

UIB WG-2

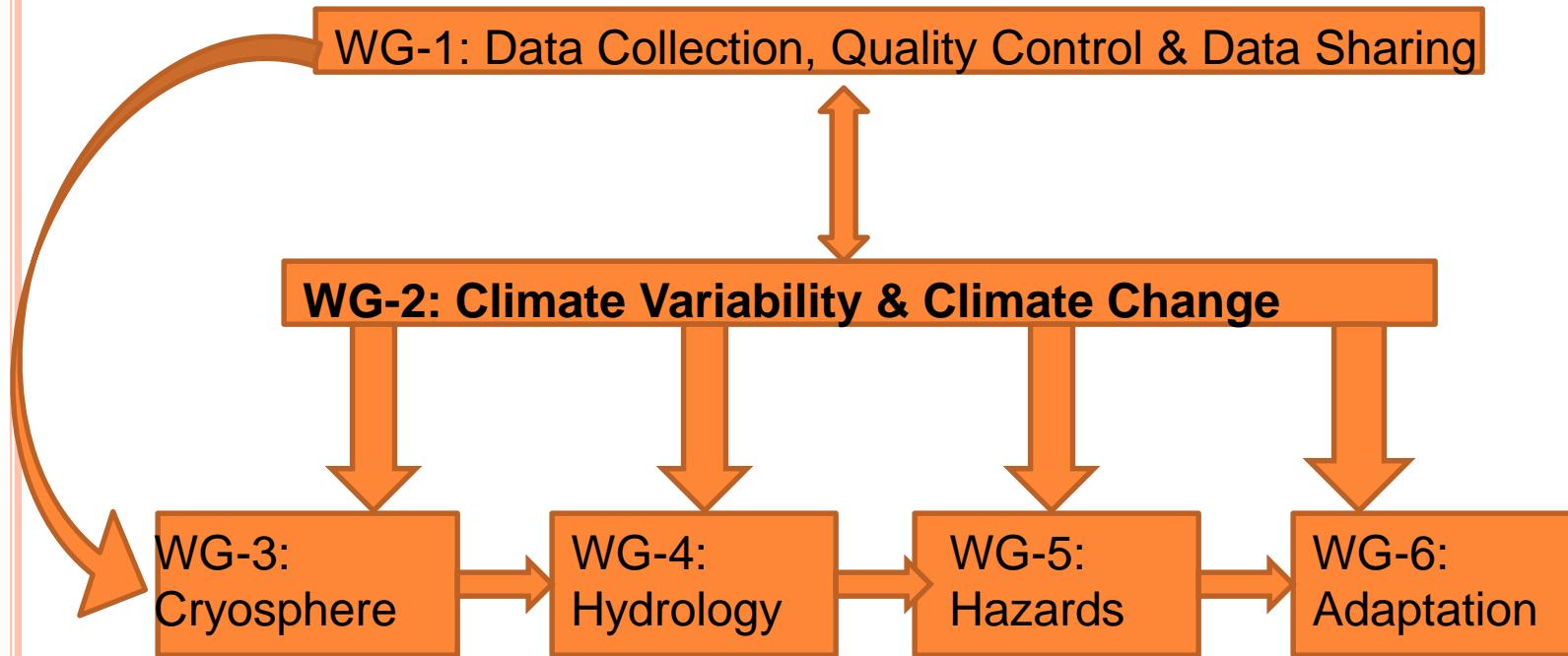
CLIMATE VARIABILITY AND CLIMATE CHANGE

Dr. Ghulam Rasul & Elisa Vuillermoz

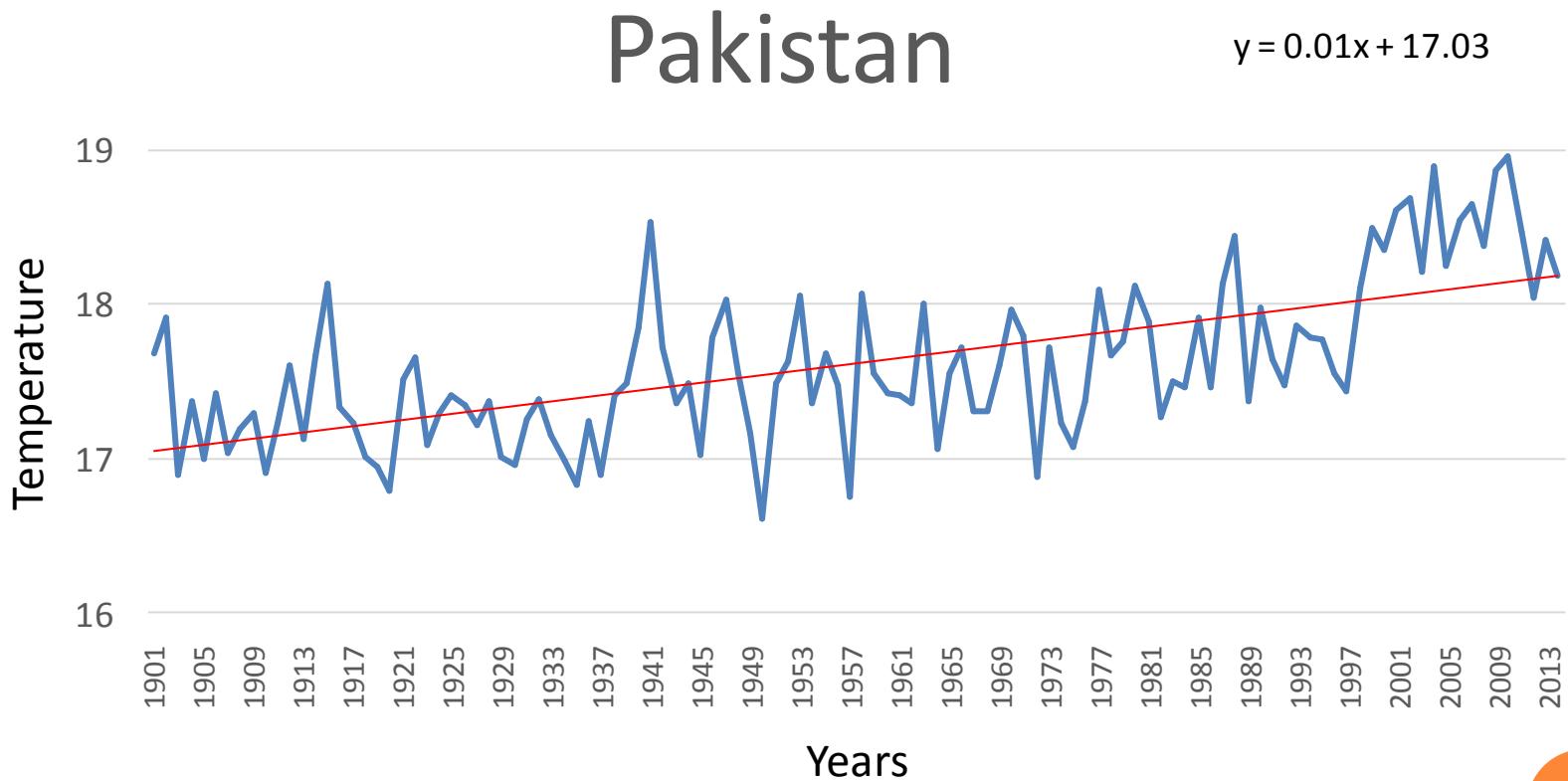
rasulpmd@gmail.com

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Coordination of Working Groups

