Current and anticipated conditions in the Pacific, Indian Ocean, the Atlantic Ocean and their impact on climate over Arab region

The 7th Arab Climate Outlook Forum (ArabCOF) Meeting &
The 4th Gulf Cooperation Council Climate Outlook Forum (GCC-COF)
Meeting
Virtual, 1 & 3 June 2021

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Meteorological Expert
Gulf Cooperation Council
Secretariat General
Possible summer season drivers over the Arabian Peninsula.

Drivers conditions.

RAII RCCs and some WMO MME LR forecasts.
Possible summer season drivers over the Arabian Peninsula
Extreme Climate Events
December 2020 – February 2021

Updated: 31 March 2021
Temp Dec 20 – Feb 21 Anomaly

Normalized Temperature Anomaly [2020.12–2021.02]
Precip Dec 20 – Feb 21 Anomaly
Correlation coefficients with two periods 1990-2008 and 1970-2008 between some MJ standardized station temperature and precipitation extreme indices and both NCP and ENSO (coefficients significant at 0.05 level are in bold and to 0.1 level in italic).

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<th>Index</th>
<th>1990-2008</th>
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Same as table 4 but the correlation coefficients for Nino3.4 teleconnection during JAS season.

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North Sea-Caspian Pattern (NCP)

Fig. 1. Map showing the poles of the North Sea – Caspian Pattern (NCP), (after Kutiel and Benaroch, 2002)
Fig. 8. The correlation of Niño 3.4 index and the mean temperature obtained from the NCEP data for the (a) Winter, (b) Spring, (c) Summer, and (d) Autumn seasons averaged over 1978-2010.
Fig. 12. The correlation of the NAO index and the mean temperature obtained from the NCEP data for (a) Winter, (b) Spring, (c) Summer, and (d) Autumn seasons averaged over 1978-2010.
Atif et al (2020) reported that the Extreme Precipitation Events over Saudi Arabia are associated with El Niño Southern Oscillation (ENSO), which shows that during the positive (negative) ENSO phase the frequency of EPEs increases (decreases) over the country.

AlMazroui et al (2019) found that during summer above normal Surface Air Temperature anomalies reported over the northern parts of the Peninsula during the cold phase of ENSO and below normal temperature during the warm phase.

Abid et al (2018) reported that the warm phase of ENSO during summer there is upper-level convergence over the southern Arabian Peninsula leads to sinking motion, low-level divergence and consequently to reduced rainfall, while reverse happens in the cold phase.
Outline

Drivers conditions.
International climate model outlooks
RAII RCCs and some WMO MME LR forecasts.
JMA Seasonal Forecast (Forecast initial month is 05 2021)
Most likely category of Precipitation for JJA 2021

Probability (%) of Most Likely Category
Below Normal  Normal (>33%)  Above Normal
33  40  50  60  80  33  40  50  60  80
JMA Seasonal Forecast (Forecast initial month is 05 2021)
Most likely category of Sea Surface Temperature for JJA 2021

Probability (%) of Most Likely Category
Below Normal
Normal (>33%)
Above Normal

33 40 50 60 80

33 40 50 60 80
Difference from average sea surface temperature forecast for June to August 2021

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Model: ACCESS-S1
Base period: 1990-2012
Model run: 22/05/2021
Issued: 24/05/2021
BCC Three-Month Forecast
Departure Percentage of Precipitation Rate
BCC_CSM1.1(m)

Started 20210501  Valid 202105 - 202107
Units: %
Member Size = 24
BCC Three-Month Forecast
2-m Air Temperature Anomaly
BCC_CSM1.1(m)

Started 20210501    Valid 202105 - 202107
Units: degC
Member Size = 24
BCC Three-Month Forecast

Sea Surface Temperature (line) and its Anomaly (shading)

BCC_CSM1.1(m)

Started 20210501    Valid 202105 - 202107
Units: °C

Member Size = 24
BCC One-Month Forecast
850 hPa Wind Anomaly
BCC_CSM1.1(m)

