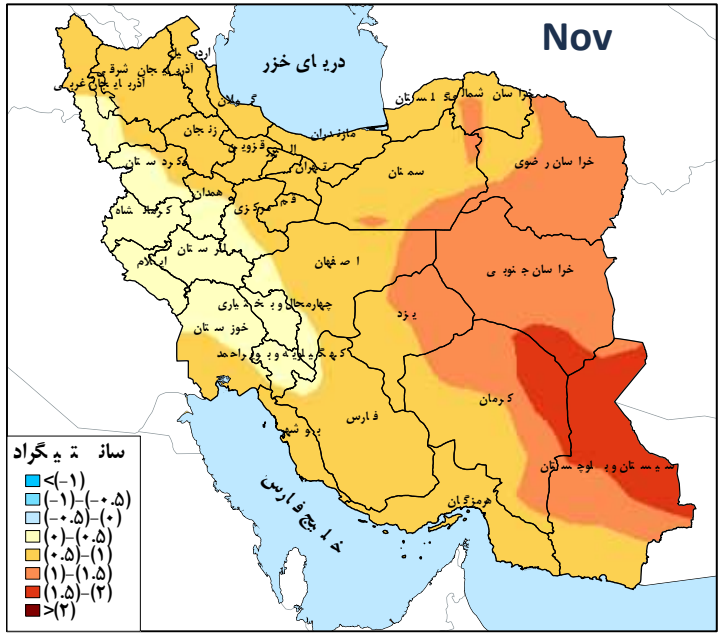


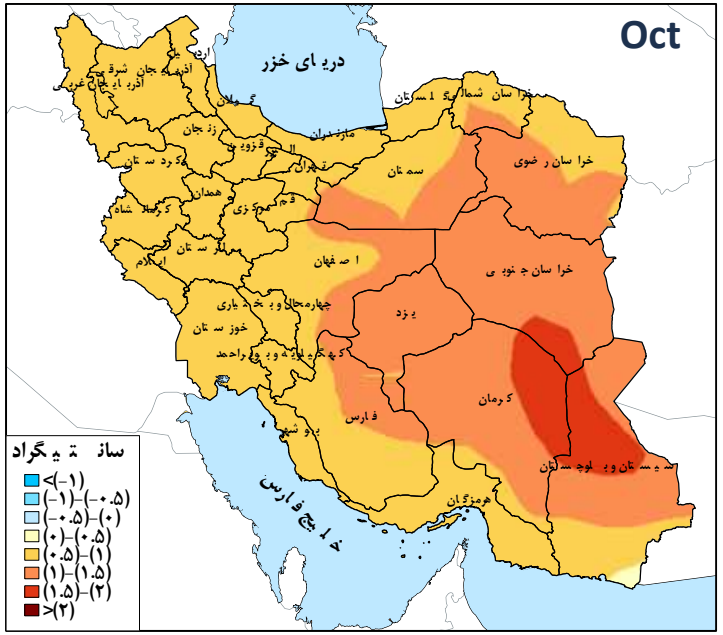


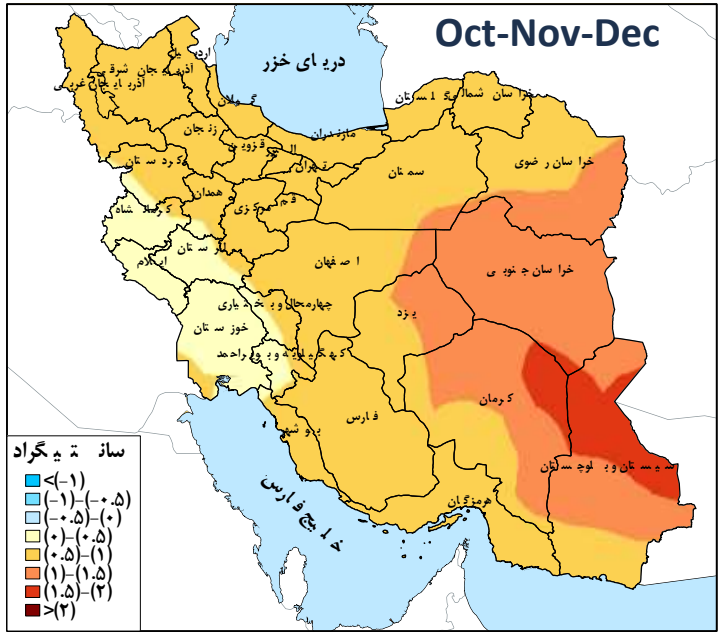


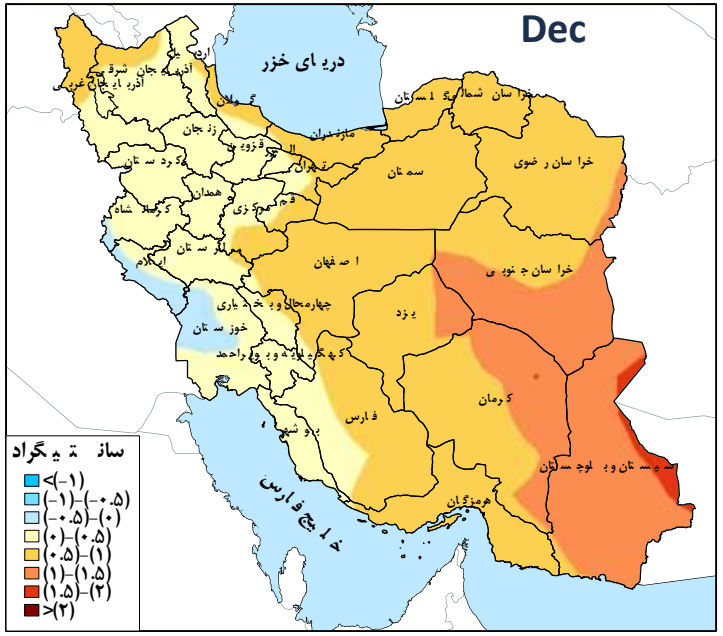


Mean Temperatre Anomaly-Model Predictiond from Oct to 31 Dec 2026



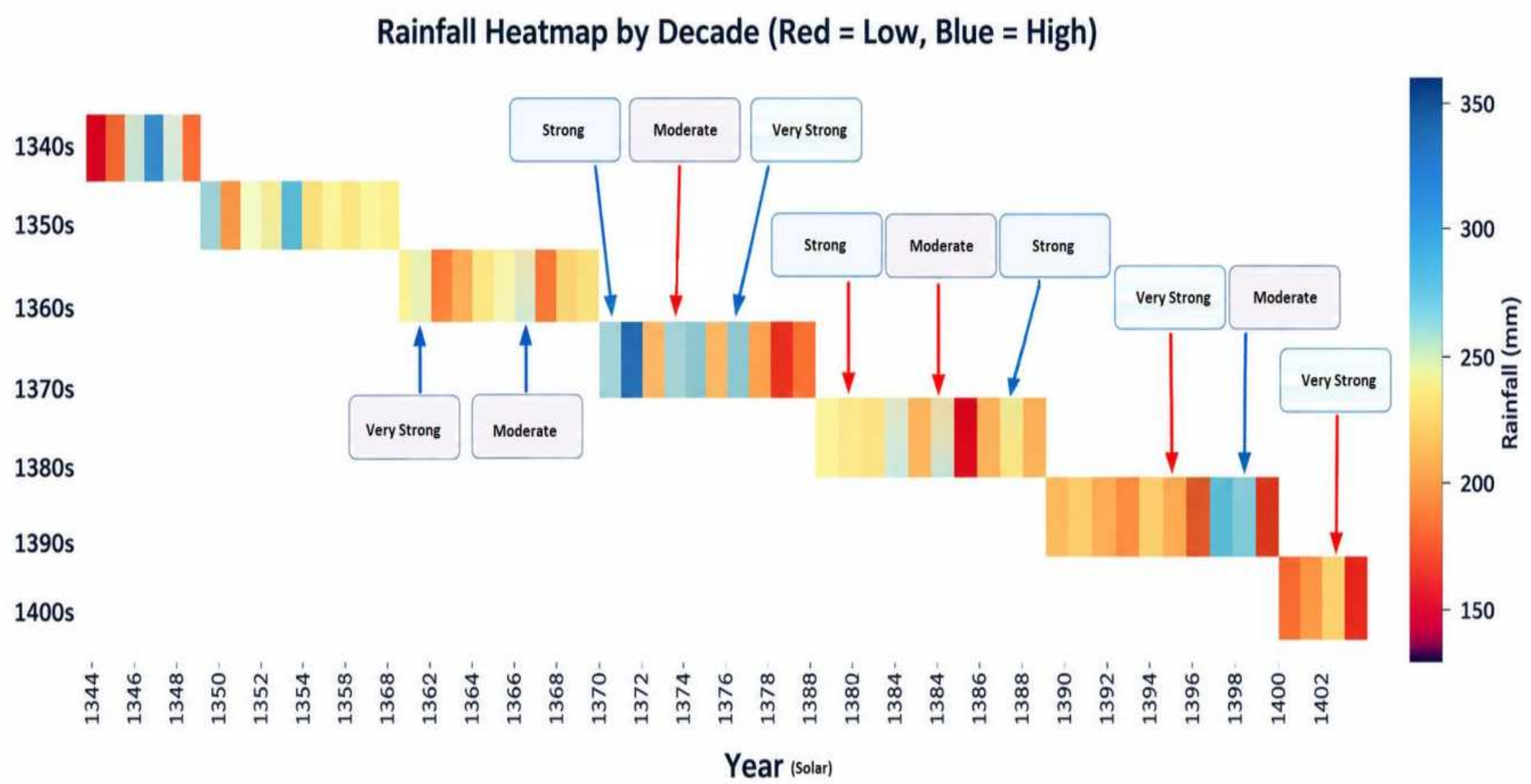




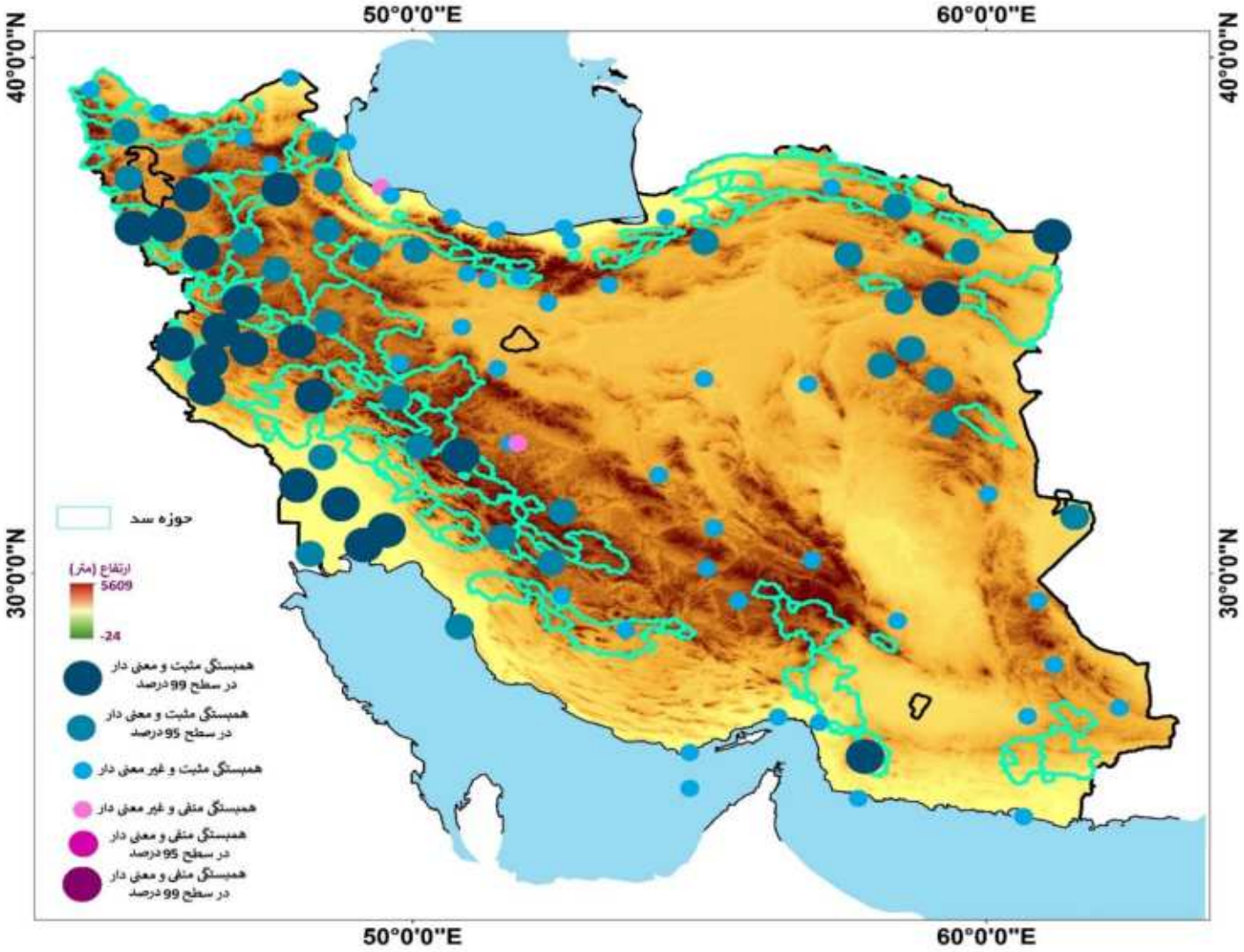


El Niño and Rain/Temperature

Iran's Precipitation Patterns During El Niño Events Over the 43-Year Period from 1981 to 2024



Correlation Between Precipitation in Iran and Sea Surface Temperature in the NINO3.4 Region (1987–2016)