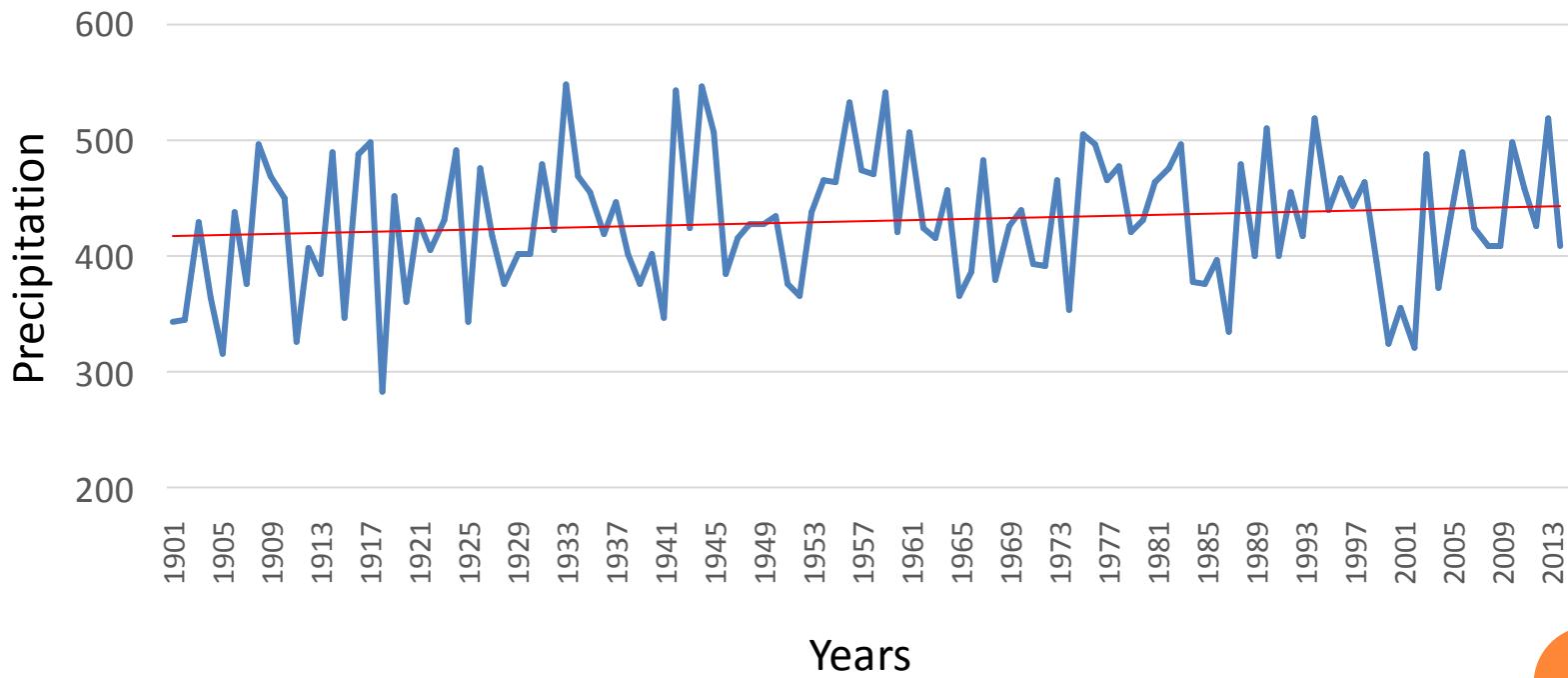


PAKISTAN MEAN TEMPERATURE (°C) 1901-2014

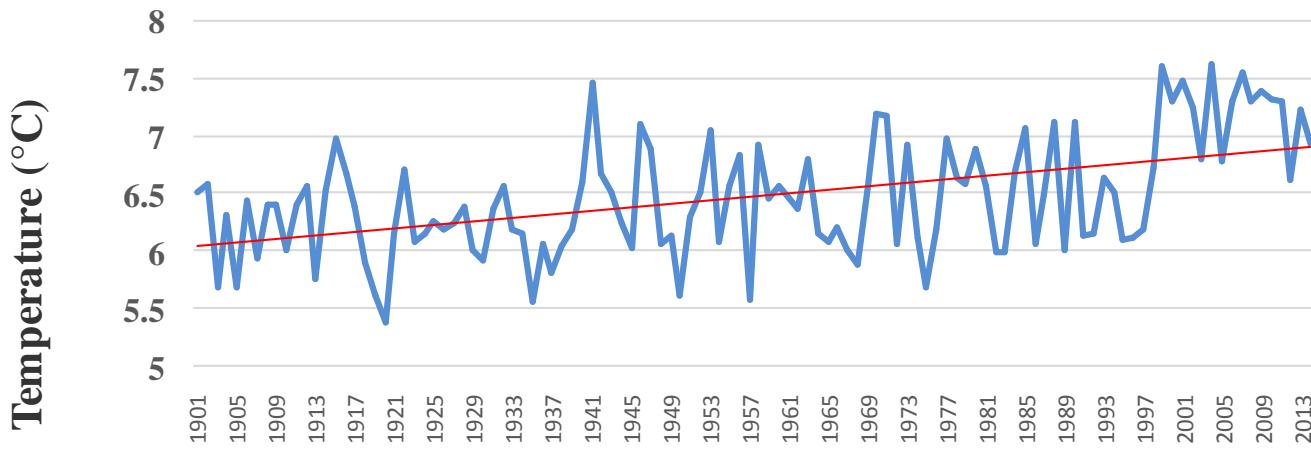


ANNUAL PRECIPITATION (MM/YR) 1901-2014

