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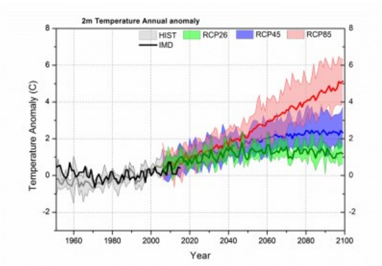

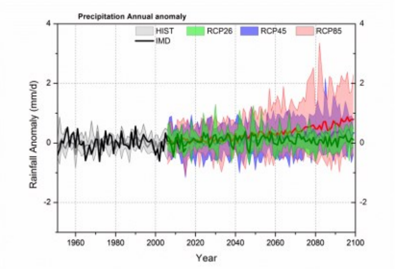

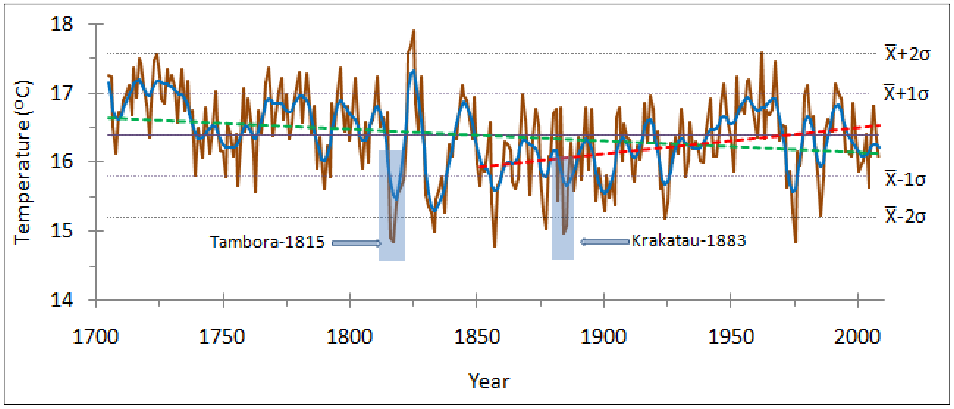

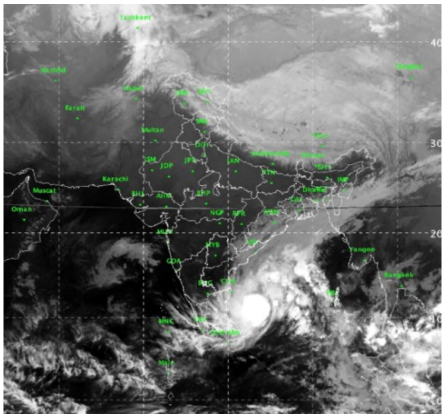

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IMSP News

Regional Climate Change Datasets for South Asia

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1. Introduction

The Centre for Climate Change Research (CCCR;http://cccr.tropmet.res.in) at the Indian Institute of Tropical Meteorology (IITM; http://www.tropmet.res.in), Pune, launched in 2009 with the support of the Ministry of Earth Sciences (MoES), Government of India, focuses on the development of new climate modelling capabilities in India and South Asia to address issues concerning the science of climate change. CCCR-IITM has the mandate of developing an Earth System Model and to make the regional climate projections. An important achievement was made by developing an Earth System Model at IITM, which is an important step towards understanding global and regional climate response to long-term climate variability and climate change. CCCR-IITM has also generated an ensemble of high resolution dynamically downscaled future projections of regional climate over South Asia and Indian monsoon, which are found useful for impact assessment studies and for quantifying uncertainties in the regional projections. A brief overview of these core climate change modeling activities of CCCR-IITM was presented in an Interim Report on Climate Change over India (available at http://cccr.tropmet.res.in/home/reports.jsp)