Started 20210501    Valid 202105
Units: m/s
Member Size = 24

Scale 1:26 000 000
Reference Vector
Probabilistic Multi-Model Ensemble Forecast
Beijing, CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, Seoul, Tokyo, Toulouse, Washington

Precipitation: JJA2021
(issued on May 2021)
Probabilistic Multi-Model Ensemble Forecast

Beijing, ECMWF, Exeter, Melbourne, Montreal, Moscow, Seoul, Tokyo, Toulouse, Washington

Sea Surface Temperature: JJA2021

(issued on May 2021)

[Map showing sea surface temperature with color coding for Below-Normal, Near-Normal, and Above-Normal conditions.]
Probabilistic Multi-Model Ensemble Forecast
Beijing, CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, Seoul, Tokyo, Toulouse,

850hPa Meridional Wind: JJA2021

(issued on May 2021)
Climate Change Impacts over Arabia
1- standardize timeseries (extremes and monthly for annual/seasons)
Almazroui (2012)

Fig. 4. Area averaged mean temperature anomalies obtained from the observed and the NCEP data for the (a) Winter, (b) Spring, (c) Summer and (d) Autumn seasons. The anomaly is taken with respect to the reference period 1978-2010.
Fig. 4. The time sequences of a) annual, b) wet season, and c) dry season rainfall (mm) with their classes obtained from the observed dataset. The normal (country average from 27 stations), deficit (20% below normal), scantly (60% below normal), and surplus (within ±20% of normal) are used to identify drought year over the country.
Average Annual GCC Summer Temperature (May-September 1981-2010).
Average Annual GCC Rainfall (October-April 1901-2016).

Jan Frederik Braun, King Abdullah Petroleum Studies and Research Center (KAPSARC), Saudi Arabia
Figure 3.1: Global Hurricane Frequency (all & major) since 1981 – 12-month running means. The top time series is the number of global tropical cyclones that reached at least hurricane-force (maximum lifetime wind speed exceeds 64-knots). The bottom time series is the number of global tropical cyclones that reached major hurricane strength. Source: Maue (2018).
Figure 3.3. (a) Per cent total of the number of hurricanes that achieved a maximum intensity of each category grouping as delineated by the Saffir–Simpson scale. (b) As in (a), but for the percentage of total hurricanes achieving each category grouping. Klotzbach and Landsea (2015)
**Other Possible Important Teleconnections**

- Charabi and Al-Hatrushi (2009) found that: According to the data, a major part of Oman Winter Rainfall (OWR) is controlled by a large scale process coupled with two main anticyclonic centers, i.e. the Azorian and **Siberian Highs**.

- Raziei et al. (2008) reported that: Winter precip modulated by interaction Siberian high and ENSO.

- Hasanean et al (2012) found that **Siberian High Index (SHI)** is positively correlated to surface air temperatures over Saudi Arabia, and this is statistically significant in the western and north-western regions.

- Hafez and Almazroui (2012) indicated that the present studies uncover the climatic relationship between the **anomalies in geopotential height over Europe** and weather conditions over KSA. The results revealed that air current aloft in the upper atmosphere over Europe, blocking systems, and climatic indices (NAO, SOI and El Nino3.4) have played a great role to impact full control of the weather conditions over KSA through the study period 1948–2012.

- Hasanean and Almazroui (2015) draw the attention of the role of the strength and **oscillation of subtropical jet stream** play a big role in pulling hot, dry air masses of Saudi Arabia.

- Hasanean and Almazroui (2016) found that the change in **Indo-Pacific warm pool (IPWP) SST** can be considered as one of the factors linked to increase surface air temperature over Saudi Arabia.
La Niña event is coming close to its end.
NINO.3 SST is likely to return to a neutral level in boreal spring (80%).
ENSO-neutral conditions are likely to continue during boreal summer and autumn (70%).
IOD is expected to continue weak and neutral.
Drivers conditions suggest more probability for near normal to above normal Temp (while southern coast and Yemen might receive below normal Temp) and no clear signal for Precip.
Climate change may contribute to increasing temperature in the upcoming JJA season.