The strongest impacts are observed across western Iran, particularly in the Karkheh, Western Border, and Greater Karun basins, as well as the Zagros and Alborz mountain ranges, northwestern and northeastern Iran, with pronounced effects along the international borders with Iraq and Türkiye.

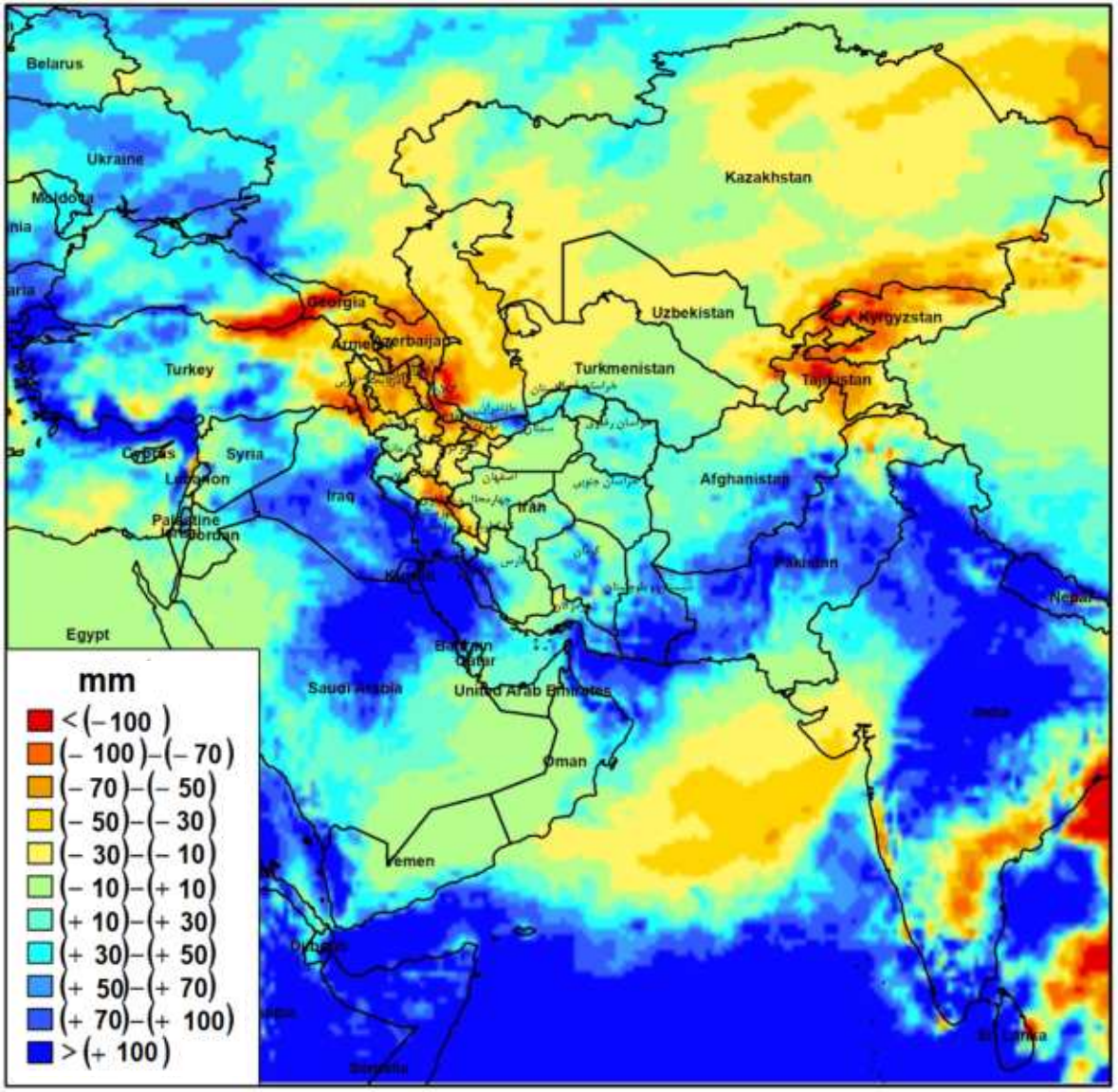
Iran's Temperature and Precipitation Patterns During Five El Niño Events, 1980–2010

Selected El Niño periods: 1982–1983, 1986–1987, 1991–1992, 2006–2007, and 2009–2010