2. Regional Climate Projections for South Asia

The ensemble of high resolution downscaled projections of regional climate and monsoon over South Asia until 2100 are generated by CCCR-IITM using a regional climate model (ICTP-RegCM4; Giorgi et al. 2012) at 50 km horizontal resolution. These high-resolution downscaled projections of regional climate over South Asia are developed as part of the WMO's World Climate Research Programme (WCRP) regional activity Coordinated Regional Climate Downscaling Experiment (CORDEX; http://cordex.org/). The CORDEX aims to foster international partnership in order to produce an ensemble of high-resolution past and future climate projections at regional scale. CCCR-IITM is the nodal agency for coordinating the CORDEX modeling activity in South Asia (https://www.wcrp-climate.org/wcrp-regional-activities/ra-asia). The CCCR-IITM and several international partner institutions have contributed towards generation and evaluation of regional climate simulations for CORDEX South Asia (http://cccr.tropmet.res.in/home/cordexsa_datasets.jsp). This CORDEX dataset is comprised of downscaled climate scenarios for the South Asia region that are derived from the Atmosphere-Ocean coupled General Circulation Model (AOGCM) runs conducted under the Coupled Model Intercomparison Project Phase 5 (CMIP5), and using three of the four greenhouse gas emissions scenarios known as Representative Concentration Pathways (RCPs). The CMIP5 AOGCM runs were developed in support of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5). The coarser spatial resolution ranging from 1.0° to 3.8°, and systematic error (called bias) of these AOGCMs limits the examination of possible impacts of climate change and adaptation strategies on a smaller scale. The dynamical downscaling method using high resolution limited area regional climate models (RCMs) utilizes the outputs provided by AOGCMs as lateral boundary condition to provide physically consistent spatiotemporal variations of climatic parameters at spatial scales much smaller than the AOGCMs' grid. The

CORDEX South Asia dataset includes dynamically downscaled projections from the 10 models and scenarios for which daily scenarios were produced and distributed under CMIP5. The purpose of these datasets is to provide a set of high resolution (50 km) regional climate change projections that can be used to evaluate climate change impacts on processes that are sensitive to finer-scale climate gradients and the effects of local topography on climate conditions. An initial assessment of the ability of the CORDEX RCMs to simulate the general characteristics of the Indian climate indicated that the geographical distribution of surface air temperature and seasonal precipitation in the present climate for land areas in South Asia is strongly affected by the choice of the RCM and boundary conditions (i.e. driving AOGCMs), and the downscaled seasonal averages are not always improved (Sanjay et al. 2017a). The CORDEX South Asia datasets was recently used for assessing the future climate projections over India in the Interim Report on Climate Change over India (available at http://cccr.tropmet.res.in/home/reports.jsp).

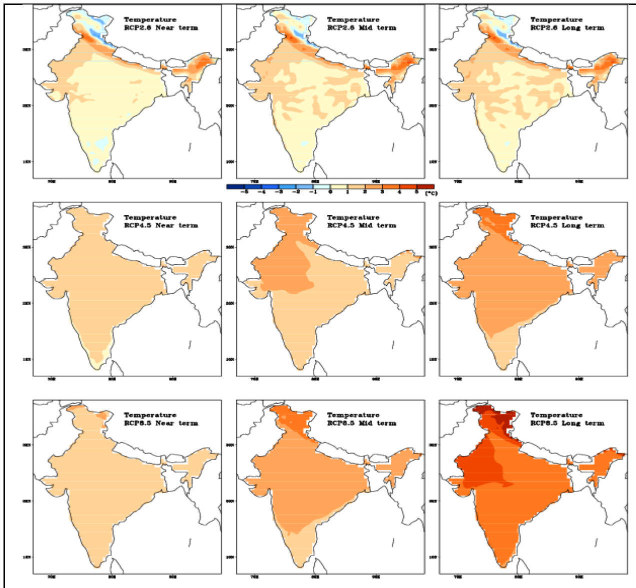

Figure 1 CORDEX South Asia multi-RCM ensemble mean projections of annual average surface air temperature (°C) changes for near-term (2016-2045), mid-term (2036–2065) and long-term (2066–2095) climate under RCP2.6, RCP4.5 and RCP8.5 scenarios, relative to 1976–2005.

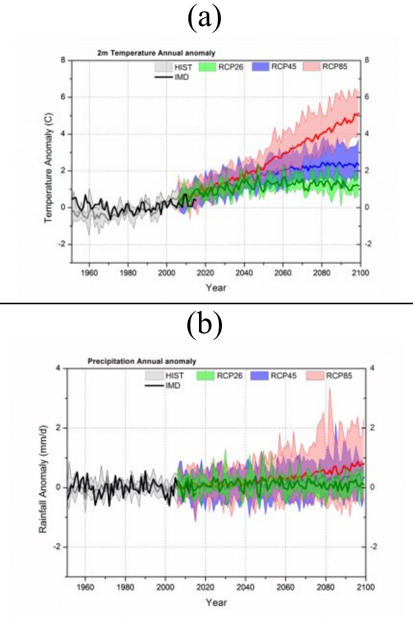

Figure 2 Time series of Indian annual mean (a) surface air temperature (°C)and (b) precipitation (mm d^{-1}) anomalies (relative to 1976–2005) from CORDEX South Asia concentration-driven experiments. The historical simulations (grey) and the downscaled projections are shown for RCP2.6 (green), RCP4.5 (blue) and RCP8.5 (red) scenarios for the multi-RCM ensemble mean (solid lines) and the minimum to maximum range of the individual RCMs (shading). The black line shows the observed anomalies during 1951-2015 based on IMD gridded data.

