# Climate Change Projections in South and Southeast Asian River Basins

**Workshop on Status of Climate Science and Technology in Asia – for IPCC AR6**
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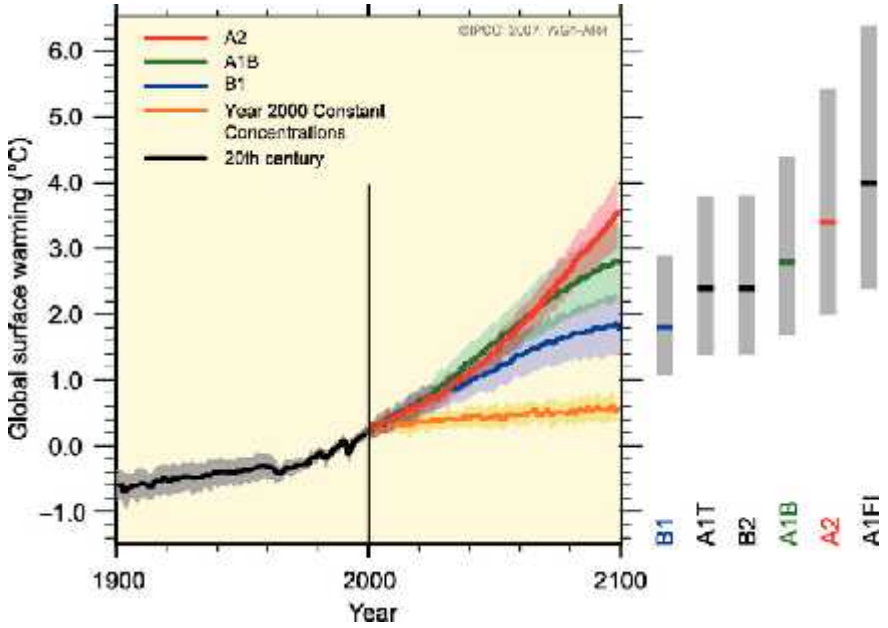
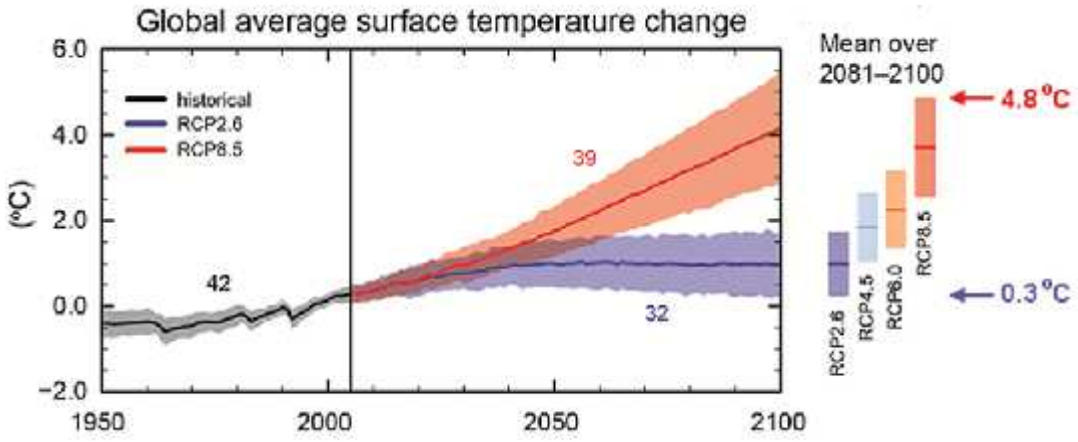
# Background

- Synthesis presentation is based on the research (AIT's MS and PhD students) and projects (APN, HSBC, USAID, WWF) related to climate change impacts and adaptation in water resources
- Basin (local) scale climate change projection is necessary for climate change impact assessment and evaluation of adaptation strategies as GCMs and RCMs do not represent local climate
- Statistical downscaling method was used for climate change projection in 21 river basins of Southeast and South Asia