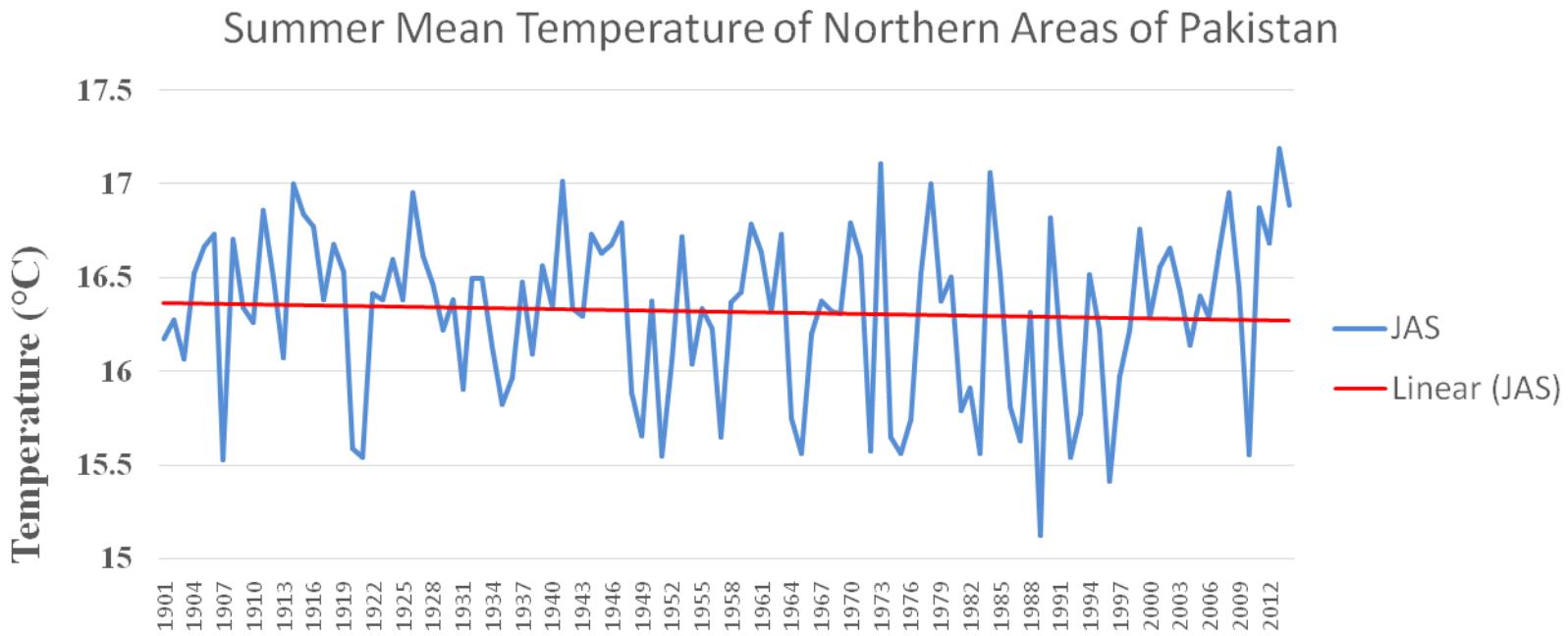
Pakistan



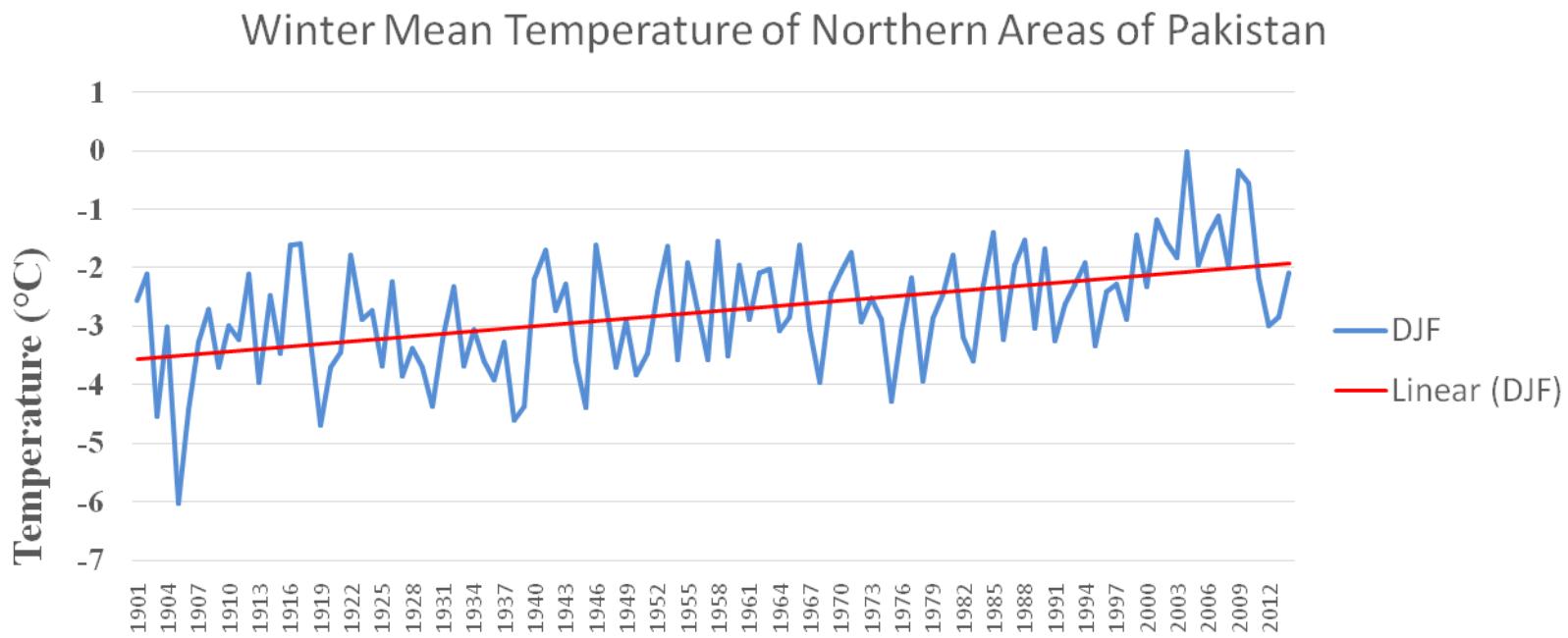
MEAN ANNUAL TEMPERATURE (°C) 1901-2014 OF NORTHERN AREAS OF PAKISTAN