The projections of near-term (2016-2045)change in the CORDEX South Asia multi-RCM ensemble mean annual mean surface air temperature relative to the reference period 1976-2005, show modest sensitivity to alternate RCP scenarios over Indian land area (see left panels of Figure 1).The projected annual warming exceeding 3°C is seen over entire India for the high-emission RCP8.5 scenario by the end of 21st century, with relatively higher change exceeding 4°C projected in the semi-arid north-west and north India (see bottom right panel of Figure 1).The CORDEX South Asia historical RCM simulations capture the observed all India averaged annual surface air temperature interannual variations and the warming trend reasonably well (Figure 2a). A consistent and robust feature across the downscaled CORDEX South Asia RCMs is a continuation of warming over India in the 21st century for all the RCP scenarios.The spread in the minimum to maximum range in the projected warming among the CORDEX South Asia RCMs for each RCP scenario (shown as shading in Figure 2a) provide a simple, but crude, measure of uncertainty.

Table 1 CORDEX South Asia multi-RCM reliability ensemble average (REA) estimate of projected changes in annual mean surface air temperature over India and the associated uncertainty range. The values in parenthesis show the uncertainty in percent for the REA estimate.

Scenario	**Annual Mean Temperature (^{o}C)**		
	2030s	**2050s**	**2080s**
RCP2.6	1.08 ± 0.12(11.1%)	1.35 ± 0.18(13.3%)	1.35 ± 0.23(17.0%)
RCP4.5	1.28 ± 0.20(15.6%)	1.92 ± 0.28(14.6%)	2.41 ± 0.40(16.6%)
RCP8.5	1.44 ± 0.17(11.8%)	2.41 ± 0.28(11.6%)	4.19 ± 0.46(11.0%)

A quantitative estimate of the associated uncertainty range based on a reliability ensemble average (REA) method (Sengupta and Rajeevan 2013) incorporating each RCM performance and convergence indicated that the all India mean surface air temperature is projected to increase in the far future (2066–2095) by 4.19 ± 0.46°C under RCP8.5 scenario, associated with 11% uncertainty range (Table 1). Although the all India annual precipitation is found to increase as temperature increases (Figure 2b), the REA assessment indicates that precipitation changes throughout the 21st century remain highly uncertain (not shown).The new information available from CORDEX South Asia wasalso found useful for contributing to the Hindu Kush Himalayan Monitoring and Assessment Programme (HIMAP; Sanjay et al. 2017b; Krishnan et al. forthcoming).

3. Dissemination of Climate Change Datasets

The CORDEX South Asia RCM outputs shared by the modeling partners are archived and published on the CCCR-IITM climate data portal designed to facilitate the dissemination of climate information using a publicly accessible web-based interface. CCCR-IITM has developed an Earth System Grid Federation (ESGF; https://esgf.llnl.gov/) data node for archival, management, retrieval and dissemination of CORDEX South Asia and CMIP6 datasets. ESGF is an international collaboration for the software that powers using a system of geographically distributed peer nodes, most global climate change research, notably assessments by the IPCC. The quality checked CORDEX South Asia RCM outputs at daily, monthly and seasonal time intervals of about 2 terabyte are published on the CCCR-IITM ESGF data node (http://cccr.tropmet.res.in/home/esgf_data.jsp) for dissemination to users and stakeholders.The CORDEX South Asia dataset available on the ESGF can be subset and extracted for downloading using a web based tool developed by CCCR-IITM (http://cccr.tropmet.res.in/home/data_cccrdx.jsp).This CORDEX dataset for South Asia region is found useful by the science community for evaluating and quantifying uncertainties in future projections at regional-scales,in conducting studies of climate change impacts at regional scales, and to enhance public understanding of possible future climate patterns at the spatial scale of homogenous regions (http://cccr.tropmet.res.in/home/cordexsa_pub.jsp).