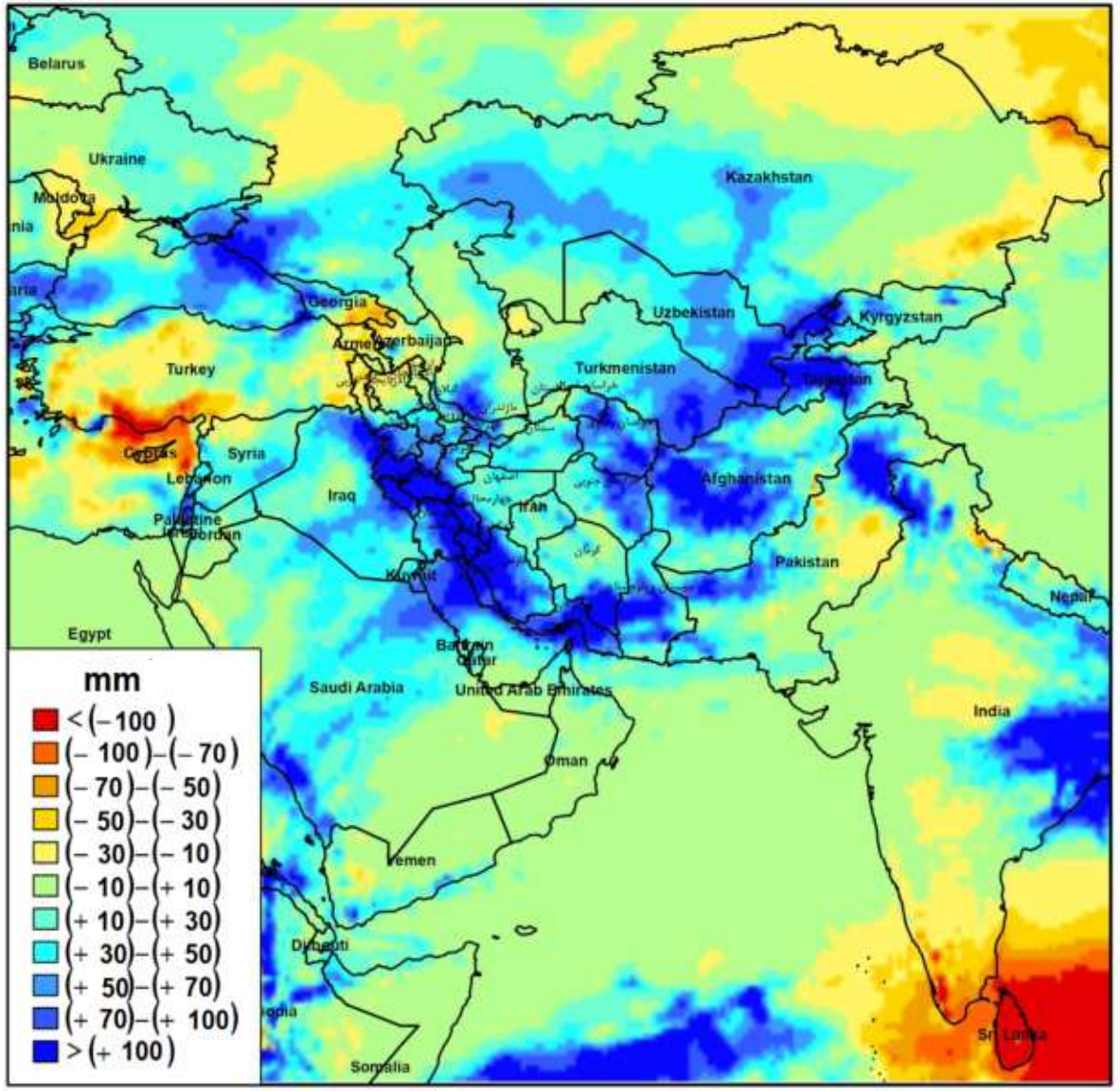
	Precipitation Anomaly (%)					Temperature Anomaly (°C)				
Region	Winter	Spring	Summer	Fall	Annual	Winter	Spring	Summer	Fall	Annual
Northwest	-20	-4.9	9.1	30	0.3	-1.1	-0.4	0	-0.6	-0.58
North	-4.2	2.2	-17	20	4.1	-0.7	-0.4	0	-0.5	-0.4
Northeast	3.8	3.8	13.4	3.3	9.4	-0.2	-0.2	-0.3	-0.4	-0.3
West	-11.8	25.4	-16.4	61.5	12.6	-1.2	-0.7	0.1	-0.7	-0.7
Center	17	18	70.6	110.7	26.4	-0.9	-0.6	0.5	-0.6	-0.7
East	13.9	19.2	19.9	190.1	26.7	-0.4	-0.3	0.3	-0.1	-0.3
Southwest	8.8	39.6	49.7	153.3	31.4	-1	-0.5	0	-0.3	-0.5
South	10.3	30.7	-18.3	186.4	24.6	-0.8	-0.2	0.1	-0.3	-0.4
Southeast	25.5	64	24.2	242.1	49.9	-0.6	-0.3	0.3	0.1	-0.3
Iran	1.5	16.6	0	59.9	16.2	-0.8	-0.4	0.2	-0.4	-0.5

Precipitation Anomalies in Autumn 1997 and Winter 1998 Relative to the Long-Term Average