# Global Climate Change Projection

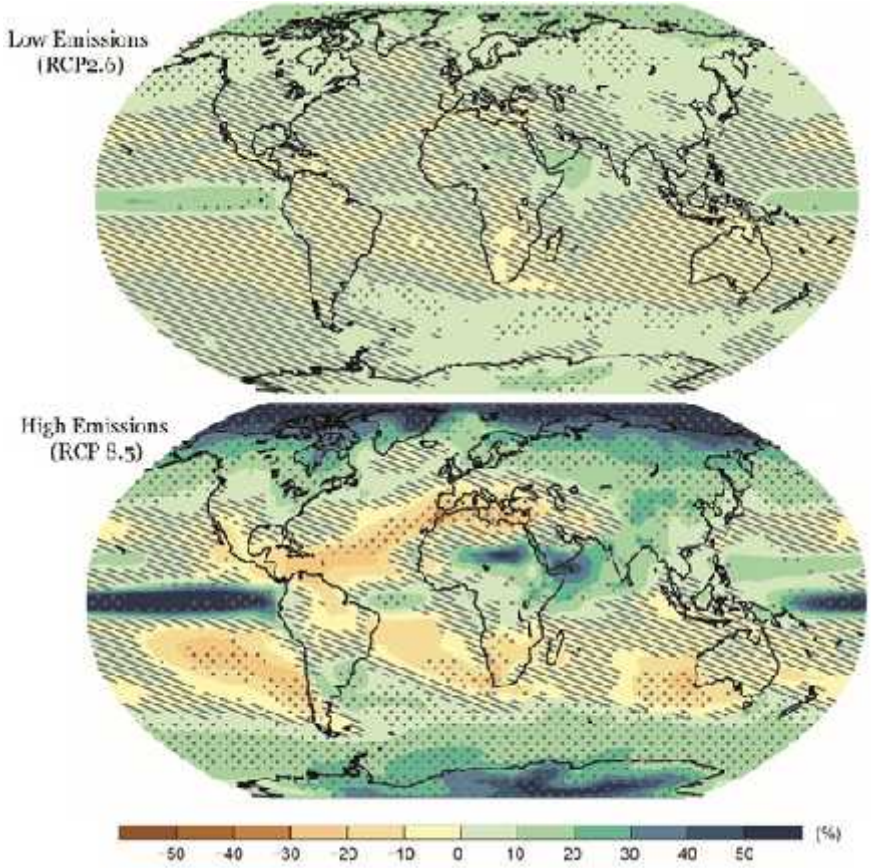



The global average surface temperature for 2090-2099 is likely to be 1.8°C in the most optimistic scenario (B1) and 4.0°C in the most pessimistic scenario (A1FI) above the average of 1980-1999. (Source: IPCC AR4)




The global average surface temperature for 2081-2100 is likely to be 0.3°C in the most optimistic scenario (RCP2.6) and 4.8°C in the most pessimistic scenario (RCP8.5) above the average of 1986-2005. (Source: IPCC AR5)