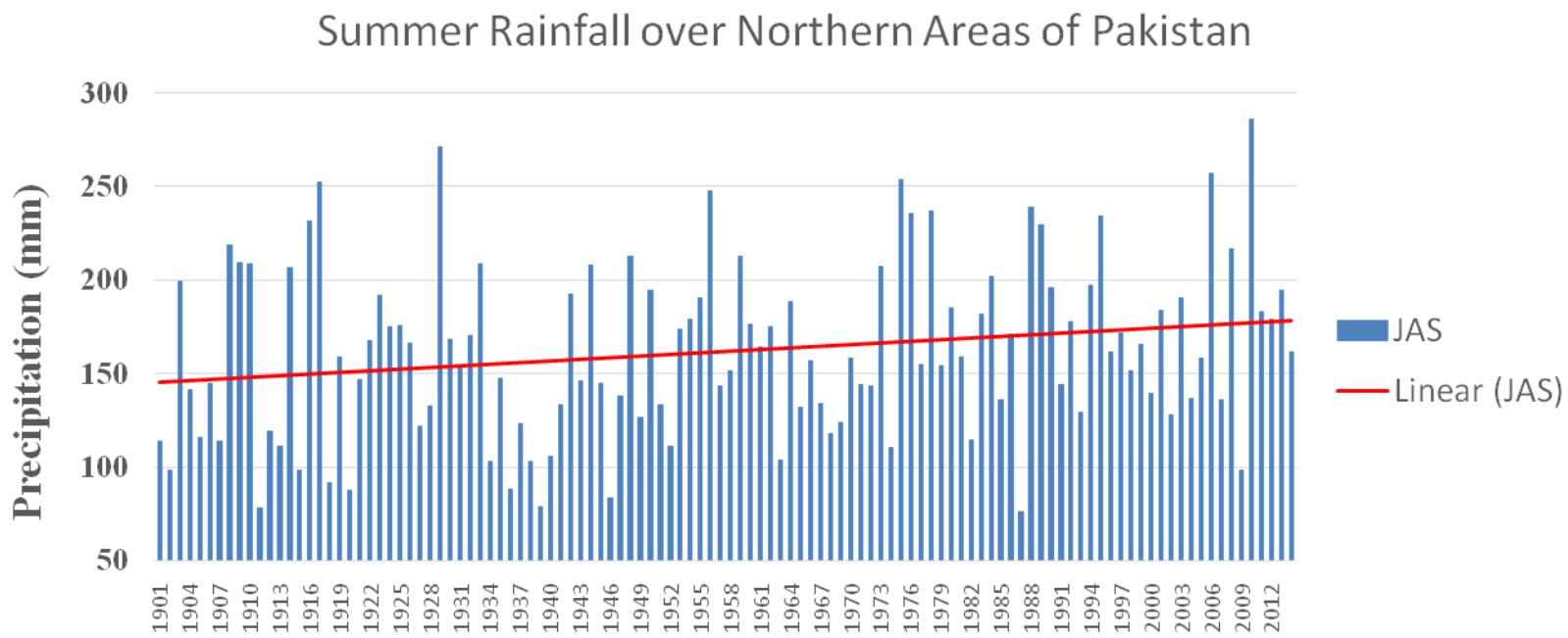
SUMMER MEAN TEMPERATURE (°C) 1901-2014 OF NORTHERN AREAS OF PAKISTAN



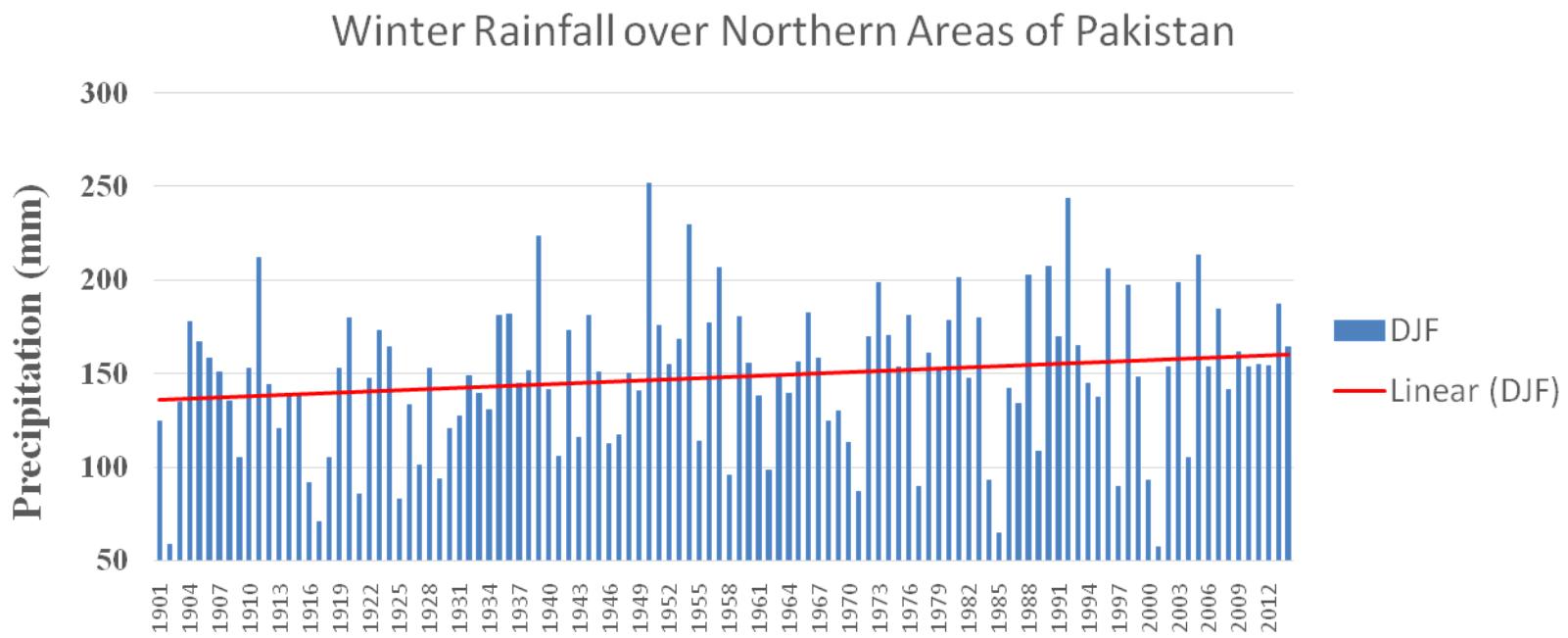
WINTER MEAN TEMPERATURE (°C) 1901-2014 OF NORTHERN AREAS OF PAKISTAN