Fall 1997

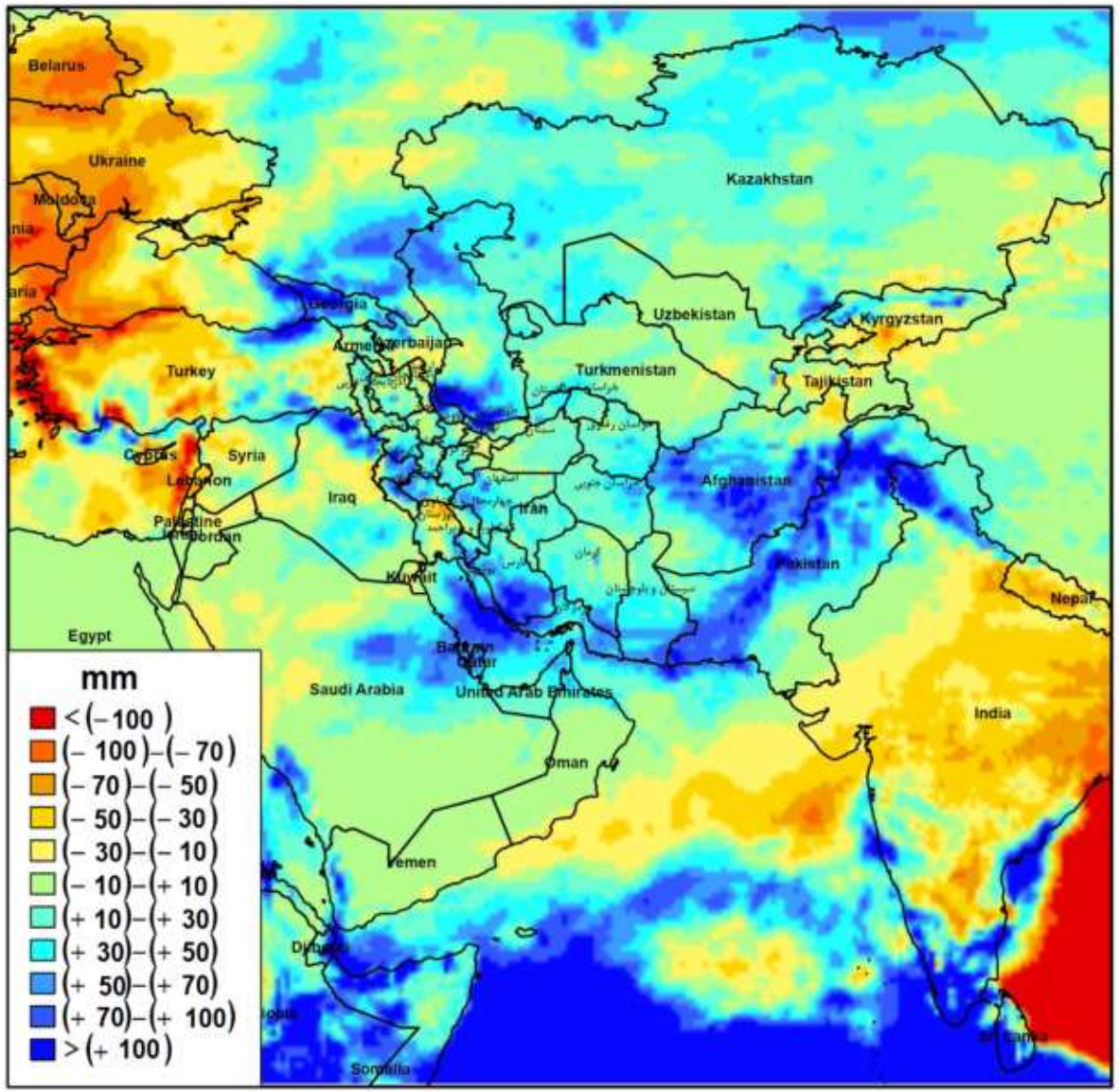


Winter 1998

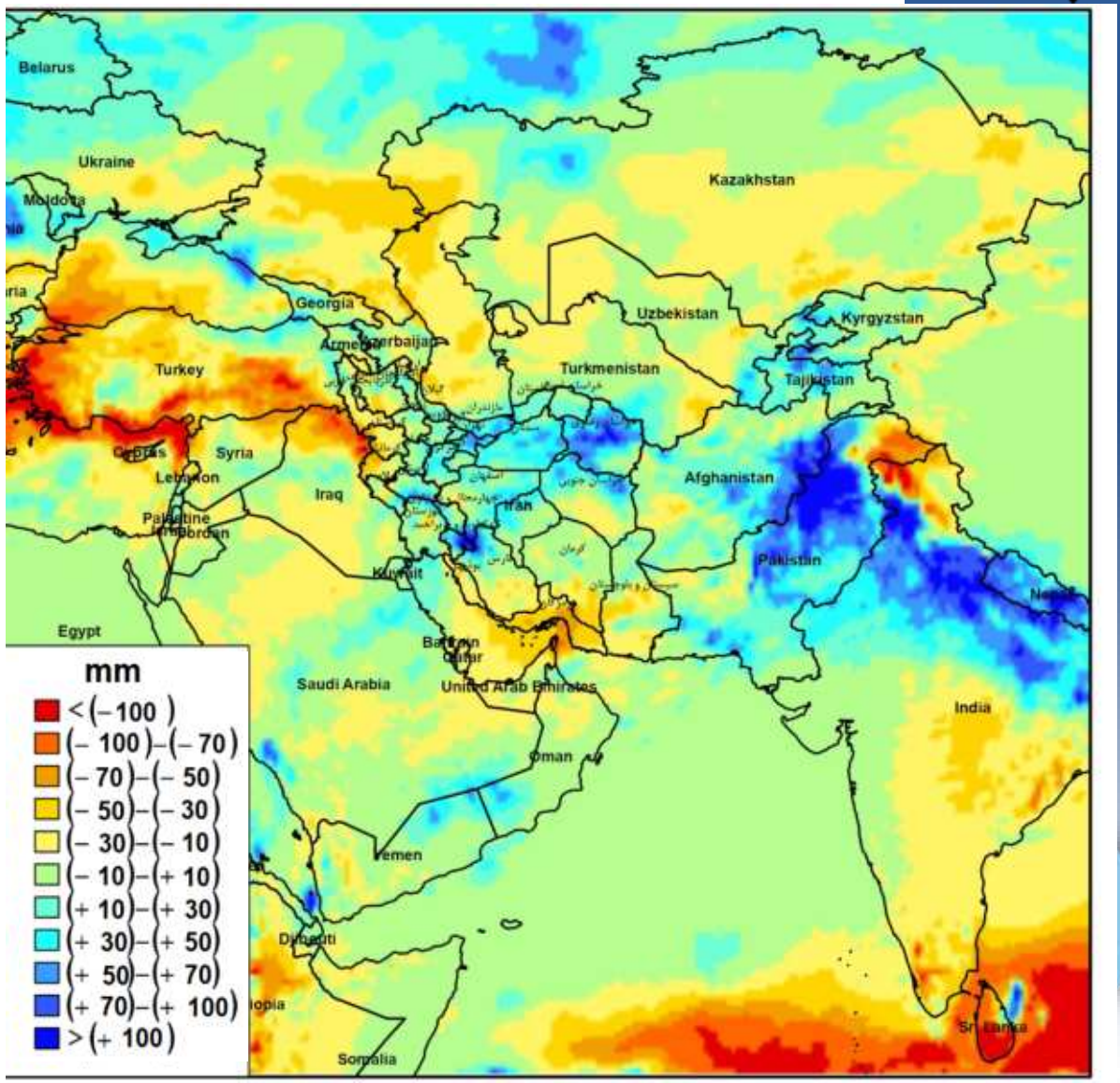


Precipitation Anomalies in Autumn 2006 and Winter 2007 Relative to the Long-Term Average

Fall 2006

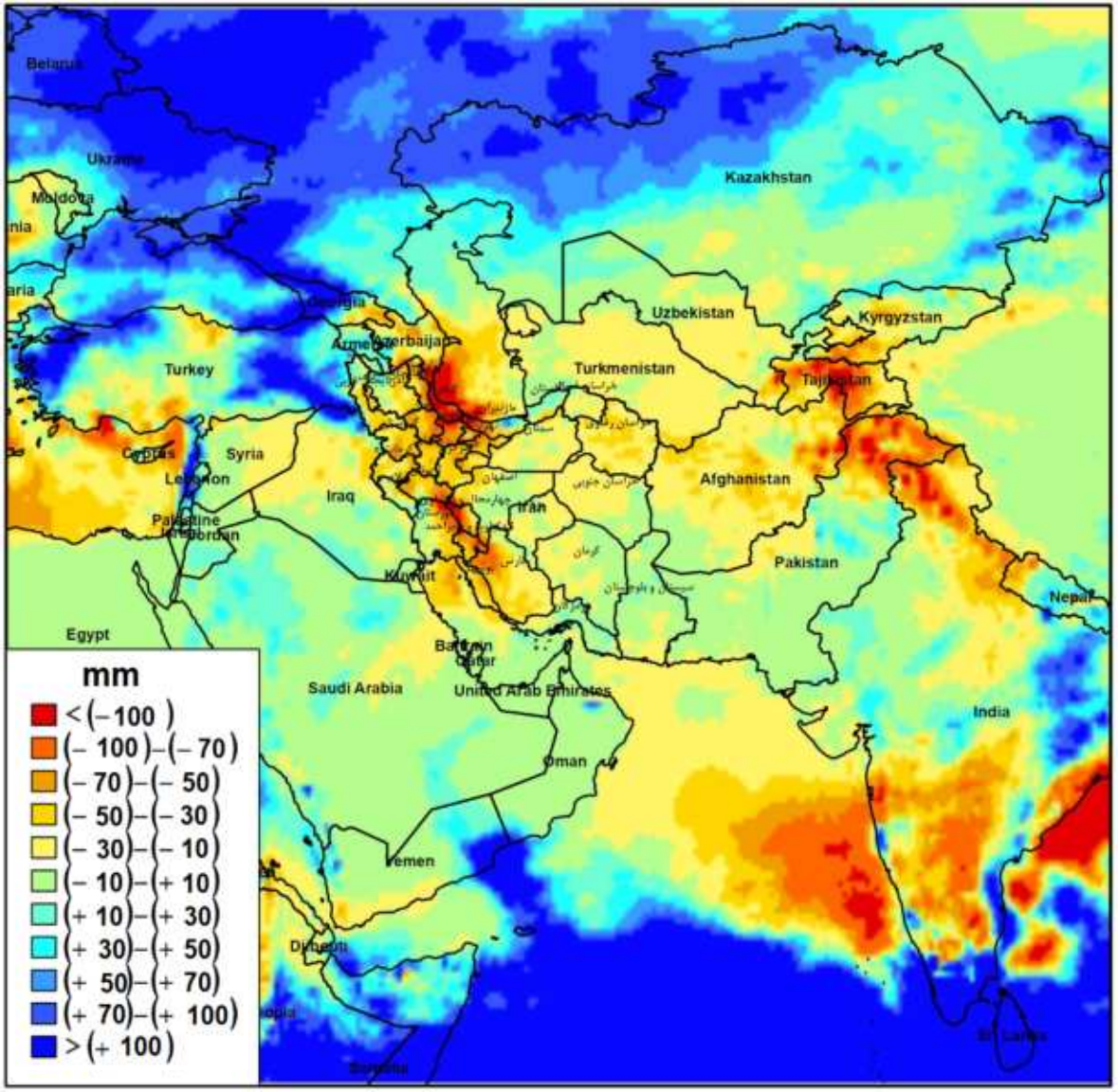


Winter 2007

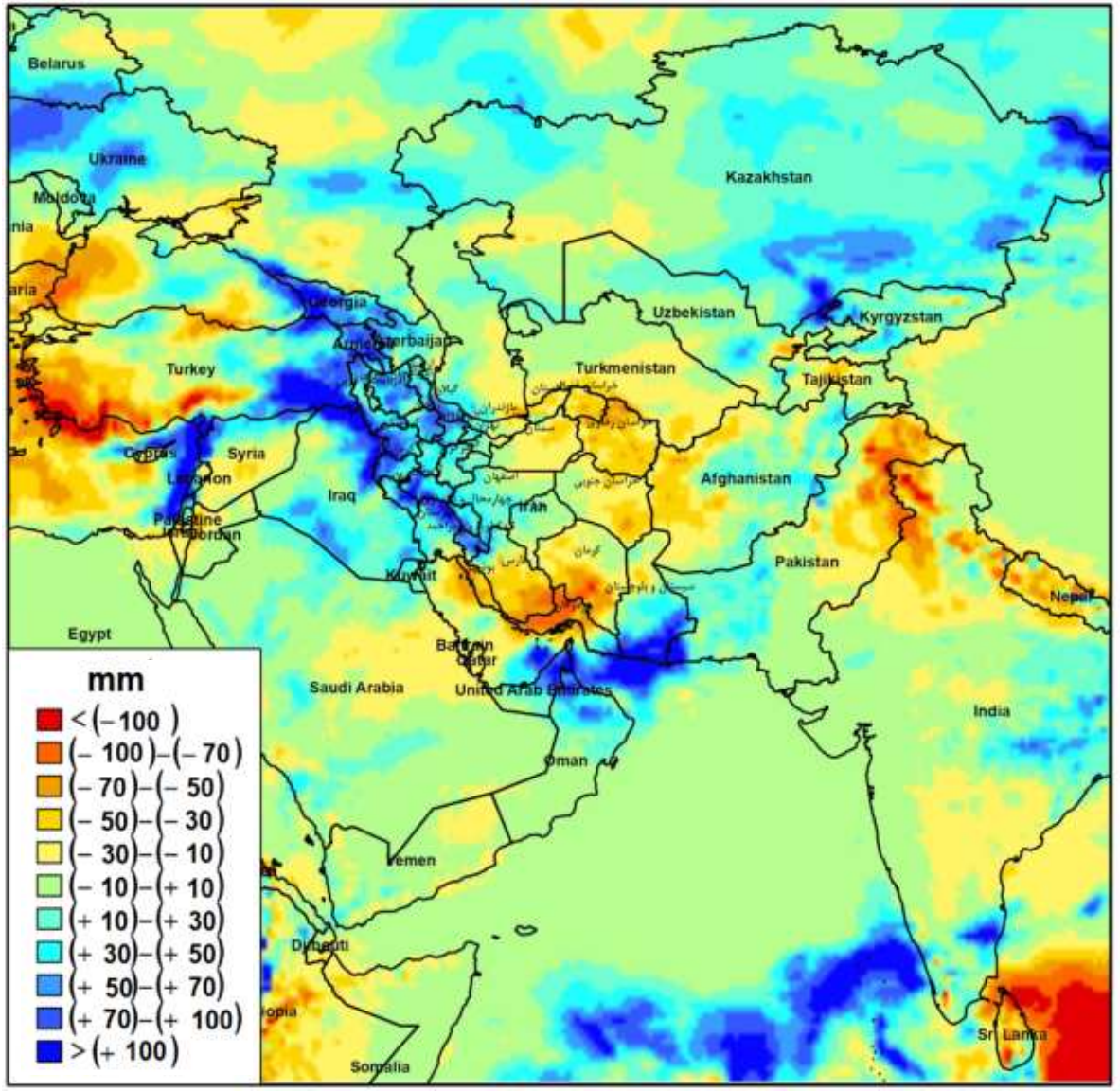


Precipitation Anomalies in Autumn 2023 and Winter 2024 Relative to the Long-Term Average