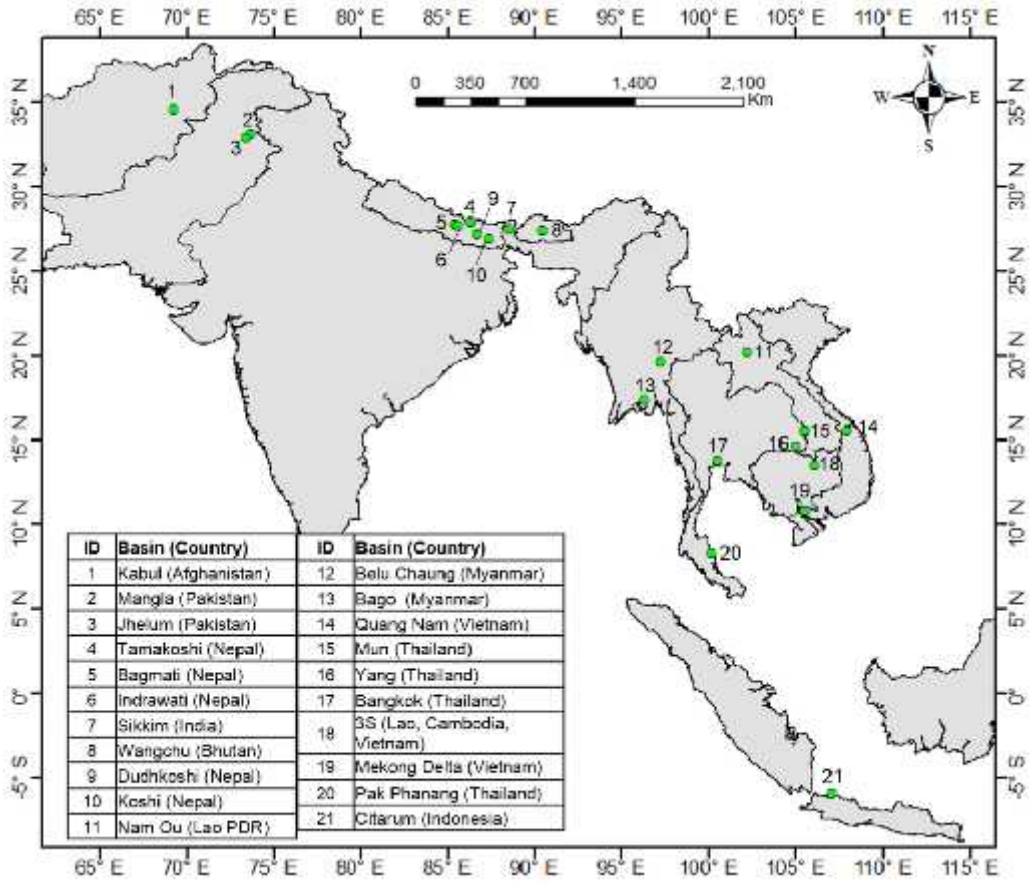
# Global Climate Change Projection




Percent change in average yearly precipitation at the end of the century relative to (1986-2005) for two emission scenarios.

Precipitation change will vary from region to region. Under RCP8.5, mid-latitude wet regions are likely to see increases in precipitation, while many mid-latitude and subtropical dry regions are likely to experience decreases in precipitation.
(Source: IPCC AR5)