Acknowledgments

The IITM-RegCM4 simulations were performed using the IITM Aaditya high power computing resources. The Director, IITM is gratefully acknowledged for extending full support to carry out this research work. IITM receives full support from the Ministry of Earth Sciences, Government of India. The World Climate Research Programme's Working Group on Regional Climate, and the Working Group on Coupled Modelling, former coordinating body of CORDEX and responsible panel for CMIP5 are sincerely acknowledged. The climate modelling groups (listed in http://cccr.tropmet.res.in/home/esgf_data.jsp) are sincerely thanked for producing and making available their model output. The Earth System Grid Federation infrastructure (ESGF; http://esgf.llnl.gov/index.html) is also acknowledged.

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Volcanic cooling signal in tree ring temperature records over Himalaya

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Introduction

Present knowledge of decadal to century scale variations in climate is based upon discontinuous and limited information beyond the observed meteorological data. Information on climate during the past 1000 years, a period of enhanced human activity on the planet, is vital to understand the various external and internal forcing on the climate and thereby make reliable future projections. In this time frame, the tree-ring, with their inter-annual resolution, has been globally recognized to be the best source of proxy climate data.

Many long-lived trees grow with annual ring structure. Climatic information recorded by trees growing in stressful forest environments can be extracted from the size, structure and chemical composition of these annual growth rings. Precisely dated and continuous climatic information from tree-rings is important for understanding seasonal to decadal scale climatic variability. With the availability of a large number of samples and cross matching in their growth pattern, it is possible to date each ring accurately. Filtering of downward trend in growth associated with increasing tree age and averaging of many series makes it possible to maximize the large scale extensive climatic signal in tree growth time series. When a large number of tree-ring chronologies are available for a region , the climatic elements like temperature, rainfall etc. can be reconstructed backward for a much longer time. The spatial anomalies in tree growth / climatic elements may be mapped and used to deduce the climatic anomalies over a wider geographical region.

Temperature Sensitive tree-ring chronologies from the Himalaya

A wide tree-ring data network from Himalayan region as well as from Central and Peninsular India have been established by the Indian Institute of Tropical Meteorology (IITM), Pune, India. This includes several tree-ring chronologies of *Pinus, Picea, Cedrus, Abies, Tsuga* covering large area of western and eastern Himalaya, and *Tectona grandis* (teak) from Central and Peninsular India. The Himalayan region has a more general climatological significance, being the greatest mountain barrier on the Earth where polar, tropical and Mediterranean influences interact. It is likely that some of the climate changes that have taken place over the region are the result of global scale events. However, it is obvious that the net change in the climate is due to a number of interactive physical mechanisms at global, regional and local scales. Few studies based on limited data network from western Himalaya (Pant *et al*, 2003, Bhutiyani *etal*. 2007) indicated overall warming trend since last few decades as observed in many other parts of the globe (Böhm*et al*. 2001: Jones and Moberg, 2003 PAGES 2K Consortium 2013).

Dendroclimatic reconstructions from various Himalayan regions provide some clues and indications of long-term climate changes since last several centuries (Bhattacharyya *et al*. 1988; Borgaonkar *et al*., 1994; 1996; Hughes, 1992; Yadav *et al*. 1999, 2004). Most of them give information on summer temperature conditions of the region. Few epochs of medieval warming, Little Ice Age (LIA) cooling is a common pattern observed in these reconstructions. Significant warming trend since last few decades is also observed in most of the reconstructions. However, cooling trends have been noticed in few pockets of western and central Himalaya (Hughes, 2001; Cook *et al*. 2003; Yadav *et al.* 2004) and warming trend in annual and winter temperature during recent decades since last 4 centuries (Esper *et al.* 2002; Cook *et al.* 2003). Few precipitation reconstructions indicated wetter conditions in recent years since last millennium particularly over the northwest Himalaya including Kashmir and Karakoram ranges (Treydte *et al*., 2006; Yadav *et al*. 2017). It is also seen that high altitude near glaciers tree-ring records would be the potential source of information on long-term temperature variability and glacier fluctuations. High altitude tree-ring chronologies from western Himalaya provide signals of winter temperature variations and glacier fluctuations (Borgaonkar *et al*. 2009, 2011). The chronology also indicated few decadal and longer epochs of Little Ice Age (LIA) cooling during 1453–1590 C.E. and 1780–1930 C.E. Many of these events have been observed to be well related to the other proxy records of glacial fluctuations of the region (Duan and Yao, 2003; Mayewaski*et al*. 1980). Higher growth in recent few decades detected in the tree-ring chronology has been noticed coinciding with the warming trend and rapid retreat of the Himalayan glaciers. Suppressed and released growth patterns in tree-rings have also been observed to be well related to the past glacial fluctuation records of the region. The higher tree growth in recent decades may be partially attributed to the warming trend over the region, particularly the increasing the winter warmth and thus to the regional manifestations of global warming.