Fall 2023



Winter 2024



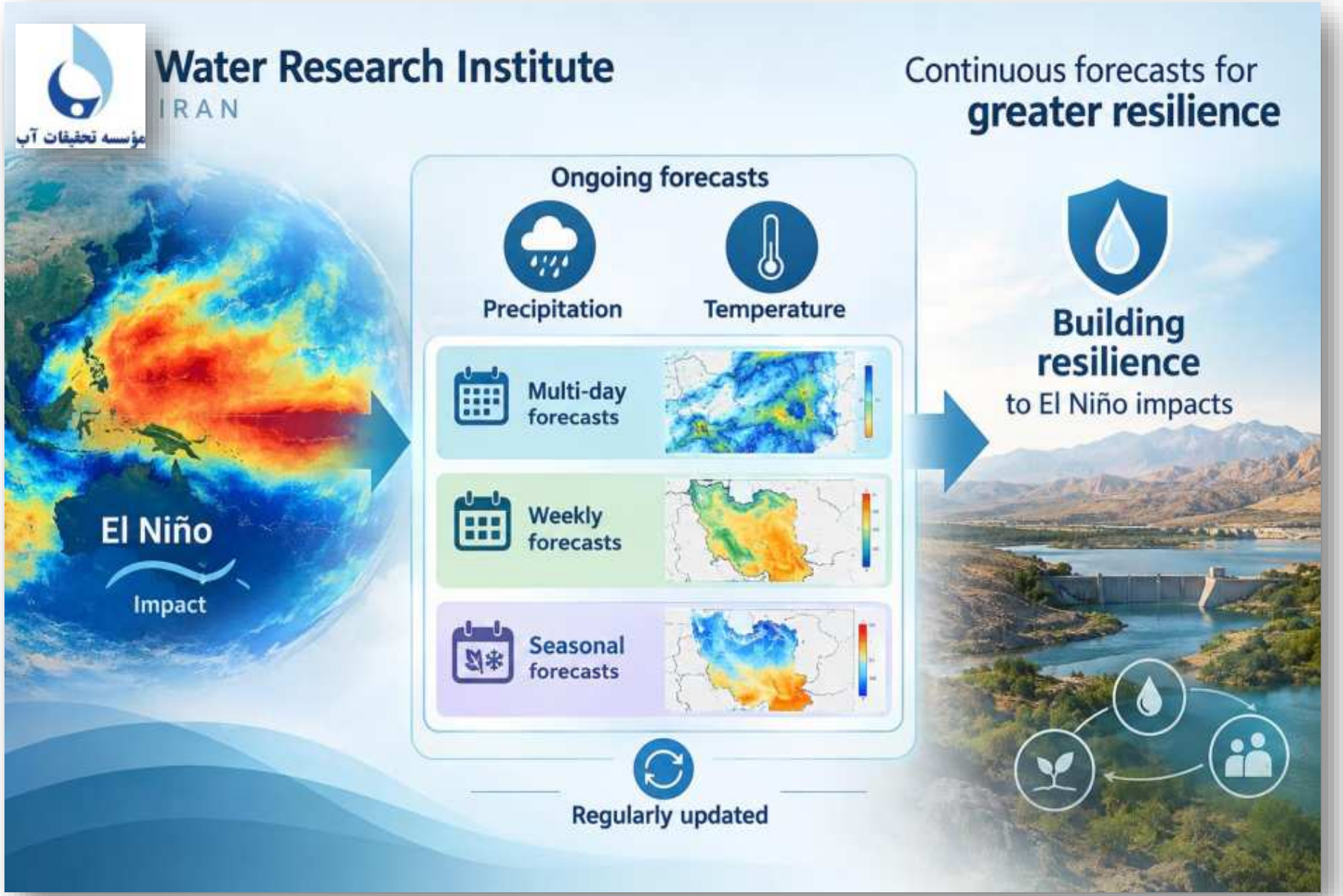
Strengthening Iran's Resilience and Mitigation to El Niño Impacts

Iran: Vulnerable to Climate Change

The 2019 Khuzestan Floods

Iran: Vulnerable to Floods, Droughts, Heatwaves, Sandstorms, Forest fires

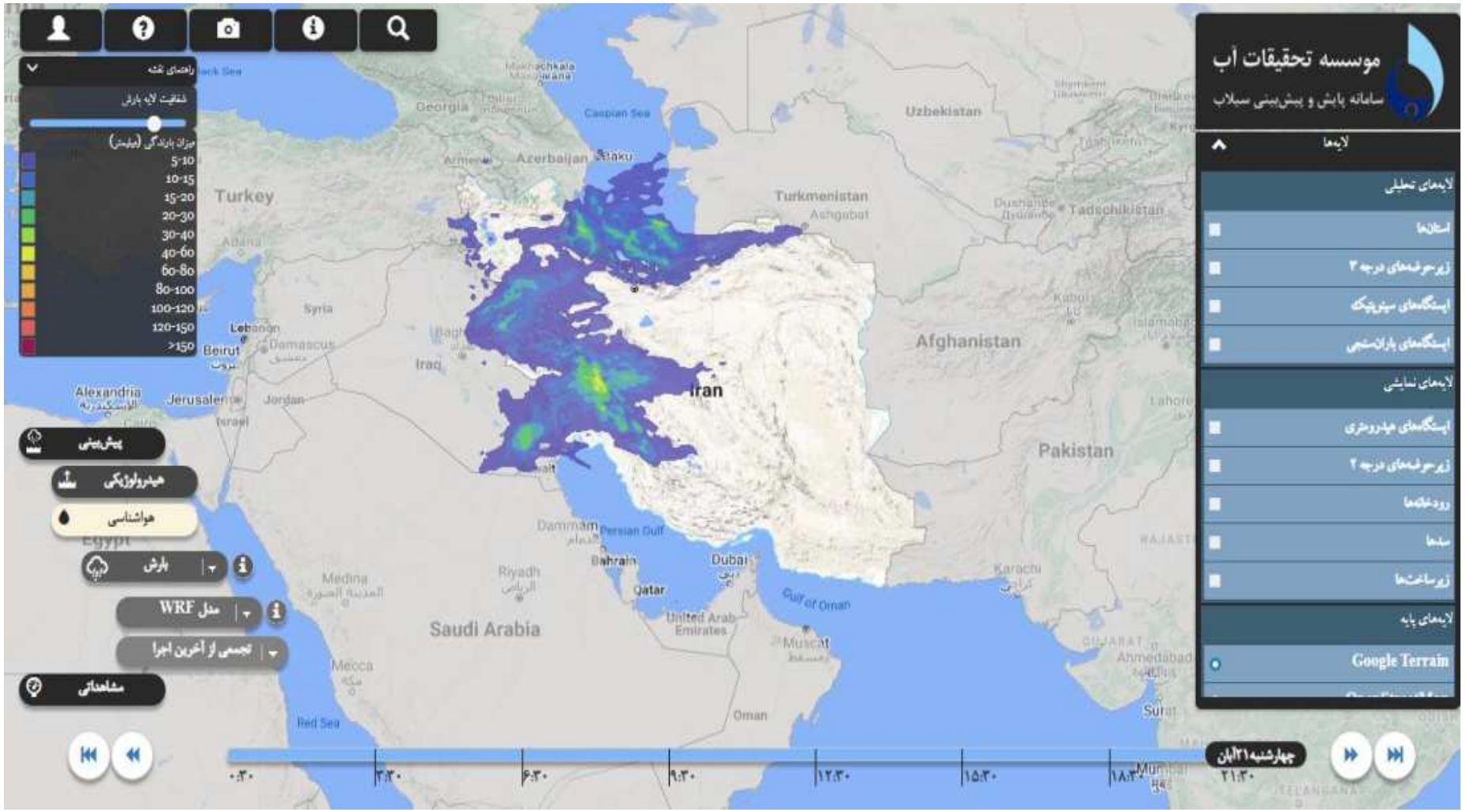
Regular Short and Long Term Forecasts (Rain, Temperature, Flood, Heat Wave, Reservoir Inflow)



Regular Short and Long Term Precipitation and Flood Forecasts

Rain Fall Monitoring and forecasting system

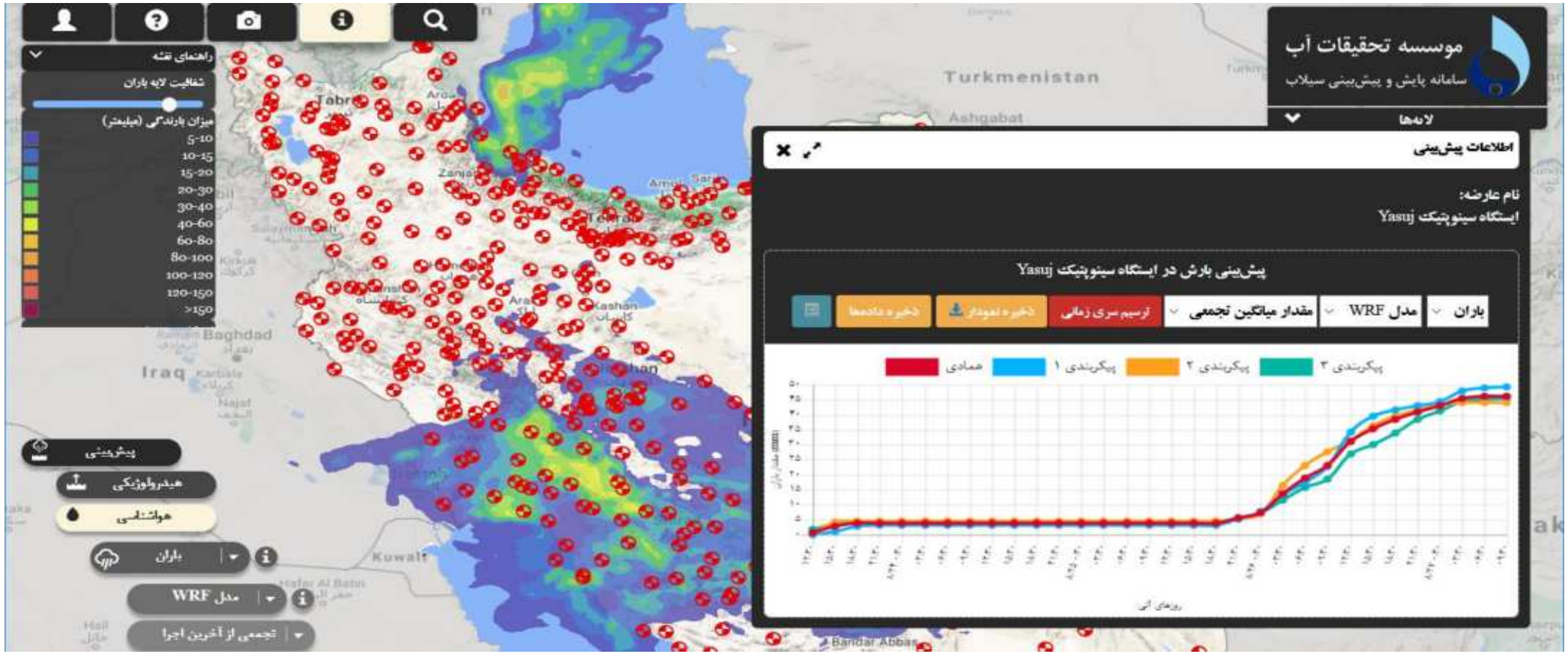
- **GFS and ICON models and WRF regional model Presentation**
- **Display of 3-hour, daily and cumulative (from the last run of the model) rainfall and precipitation(sum of snow and rain) forecasted data.**