# Local Climate Change Projection

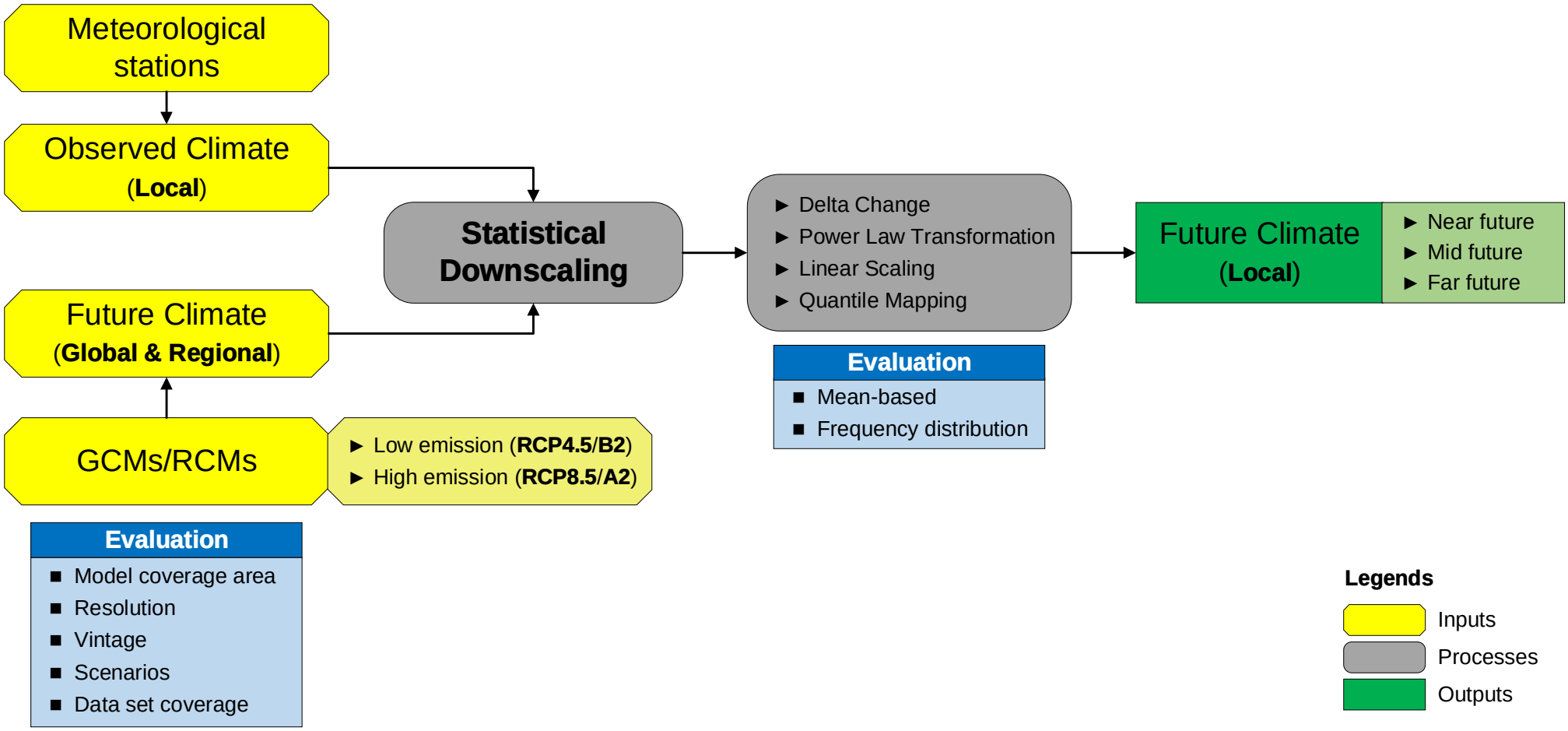



| ID | Basin (Country) | ID | Basin (Country) |
|---|---|---|---|
| 1 | Kabul (Afghanistan) | 12 | Belu Chaung (Myanmar) |
| 2 | Mangla (Pakistan) | 13 | Bago (Myanmar) |
| 3 | Jhelum (Pakistan) | 14 | Quang Nam (Vietnam) |
| 4 | Tamakoshi (Nepal) | 15 | Mun (Thailand) |
| 5 | Bagmati (Nepal) | 16 | Yang (Thailand) |
| 6 | Indrawati (Nepal) | 17 | Bangkok (Thailand) |
| 7 | Sikkim (India) | 18 | 3S (Lao, Cambodia, Vietnam) |
| 8 | Wangchu (Bhutan) | 19 | Mekong Delta (Vietnam) |
| 9 | Dudhkoshi (Nepal) | 20 | Pak Phanang (Thailand) |
| 10 | Koshi (Nepal) | 21 | Citarum (Indonesia) |
| 11 | Nam Ou (Lao PDR) | | |

| No. | Basin, Country | Location (Lat, Long) | Area ($km^2$) | Altitude (masl) | Climate | Rainfall (mm/yr) |
|---|---|---|---|---|---|---|
| 1 | Kabul, Afghanistan | 34.52, 69.17 | 76,908 | 5,000 | Arid | 1,035 |
| 2 | Mangla, Pakistan | 33.13, 73.63 | 33,342 | 4,000 | Sub- | 1,200 |
| 3 | Jhelum, Pakistan | 32.93, 73.37 | 33,342 | 3260 | Sub- | 1265 |
| 4 | Tamakoshi, Nepal | 27.88, 86.27 | 2,926 | 4,082 | Sub-tropical | 1,900 |
| 5 | Bagmati, Nepal | 27.78, 85.30 | 3,750 | 1,400 | Sub-tropical | 1,300 |
| 6 | Indrawati, Nepal | 27.67, 85.56 | 1,240 | 3,200 | Sub-tropical | 3,000 |
| 7 | Sikkim, India | 27.52, 88.50 | 7,096 | 3,800 | Sub- | 3,050 |
| 8 | Wangchu, Bhutan | 27.45, 90.43 | 4,000 | 2,500 | Sub-tropical | 2,200 |
| 9 | Dudhkoshi, Nepal | 27.23, 86.60 | 3,718 | 4,650 | Sub- | 1,930 |
| 10 | Koshi, Nepal | 26.90, 87.30 | 69,300 | 4,032 | Tropical- | 1,800 |
| 11 | Nam Ou, Lao PDR | 20.22, 102.20 | 26 ,180 | 1,150 | Tropical | 1,700 |
| 12 | Belu Chaung, | 19.66, 97.20 | 8,329 | 760 | Tropical | 1,273 |
| 13 | Bago, Myanmar | 17.33, 96.29 | 4,883 | 30 | Tropical | 2,500 |
| 14 | Quang Nam, Vietnam | 15.53,107.92 | 10,438 | 690 | Tropical | 2,700 |
| 15 | Mun, Thailand | 15.47, 105.48 | 119,180 | 530 | Tropical | 1,080 |
| 16 | Yang, Thailand | 14.62, 105.00 | 4,145 | 300 | Tropical | 1,390 |
| 17 | Bangkok, Thailand | 13.75, 100.50 | 1,569 | 2 | Tropical | 1,500 |
| 18 | 3S (Laos, Cambodia, | 13.50, 106.00 | 78,529 | 1,060 | Tropical | 2,450 |
| 19 | Mekong Delta | 10.77, 105.49 | 39,734 | 0.3 | Tropical | 1,727 |
| 20 | Pak Phanang, Thailand | 8.30, 100.12 | 422 | 4 | Tropical | 2,200 |
| 21 | Citarum, Indonesia | -5.93, 107.00 | 6,080 | 800 | Tropical | 2,300 |