SUMMER MEAN PRECIPITATION 1901-2014 OF NORTHERN AREAS OF PAKISTAN

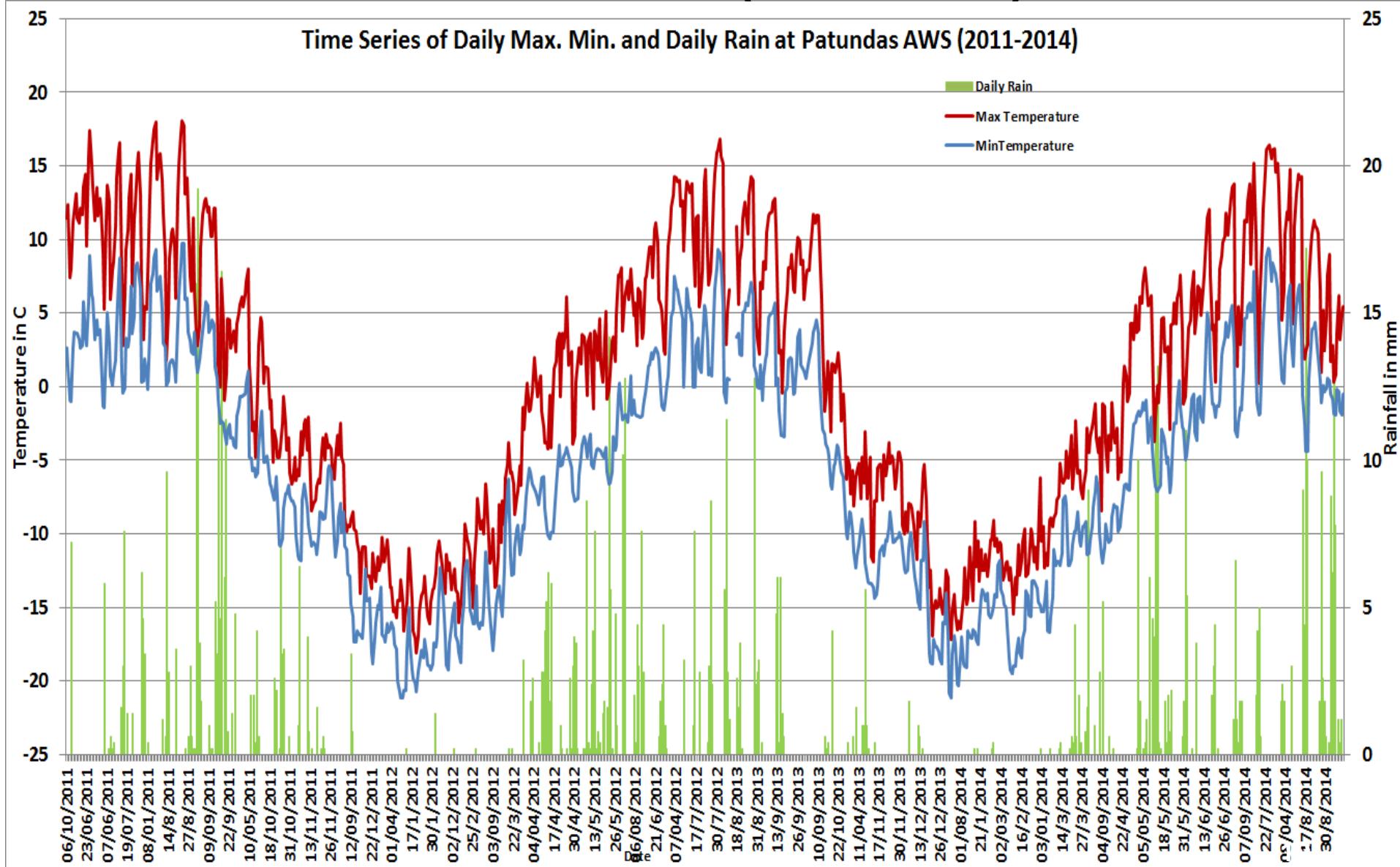


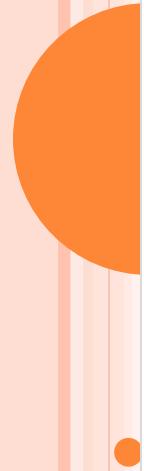
WINTER MEAN PRECIPITATION 1901-2014 OF NORTHERN AREAS OF PAKISTAN



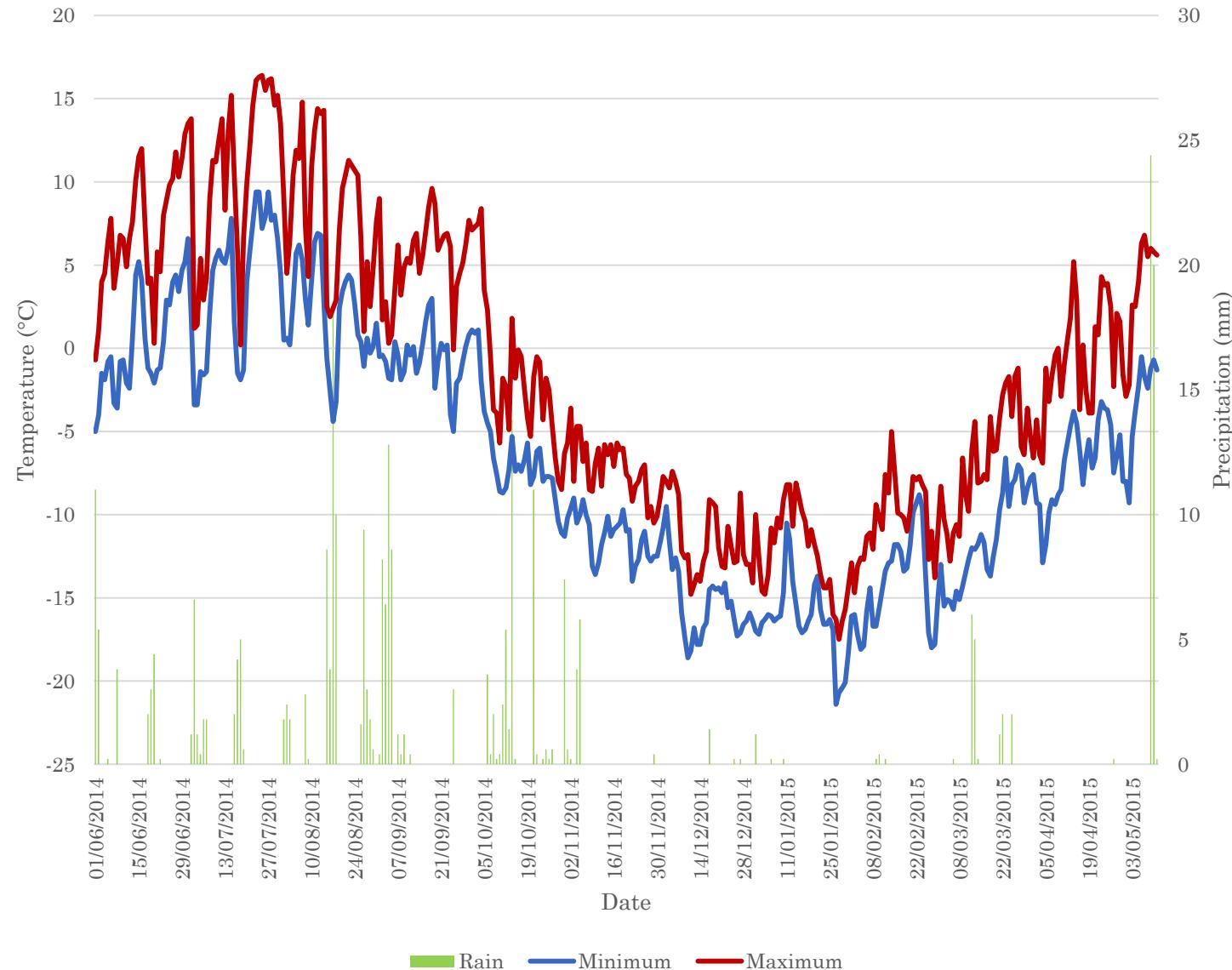
Passu Peak Data (2011-2014)

