Regional Climate Projections and Applications for Sand and Dust Storms Analysis

Enhancing Understanding and Expanding Inter-regional and Regional Cooperation on Sand and Dust Storms

7 July 2021

Marlene Tomaszkiewicz
Regional Advisor for GIS for Climate Change Analysis
Arab Centre for Climate Change Policies, ESCWA
RICCAR and the Arab Domain
Arab Domain Regional Climate Modelling
Mean change in temperature
Drivers of Sand and Dust Storms

Land Degradation
- Unsustainable land and water use
- Vegetation decline
- Land use changes

Desertification
- Greater aridity
- Drier soils
- Water diversion

Climate Change
- Higher air temperature
- Less precipitation
- Stronger winds

© Copyright ESCWA. All rights reserved. No part of this presentation in all its property may be used or reproduced in any form without written permission.
Seasonal drought frequency

Reference period
1986-2005

Mid-century
2046-2065

End-century
2081-2100

Tomaszkiewicz / Atmosphere (2021) 12(7), 856
Focus on Mashreq Domain

- Afghanistan (partial)
- Armenia
- Azerbaijan
- Bahrain
- Bulgaria (partial)
- Cyprus
- Djibouti
- Egypt (partial)
- Eritrea
- Ethiopia
- Georgia
- Greece (partial)
- Iran
- Iraq
- Jordan
- Kazakhstan (partial)
- Kenya (partial)
- Kuwait
- Lebanon
- Moldova
- Oman
- Pakistan (partial)
- Palestine
- Qatar
- Romania (partial)
- Russia
- Saudi Arabia
- Somalia (partial)
- South Sudan (partial)
- Sudan (partial)
- Syria
- Turkey
- Uganda (partial)
- United Arab Emirates
- Uzbekistan (partial)
- Yemen
SDS Frequency from meteorological stations (2000-2013)

New Mashreq Domain Climate Modelling Outputs

- 10 km grid spatial scale
- Multiple climate parameters suitable for SDS analysis (and other studies)
- Bias-corrected temperature and precipitation
- 1961 – 2070
- SSP5-8.5 climate scenario
- 6 downscaled climate models
<table>
<thead>
<tr>
<th>Model</th>
<th>Institute</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMCC-CM2-SR5</td>
<td>Euro-Mediterranean Centre on Climate Change</td>
<td>Cherchi et al. 2018</td>
</tr>
<tr>
<td>CNRM-ESM2-1</td>
<td>National Center for Meteorological Research, France</td>
<td>Séférian et al. 2019</td>
</tr>
<tr>
<td>EC-Earth3-Veg</td>
<td>European Consortium</td>
<td>Wyser et al. 2020</td>
</tr>
<tr>
<td>MPI-ESM1-2-LR</td>
<td>Max Planck Institute for Meteorology, Germany</td>
<td>Mauritsen et al. 2019</td>
</tr>
<tr>
<td>MRI-ESM2-0</td>
<td>Meteorological Research Institute, Japan</td>
<td>Yukimoto et al. 2019</td>
</tr>
<tr>
<td>NorESM2-MM</td>
<td>Norwegian Meteorological Institute</td>
<td>Tjiputra et al. 2020</td>
</tr>
</tbody>
</table>

**Regional Climate Model**

<table>
<thead>
<tr>
<th>Model</th>
<th>Institute</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCLIM-ALADIN</td>
<td>Swedish Meteorological and Hydrological Institute</td>
<td>Belušić et al., 2020</td>
</tr>
</tbody>
</table>
Mean change in annual temperature compared to the baseline period

Baseline
1995 – 2014

Near-term
2021 – 2040

Mid-term
2041 – 2060

Temperature (°C)

Change in temperature (°C)

Change in temperature (°C)
Mean change in daily maximum wind speed compared to the baseline period

Baseline
1995 – 2014

Near-term
2021 – 2040

Mid-term
2041 – 2060

Daily maximum wind speed (m/s)

Change in daily maximum wind speed (m/s)

(Not bias-corrected)
## Results for selected subdomains

### Temperature (°C)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.2</td>
<td>0.9</td>
<td>2.1</td>
</tr>
<tr>
<td>2</td>
<td>21.7</td>
<td>0.9</td>
<td>2.1</td>
</tr>
<tr>
<td>3</td>
<td>24.9</td>
<td>0.9</td>
<td>2.1</td>
</tr>
<tr>
<td>4</td>
<td>19.8</td>
<td>0.9</td>
<td>2.1</td>
</tr>
<tr>
<td>5</td>
<td>27.8</td>
<td>1.0</td>
<td>2.2</td>
</tr>
<tr>
<td>6</td>
<td>28.5</td>
<td>0.8</td>
<td>1.7</td>
</tr>
<tr>
<td>7</td>
<td>24.7</td>
<td>0.6</td>
<td>1.4</td>
</tr>
</tbody>
</table>

### Daily max wind speed (m/s)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>5.4</td>
<td>-0.1</td>
<td>0.0</td>
</tr>
<tr>
<td>3</td>
<td>5.9</td>
<td>-0.1</td>
<td>-0.1</td>
</tr>
<tr>
<td>4</td>
<td>5.2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>5</td>
<td>6.5</td>
<td>0.0</td>
<td>-0.1</td>
</tr>
<tr>
<td>6</td>
<td>5.0</td>
<td>0.0</td>
<td>0.1</td>
</tr>
<tr>
<td>7</td>
<td>5.2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Next steps

• Seasonal forecasting conducted twice a year by the Arab Climate Outlook Forum
  • Intergovernmental process launched under the Council of Ministers responsible for Meteorology and Climate under the League of Arab States
• Seasonal climate modelling outputs under RICCAR
• Evaluate national SDS trends and frequency analysis to identify proxy parameters and link to regional and inter-regional trends
• Remote sensing analysis to study historical events and link to climate modelling outputs
Thank you!

Discussion - Questions

Marlene Tomaszkiewicz
tomaszkiewiczm@un.org

www.riccar.org
www.unescwa.org/acccp