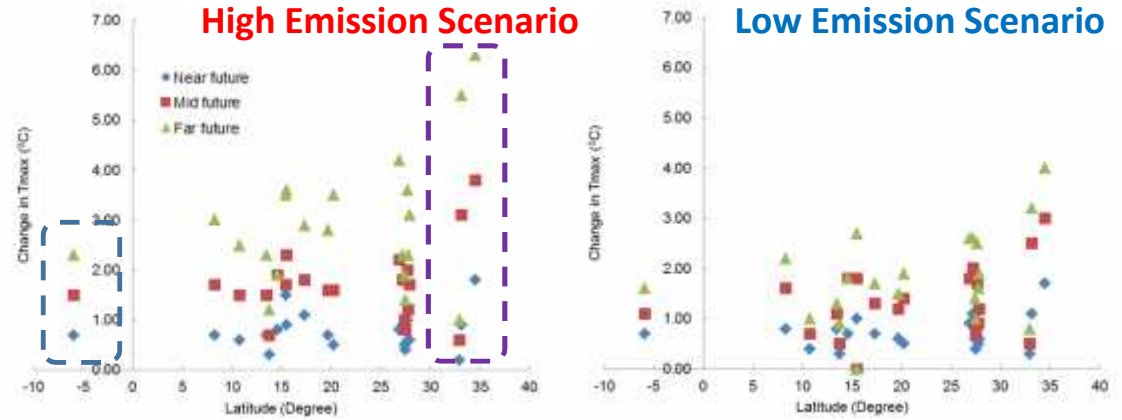
Location map of selected basins for climate change projections in South and Southeast Asia