Time Series of Daily Max. Min. and Daily Rain at Patundas AWS (2011-2014)





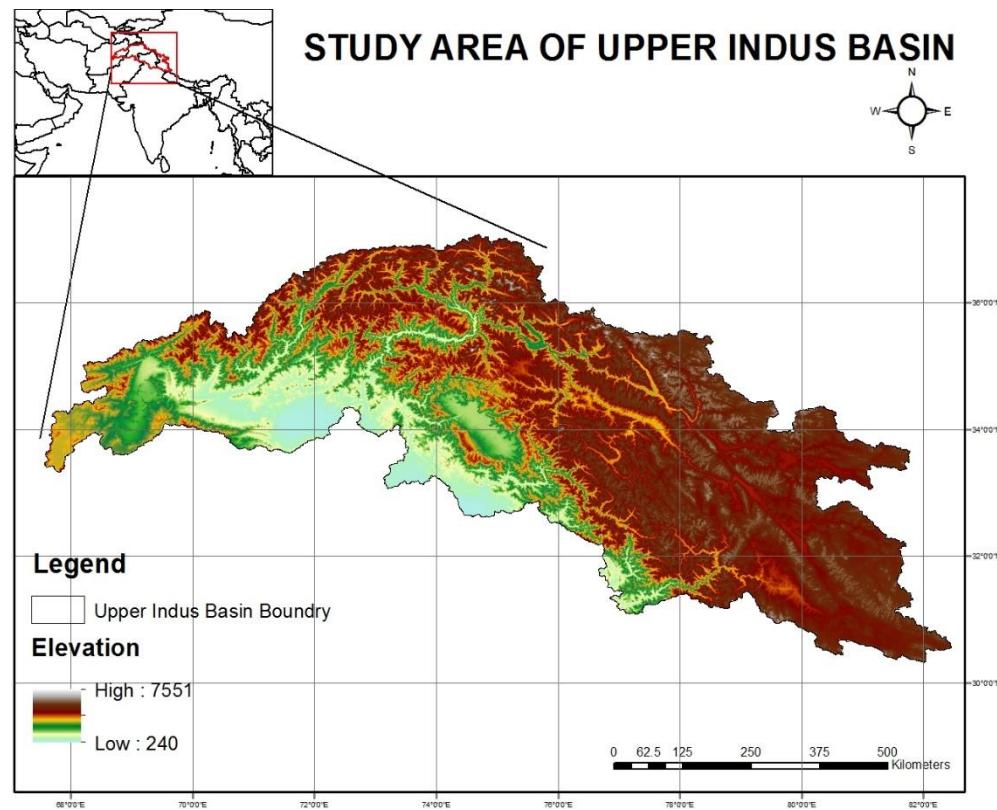
Passu Peak 2014-2015



GENERATION OF HIGH RESOLUTION DATA FOR UPPER INDUS BASIN

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 study area extends over four countries Afghanistan, Pakistan, India and China if we move from west to east.



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.

CMIP5 MODEL SELECTION

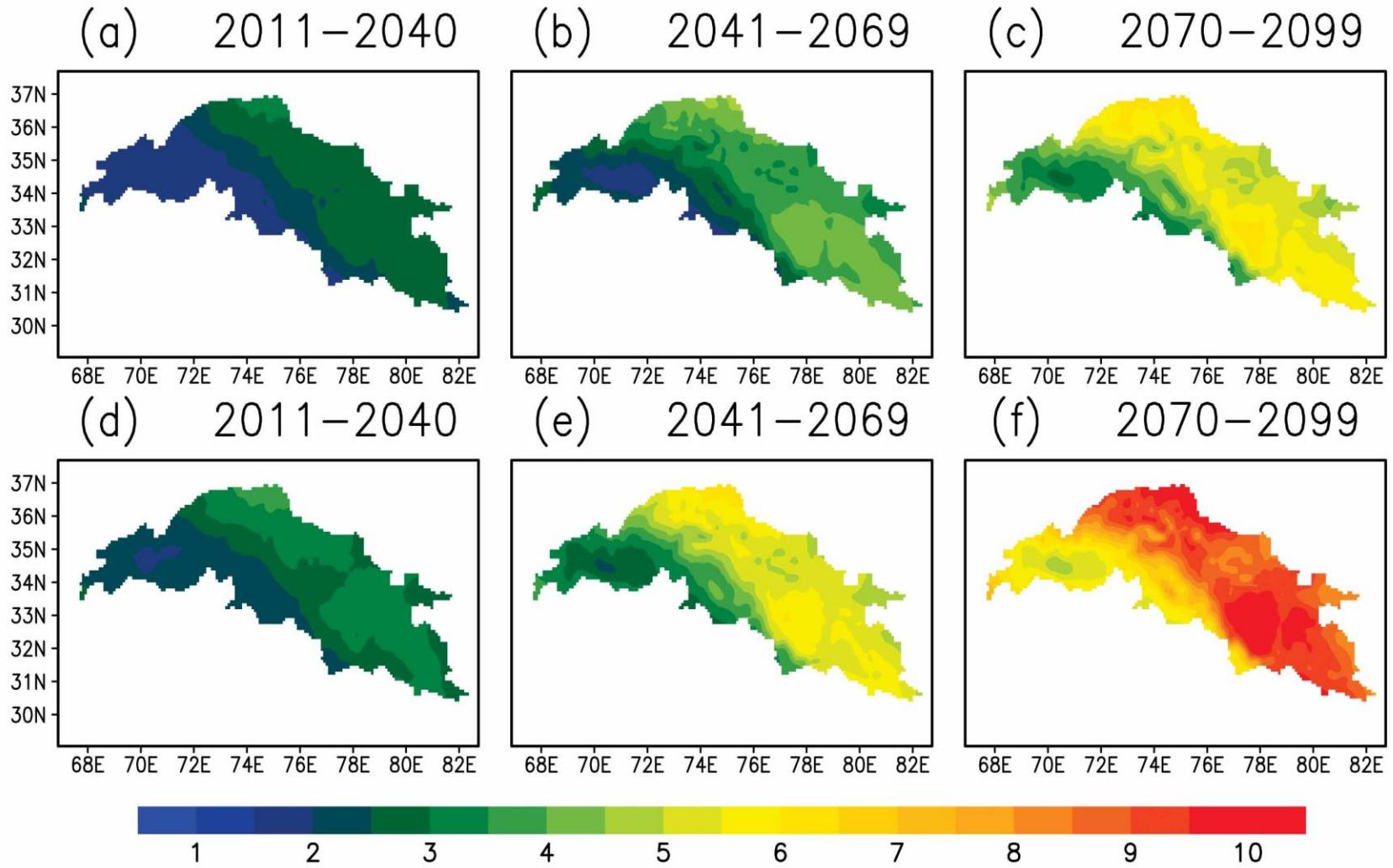
- Four GCMs have been selected based on their goodness of fit criteria:
- They have a good Pearson's Correlation Coefficient (greater than or equal to 0.88) with baseline APHRODITE time-series.
- Their normalized root mean square error is less than or equal to 0.15
- Their normalized standard deviations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

