UIB WG-2
CLIMATE VARIABILITY AND CLIMATE CHANGE

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Coordination of Working Groups

WG-1: Data Collection, Quality Control & Data Sharing

WG-2: Climate Variability & Climate Change

WG-3: Cryosphere

WG-4: Hydrology

WG-5: Hazards

WG-6: Adaptation
Pakistan Mean Temperature (°C) 1901-2012

Period
- Last 110 Years
- Last 75 Years
- Last 50 Years
- Last 25 Years
Rainfall (mm) vs. Year

Pakistan Mean Annual Rainfall (mm) 1901-2012

y = 0.3627x + 273.44

Northern Areas: Annual Mean Precipitation (mm) 1901-2012 based on CRU data

\[ y = 0.7317x + 182.35 \]
Northern Areas: Annual Mean Temperature(°C) 1901-2012
based on CRU data

\[ y = 0.0116x - 0.6745 \]
CMIP5 Downscaling for Upper Indus Basin

Statistical Downscaling

- Statistical downscaling is a technique employed in various climate-related studies where sub-grid scale processes need essential handling.
- The method named as Linear Interpolation and Bias Correction (LIBC) utilizes station data and high resolution geographic information.
- Future climate is projected after bias correction and downscaling of GCM data based on interpolated station observations.
- The result is high resolution gridded projections of temperature and precipitation parameters.
STUDY AREA

- The study area lies between 30.3N to 37.2N Latitude and 67.5E to 82.5E longitude with an area of 437213.34 sq. km.
- The elevation ranges from 240 m.a.s.l to 7,551 m.a.s.l. within the study area.
- The study area extends over four countries Afghanistan, Pakistan, India and China if we move from west to east.
CMIP5 Model Selection

- Four GCMs have been selected based on their goodness of fit criteria:
  - They have a good Pearson’s Correlation Coefficient (greater than or equal to 0.88) with baseline APHRODITE time-series.
  - Their normalized root mean square error is less than or equal to 0.15
  - Their normalized standard deviations lie within ±0.4 to that of normalized standard deviation of APHRODITE dataset.

<table>
<thead>
<tr>
<th>Model</th>
<th>Center</th>
<th>Spatial Resolution</th>
<th>RMSE_T</th>
<th>RMSE_P</th>
<th>SD_T</th>
<th>SD_P</th>
<th>CC_T</th>
<th>CC_P</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCSM4</td>
<td>NCAR</td>
<td>1.25x0.94</td>
<td>0.05</td>
<td>0.15</td>
<td>0.31</td>
<td>0.28</td>
<td>0.99</td>
<td>0.89</td>
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<tr>
<td>CanESM2</td>
<td>CCCMA</td>
<td>2.81x2.81</td>
<td>0.05</td>
<td>0.11</td>
<td>0.31</td>
<td>0.28</td>
<td>0.99</td>
<td>0.94</td>
</tr>
<tr>
<td>GFDL-ESM2M</td>
<td>GFDL</td>
<td>2.5x2.011</td>
<td>0.05</td>
<td>0.15</td>
<td>0.31</td>
<td>0.25</td>
<td>0.99</td>
<td>0.86</td>
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<tr>
<td>HadGEM2-ES</td>
<td>MOHC</td>
<td>1.87 x 1.25</td>
<td>0.04</td>
<td>0.11</td>
<td>0.30</td>
<td>0.24</td>
<td>0.99</td>
<td>0.92</td>
</tr>
</tbody>
</table>
LINEAR INTERPOLATION AND BIAS CORRECTION METHOD (LIBC)

- Time sorting of the observed dataset.
- Domain filtering of the observed dataset.
- Building of Climatology of the respective variable.
- Building of the Climatology of the Standard Deviation of the respective variable.
- Interpolation of the observed dataset to desired horizontal resolution.
Decadal change Winter mean temperature (°C) future – baseline (1975-2005)
Decadal change summer mean temperature (°C)
Future – Baseline (1975-2005)
Decadal change summer precipitation (%) future – baseline (1975-2005)
Decadal change Winter precipitation (%) future – baseline (1975-2005)
**FUTURE MEAN TEMPERATURE (°C) TRENDS UNDER RCP 8.5 SCENARIO**

**Gilgit**

- 2010-2039: Baseline (1980-2010)
- 2040-2069: Baseline (1980-2010)
- 2070-2099: Baseline (1980-2010)

**Gupis**

- 2010-2039: Baseline (1980-2010)
- 2040-2069: Baseline (1980-2010)
- 2070-2099: Baseline (1980-2010)

**Chilas**

- 2010-2039: Baseline (1980-2010)
- 2040-2069: Baseline (1980-2010)
- 2070-2099: Baseline (1980-2010)

**Bunji**

- 2010-2039: Baseline (1980-2010)
- 2040-2069: Baseline (1980-2010)
- 2070-2099: Baseline (1980-2010)
FUTURE PROJECTIONS OF Precipitation

- **Gilgit**
  - Baseline (1980-2010)
  - Future (RCP8.5)

- **Gupis**
  - Baseline (1980-2010)
  - Future (RCP8.5)

- **Chilas**
  - Baseline (1980-2010)
  - Future (RCP8.5)

- **Bunji**
  - Baseline (1980-2010)
  - Future (RCP8.5)
THANKS