# Methodology and Data

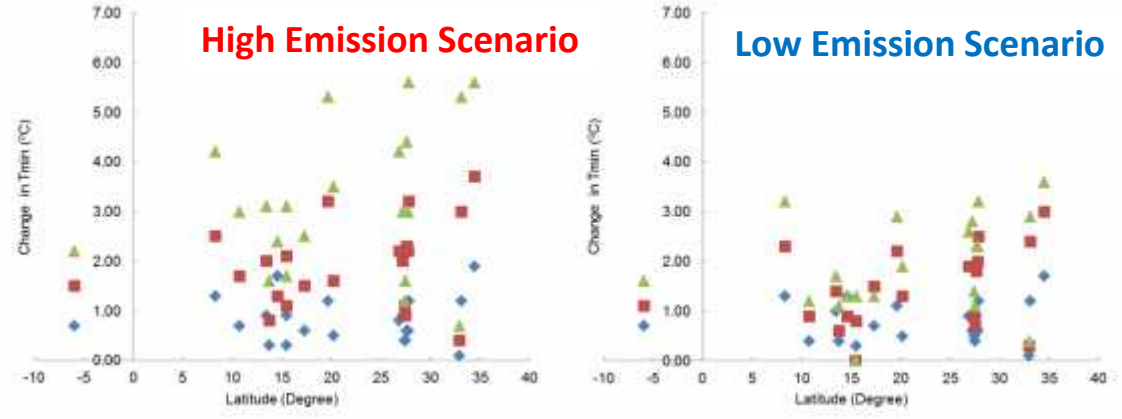


# Results: Change in Temperature

**Tmax**




**Tmin**



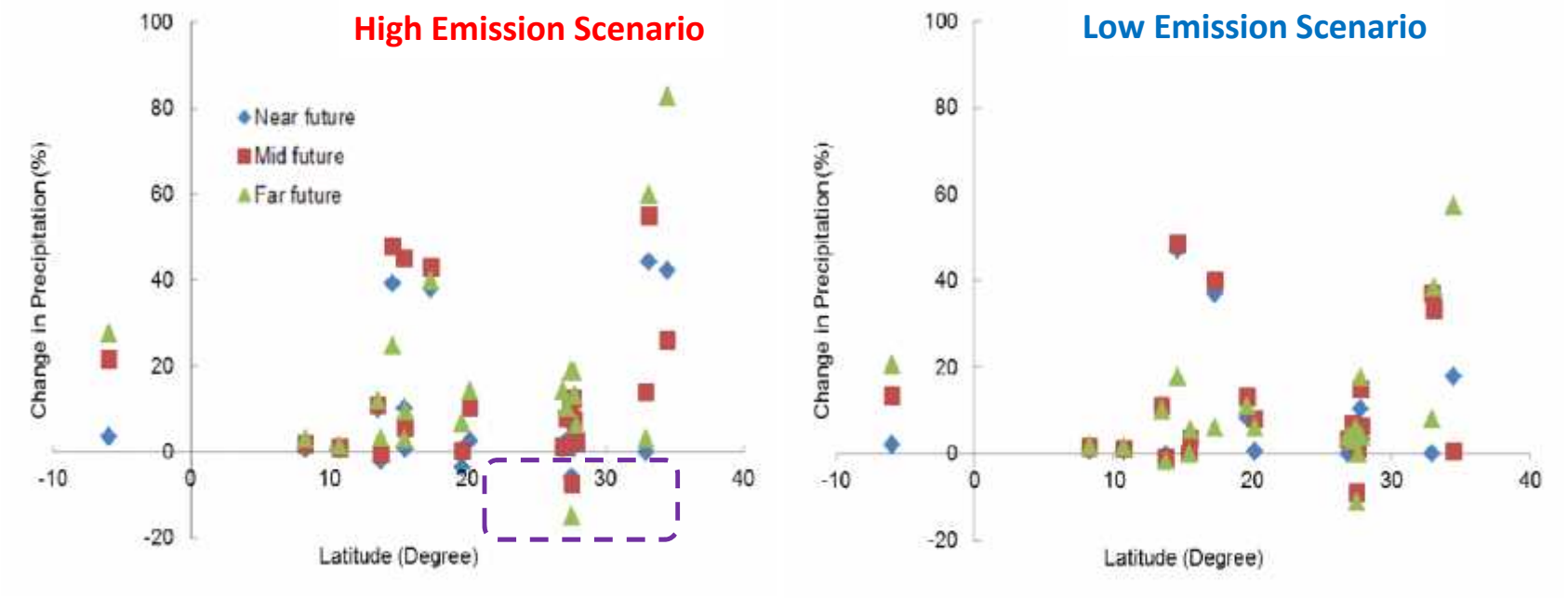

Projected change in average annual maximum temperature (Tmax) and minimum temperature (Tmin)

# Results: Change in Temperature

Projected change in average annual maximum temperature (Tmax) and minimum temperature (Tmin) in far future period

| | Emission scenarios | Tmax | Highest increase in Tmax | Tmin | Highest increase in Tmin |
|---|---|---|---|---|---|
| **Higher latitude** | Low emission scenario | 0.8 to 2.6°C | Kabul River Basin (Afghanistan) | 0.4 to 3.6°C | Kabul River Basin (Afghanistan) |
| | High emission scenario | 1.0 to 6.3°C | | 0.7 to 5.6°C | |
| **Lower latitude** | Low emission scenario | 0.9 to 2.7°C | Quang Nam River Basin (Vietnam) | 1.0 to 3.2°C | Belu Chaung River Basin (Myanmar) |
| | High emission scenario | 1.2 to 3.6°C | | 1.6 to 5.3°C | |

# Results: Change in Precipitation




Projected changes (%) in average annual precipitation, as compared to the baseline period under high and low emission scenarios in near, mid, and far future periods

# Results: Change in Precipitation

Projected change in average annual precipitation (%) in far future period

| | Emission scenarios | Highest increase | Highest decrease |
|---|---|---|---|
| **Higher latitude** | Low emission scenario | +57.3%, Kabul Basin (Afghanistan) | -11%, Sikkim Basin (India) |
| | High emission scenario | +82.6%, Kabul Basin (Afghanistan) | -15%, Sikkim Basin (India) |
| **Lower latitude** | Low emission scenario | +20,7%, Citarum Basin (Indonesia) | -1.8%, Bangkok (Thailand) |
| | High emission scenario | +40%, Bago Basin (Myanmar) | -0.4%, Bangkok (Thailand) |

# Conclusions

- Average annual maximum and minimum temperatures are projected to increase in all three future time periods, with lower increase in the near future and higher increase in the far future periods.
- The magnitude of increase of average annual minimum temperature is higher than average annual maximum temperature in a majority of the basins.
- Unlike temperature, precipitation shows different directions of change in the basins.
- Uncertainty exists in climate change projections due to selection of climate models, downscaling/bias correction methods.

# Acknowledgements

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