Model	Center	Spatial Resolution	RMSE_T	RMSE_P	SD_T	SD_P	CC_T	CC_P
CCSM4	NCAR	1.25x0.94	0.05	0.15	0.31	0.28	0.99	0.89
CanES M2	CCCMA	2.81x2.81	0.05	0.11	0.31	0.28	0.99	0.94
GFDL-ESM2 M	GFDL	2.5x2.011	0.05	0.15	0.31	0.25	0.99	0.86
HadGE M2-ES	MOHC	1.87 x 1.25	0.04	0.11	0.30	0.24	0.99	0.92

LINEAR INTERPOLATION AND BIAS CORRECTION METHOD (LIBC)

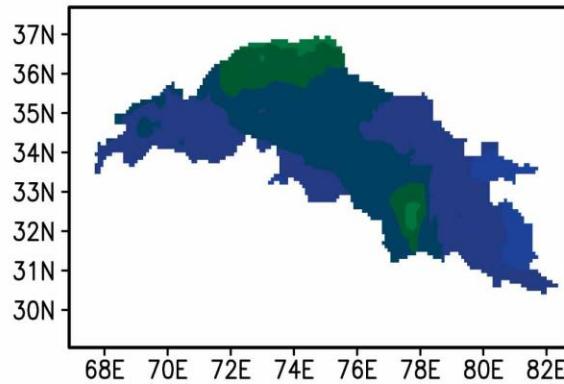
- Time sorting of the observed dataset.
- Domain filtering of the observed dataset.
- Building of Climatology of the respective variable.
- Building of the Climatology of the Standard Deviation of the respective variable.
- Interpolation of the observed dataset to desired horizontal resolution.

DECadal Change Winter Mean Temperature ($^{\circ}\text{C}$) Future – Baseline (1975–2005)

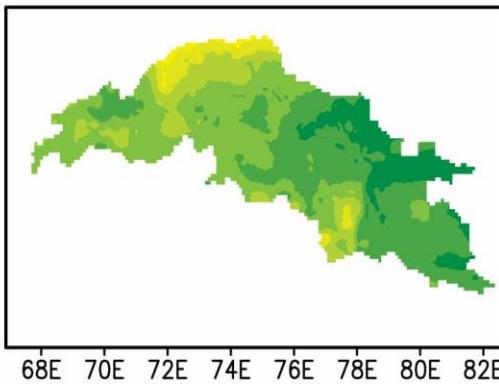


DECadal Change Summer Mean Temperature (°C) Future – Baseline (1975-2005)