Regular of Short and Long Term Flood Forecasts

Flood Monitoring and forecasting system

- **Reporting the average, maximum and cumulative values of forecasted rainfall for provinces, watersheds, synoptic and rain gauge stations in the form of graphs and value.**

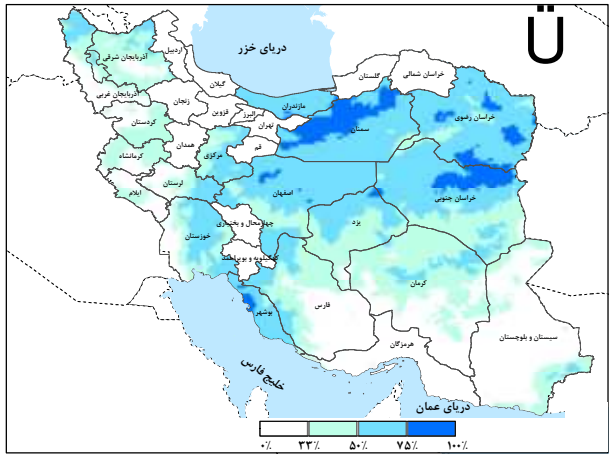


Regular Updating of Short and Long Term Precipitation and Temperature Forecasts

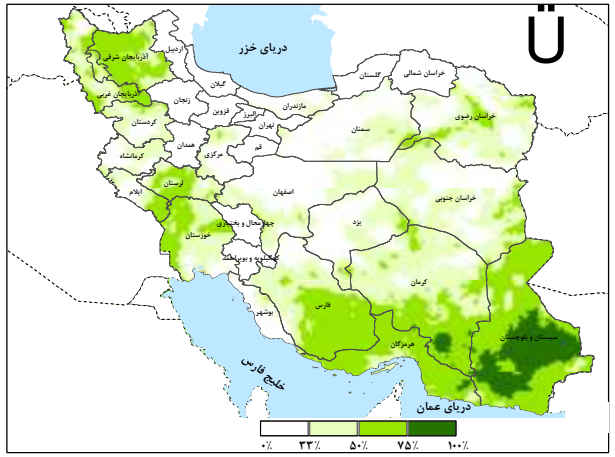
Monthly to Seasonal Precipitation Forecasting Reports

- **Reporting the average, maximum and cumulative values of forecasted rainfall for provinces, watersheds, synoptic and rain gauge stations in the form of graphs and value.**