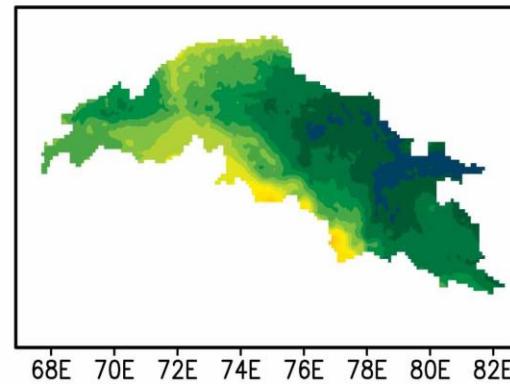
(a) 2011–2040



(b) 2041–2069

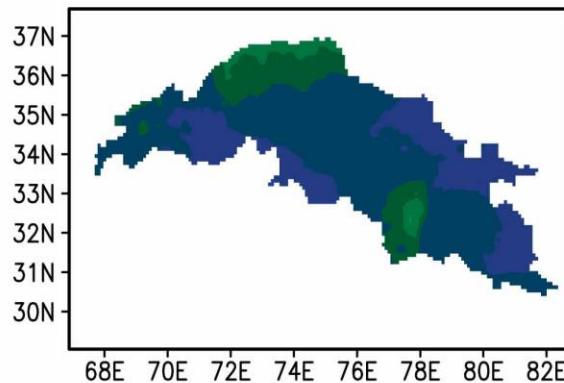


(c) 2070–2099

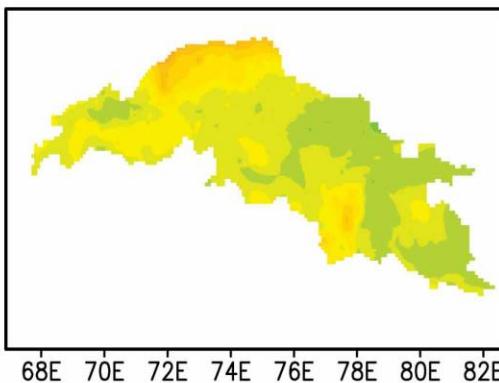


RCP 4.5

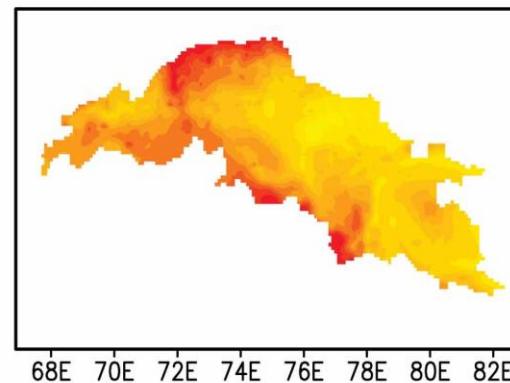
(d) 2011–2040



(e) 2041–2069

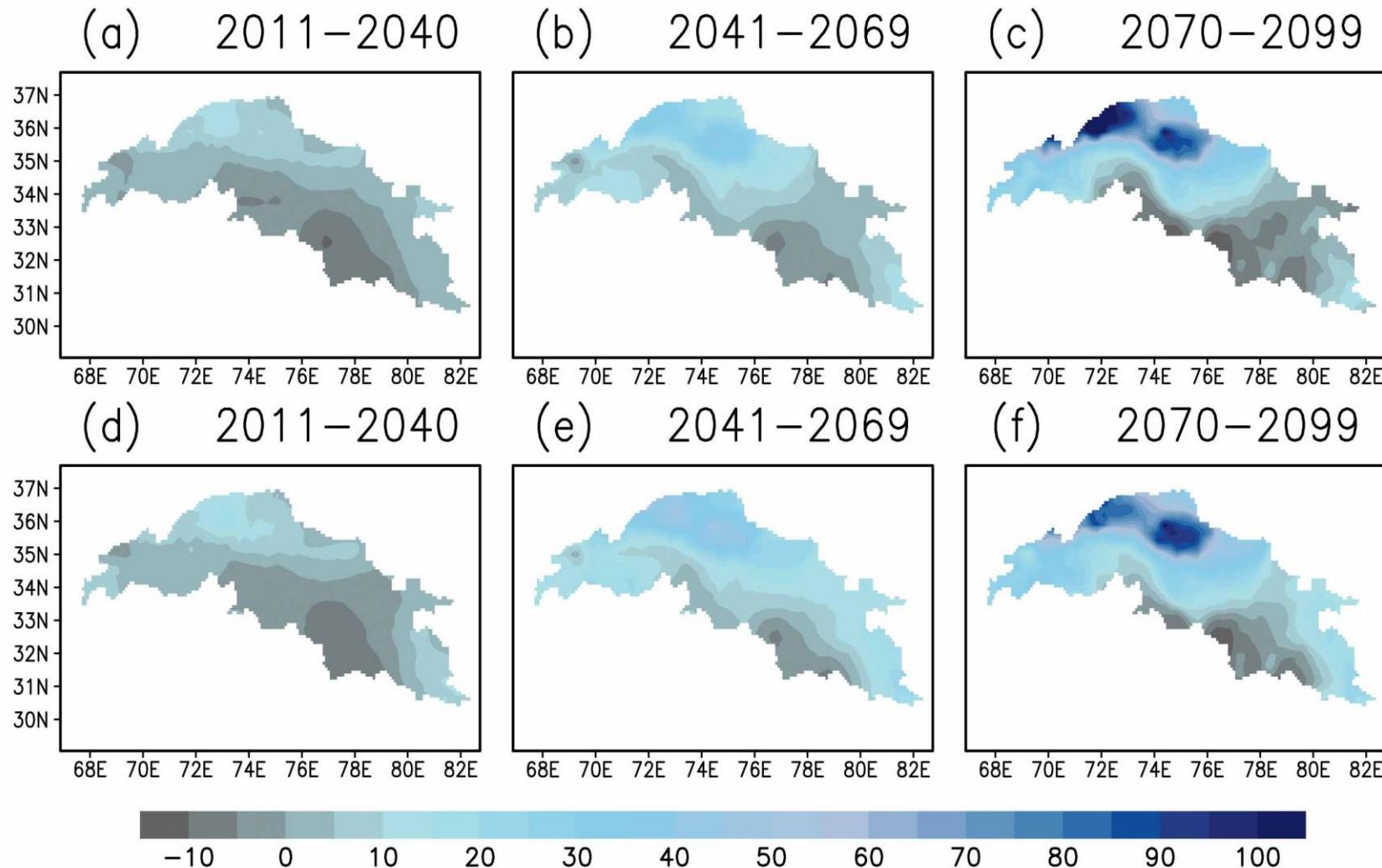


(f) 2070–2099

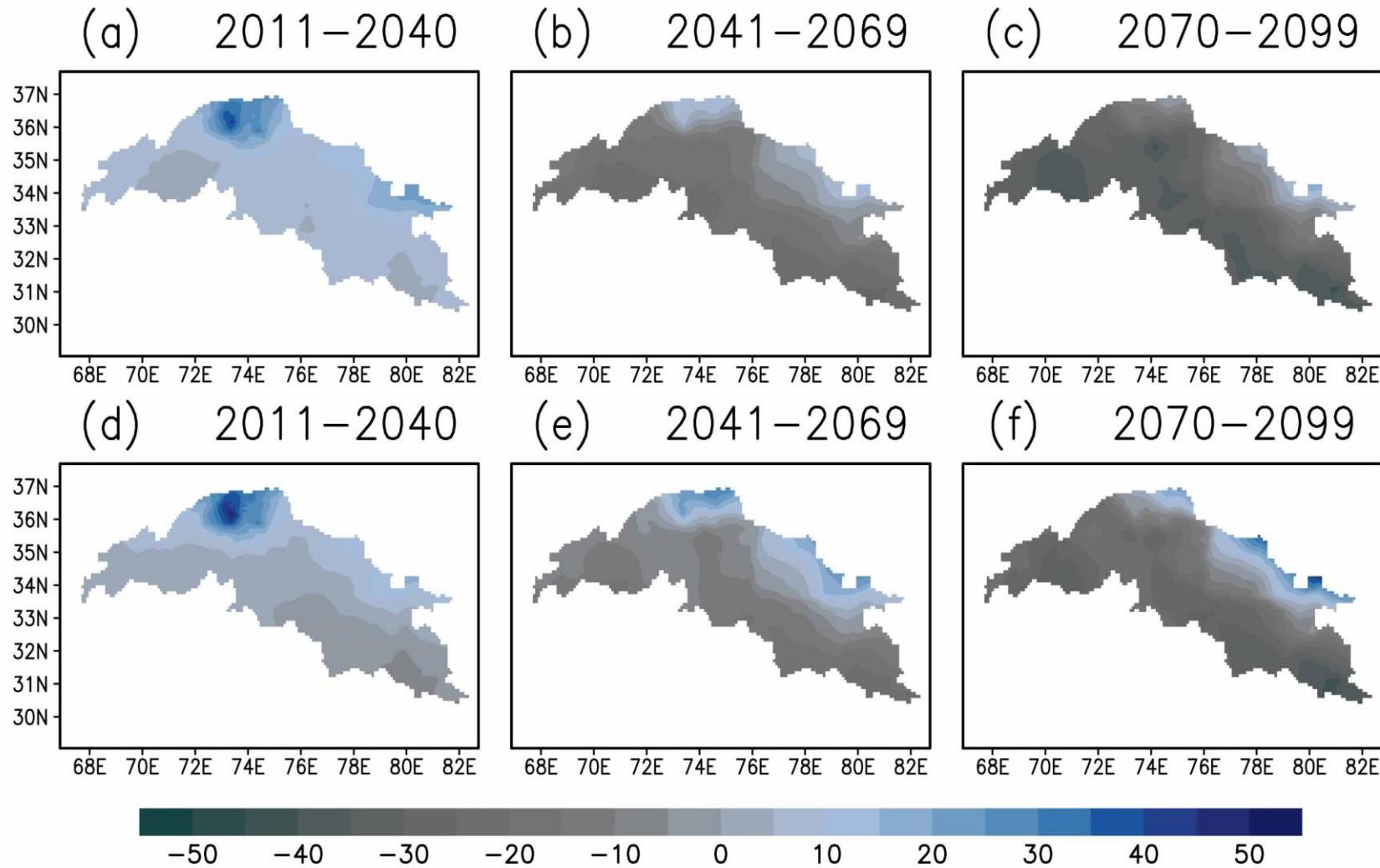


RCP 8.5

DECadal Change Summer Precipitation(%) Future – Baseline (1975-2005)



DECadal Change Winter Precipitation(%) Future – Baseline (1975-2005)



THANKS