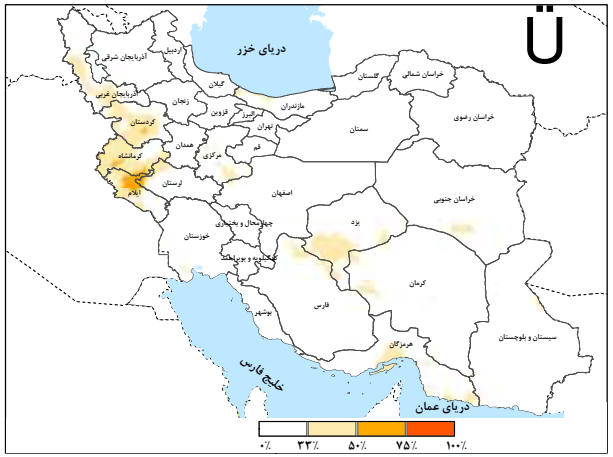
Above the Normal %



Normal %

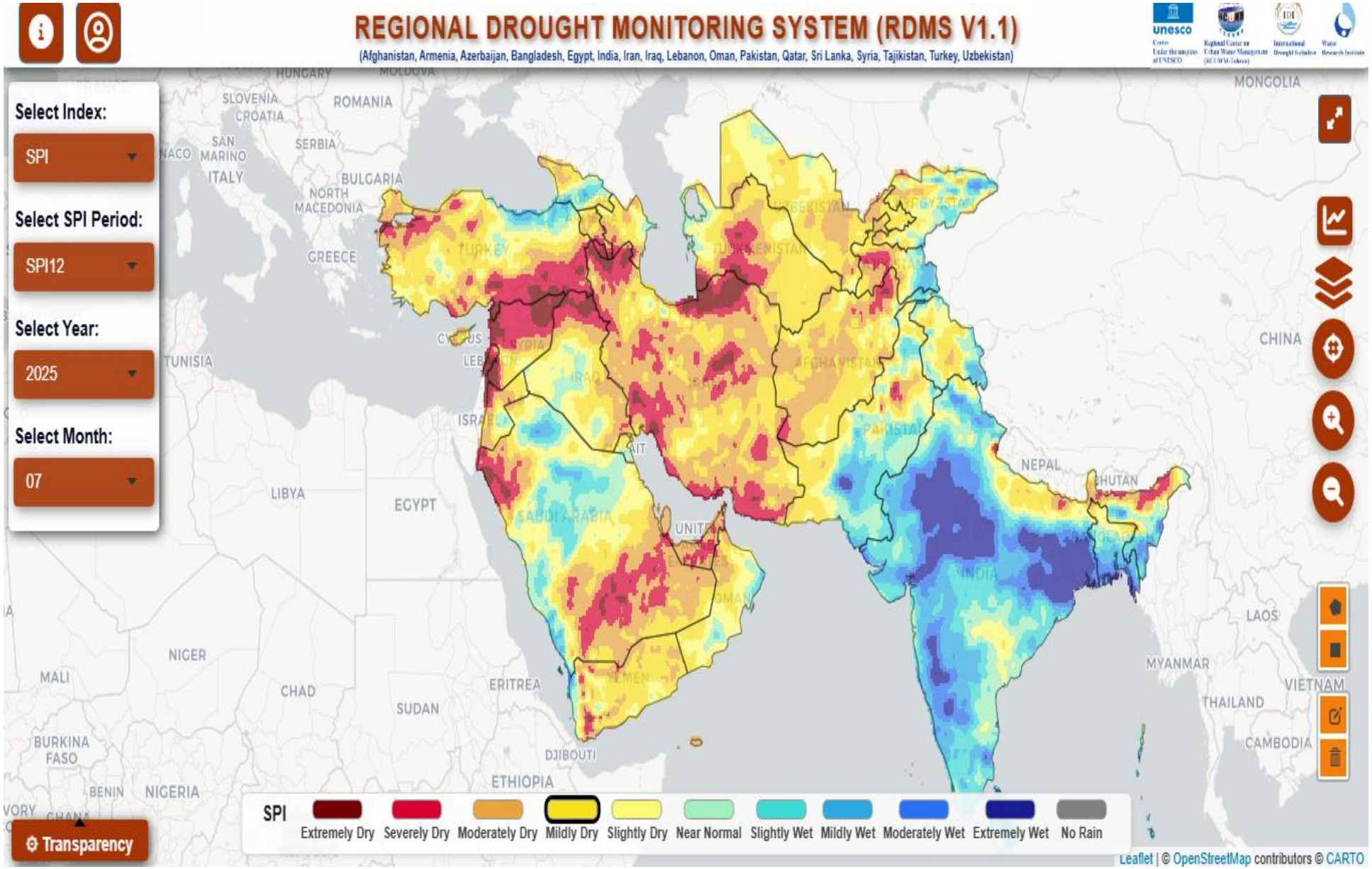


Below the Normal %



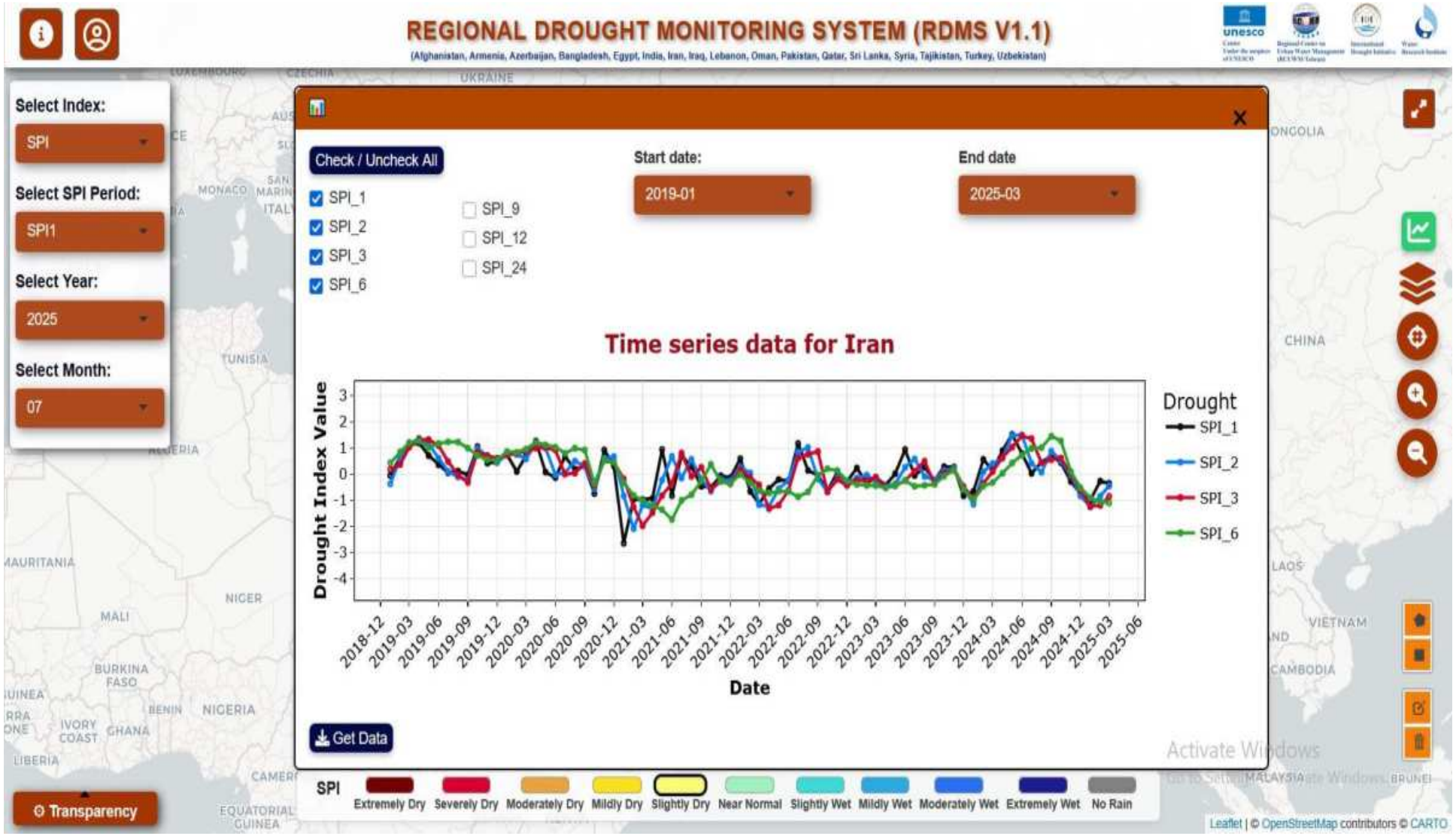
Regular Updating of Short and Long Term Drought Monitoring (SPI Index)

Regional 1-36 Month Drought Monitoring System (RDMS)



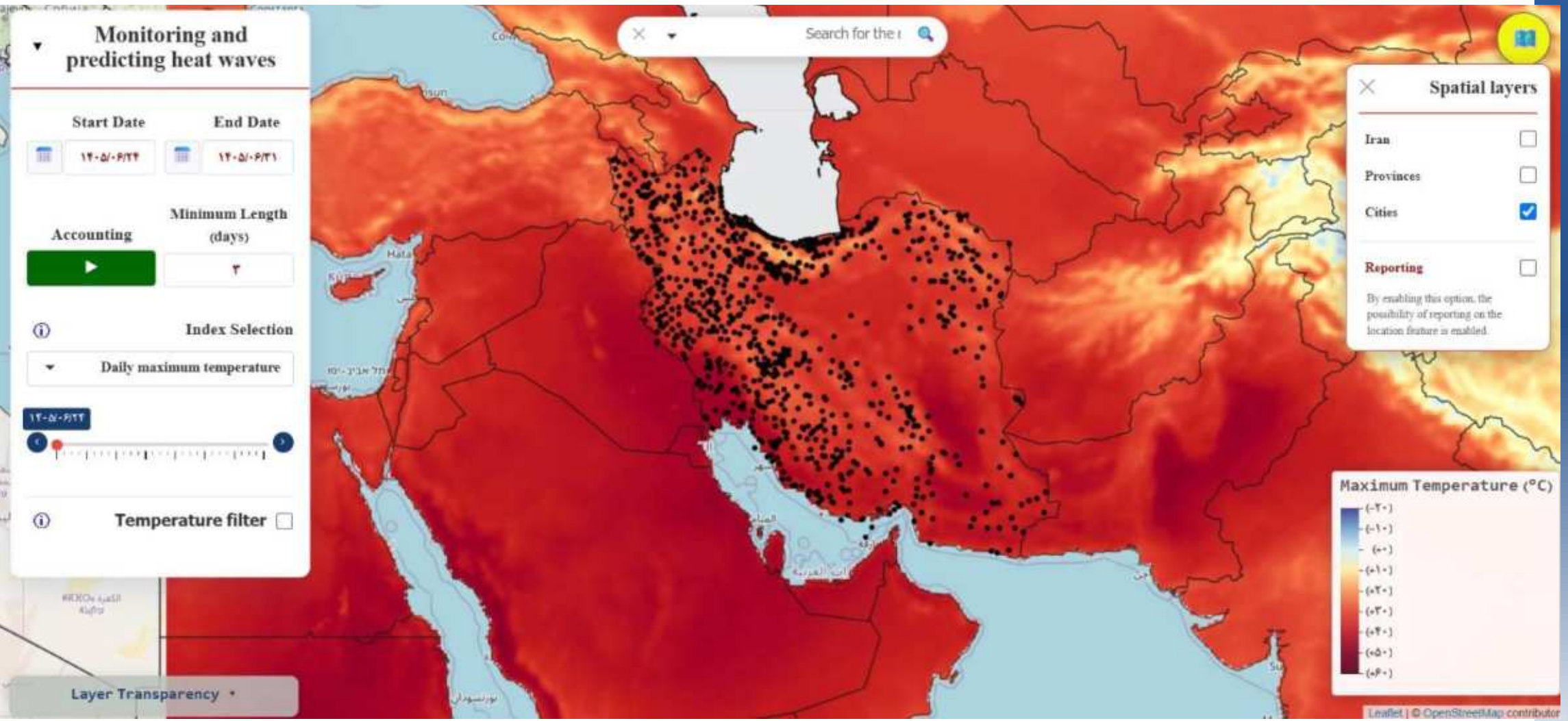
Regular Updating of Short and Long Term Drought Monitoring (SPI Index)

Regional 1-36 month Drought Monitoring System (RDMS)

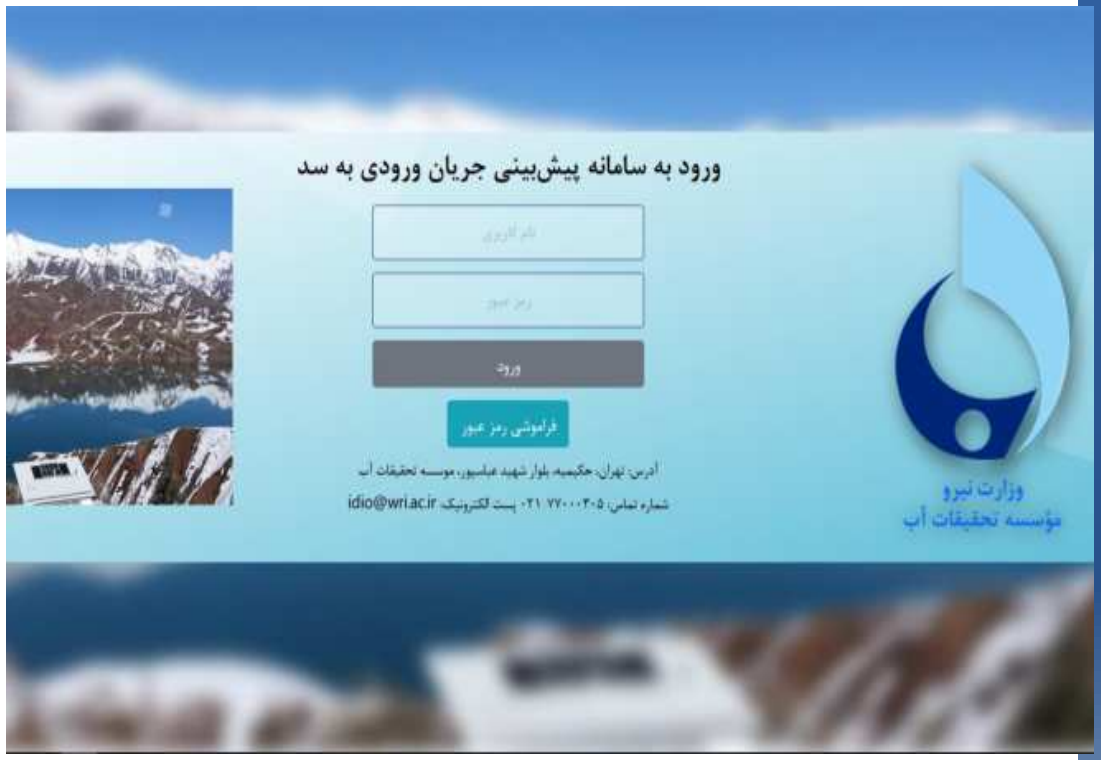


Regular Short and Long Term Heatwave Monitoring and Forecasts

Heatwave Monitoring and Forecasting System

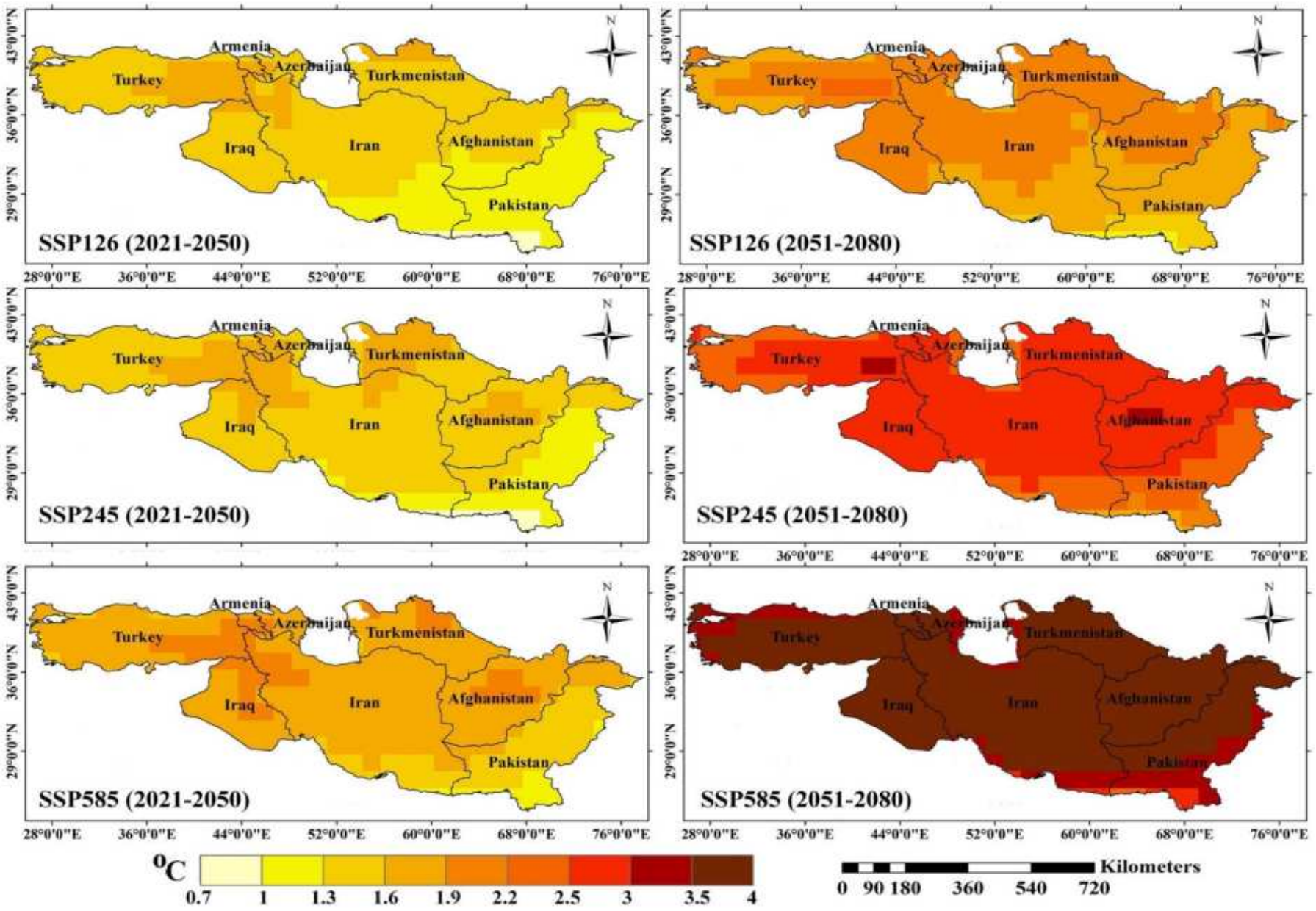


Reservoir 6-month Inflow Forecast System

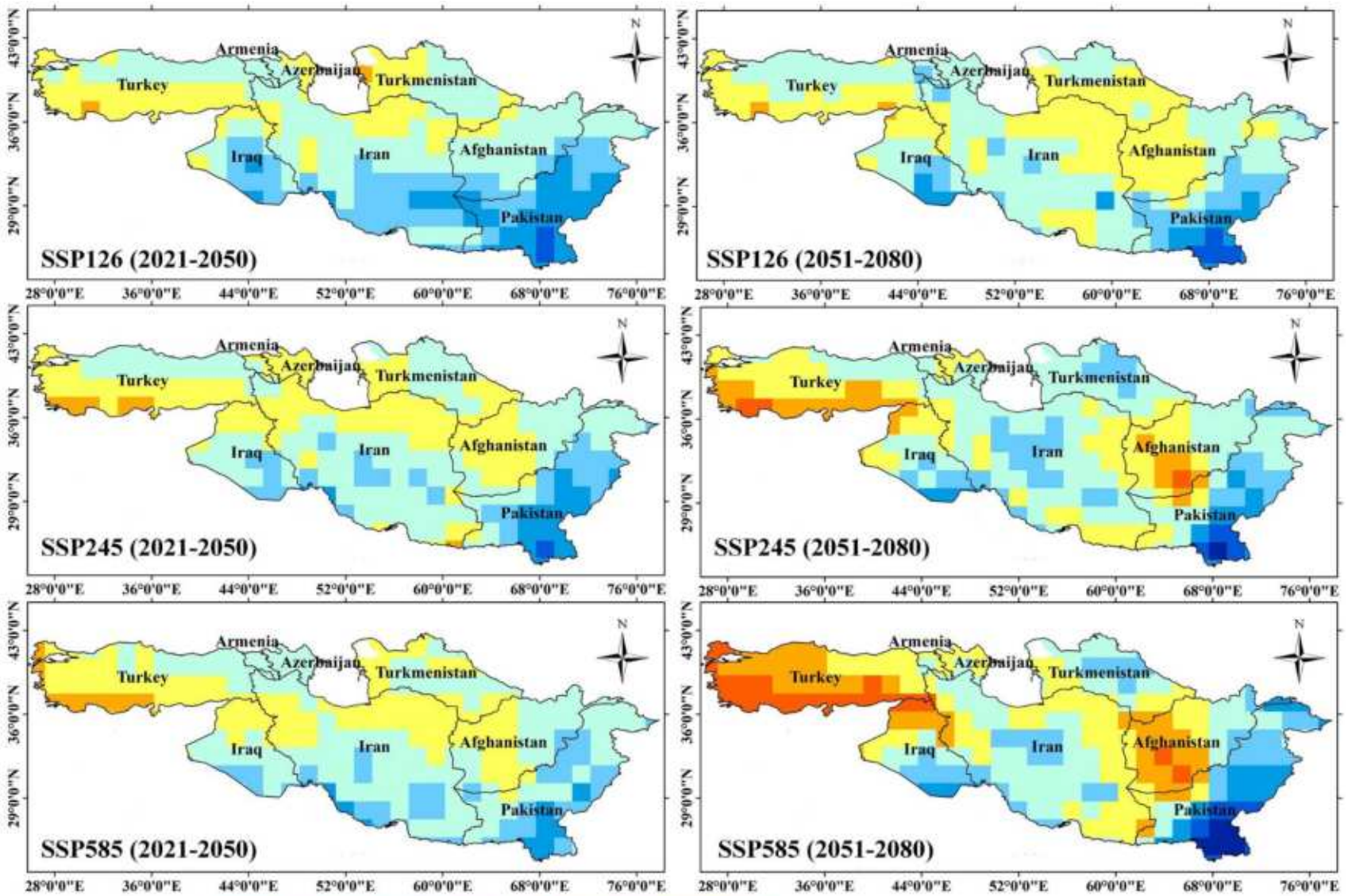


- The Reservoir Inflow Forecasting System has been developed for 30 major dams in Iran and is capable of predicting reservoir inflow volumes up to six months ahead using probabilistic forecasting methods.
- This system can be customized and developed separately for each dam and it is also adaptable for implementation in other countries.

Regional-Scale Assessment of Climate Change Impacts on Temperature



Regional-Scale Assessment of Climate Change Impacts on Precipitation



2. Holding Specialized Expert Meetings

El Niño Review Meeting at Khuzestan Water and Power Authority

El Niño Phenomenon Assessment Meeting at Mazandaran Regional Water Company

3. Establishment of Management and Operational Working Groups

El Niño Committee at Iran Water Resources Management Company

El Niño Committee at Qazvin Regional Water Company

3. Establishment of Management and Operational Working Groups

El Niño Committee at Iran Disaster Management Organization

El Niño Committee at Kurdistan Regional Water Company

- **El Niño Committee by Social Affairs and Public Relations of Water Resources Management Company**
- **El Niño Committee by Crisis Management Office of Water Resources Management Company**

Strategic Recommendations for El Niño Resilience

Recommendations

- Strengthen regional early warning systems and climate monitoring for timely detection of El Niño impacts.
- Improve seasonal forecasts into anticipatory actions before floods, droughts and other impacts occur.
- Develop regional financial mechanisms to support vulnerable countries and communities.
- Enhance regional and transboundary cooperation for integrated drought and flood management.
- Establish platforms for sharing climate data, experiences, lessons learned and successful resilience practices.
- Promote international/regional research and improve seasonal forecasting and impact-based climate information for decision-makers.

Recommendations

- Increase strategic food reserves in vulnerable countries to strengthen food security during disruptions in production and supply.
- Strengthen regional cooperation in humanitarian response and mobilize resources and equipment in the event of severe El Niño-related impacts.
- Strengthen the resilience of critical water–energy–agriculture–urban infrastructure through a Nexus-based approach.


Shushtar Waterfalls


Zarch Qanat-Yazd


Si-o-se-Pol Bridge


Korit Dam- Tabas

Thank you for your attention