Tree-ring studies over the central (Cook *et al*., 2003) and eastern Himalaya including Sikkim, Arunachal Pradesh and Bhutan (Bhattacharyya and Chaudhary, 2003; Yadava *et al*. 2015; Krusic *et al*., 2015; Borgaonkar *et al*. 2018), Tibetan Plateau (Li *et al*. 2015; Wang *et al*., 2010; Bräuning and Mantwill, 2004; Fan *et al*., 2009); east Asia (Cook *et al*., 2013) have indicated a warming trend in recent decades.

Tree-ring and volcanic eruption:

In many studies, it was noticed that warm season temperature sensitive tree-ring chronologies of conifers in northern latitudes show frost-damaged growth rings and narrow ring pattern associated with lowered temperature and with large explosive volcanic eruptions (LaMarche and Hirschboeck, 1984; Scuderi, 1990; Salzer and Kipfmueller, 2005; Salzer and Hughes;2007). Very narrow rings (Hughes *et al.*1999) and rings with low maximum latewood density (Jones *et al*., 1995; Briffa *et al*., 1998) from tree-ring chronologies near circum boreal tree limit have also been shown to be coincident with major volcanic eruptions. Seasonal and annual temperature reconstructions derived from tree-ring chronologies could be used to examine impact of volcanic eruptions on climate. Studies have demonstrated that there is significant decrease in surface air temperatures in the two to three years following the large eruptions (Oliver, 1976; Mass and Schneider, 1977; Taylor *et al.,* 1980; Self *et al*., 1981; Rampino and Self, 1982).The major impact of volcanic eruptions on climate can be seen as changes in large scale areal average temperatures such as those for the Northern Hemisphere landmasses. Regional scale patterns of climate variation are observed to be less impacted following major eruptions.

Large amount of sulphur compounds and ash accumulate into the upper troposphere and stratosphere due to intense explosive eruptions, which combine with water to produce sulphuric acid aerosol (Rampino and Self, 1982). This changes the radiative balance by increasing absorption and reflection of incoming short wave radiation by stratospheric aerosols, and generally has a cooling effect on climate (Lacis *et al*., 1992; Minnis *et al*., 1993; McMormick *et al*., 1995). Winter warming is also noted (Robock and Mao, 1992; Kelly *et al*., 1996) over the extra-tropical Northern Hemisphere due to cold season shifts in the Arctic Oscillation resulted from strong volcanic activities. However, radiative forcing dominates the net surface temperature changes from very large eruptions and leads to significant cooling (Shindell *et al*., 2003). Studies (Porter, 1986; Mann *et al*., 1998; Crowley, 2000) also indicated changes in past global temperatures associated with volcanic events, contributed substantially to the decadal-scale climate variability of the Little Ice Age (LIA) interval (1400–1850 C.E.).

Over the Himalayan region, temperature reconstructions of western Himalayan tree-ring did not show significant cooling impact associated with major volcanic eruptions, however, tree-ring based summer temperature reconstructions from Nepal, Sikkim, Bhutan, eastern Tibet show significant cooling associated with strong volcanic events of Tambora (1815) and Krakatau (1883) (Cook *et al*. 2003, 2013; Krusic *et al*. 2015; Borgaonkar *et al*, 1018).

Figure-1 shows Sikkim summer temperature reconstruction derived from *Tsuga dumosa* tee-ring chronologies (Borgaonkar *et al*. 2018). Extremely warm temperature years ($\geq \bar{x}+2\sigma$) are identified as 1724, 1823, 1824, 1825, and 1962 C.E., and warm periods ($\geq\bar{x}+1\sigma$) are identified as 1713-1734 and 1823-1827 C.E. Extremely cold years ($\leq \bar{x}-2\sigma$) are identified as 1816, 1817, 1833, 1857, 1877, 1884, 1885, 1924, and 1975 C.E., and cold periods ($\leq \bar{x}-1\sigma$) are identified as 1816-1819, 1831-1837, 1856-1859, 1884-87, 1898-1903, 1923-1925, and 1973-1975 C.E. Two consecutive years, 1816 and 1817 C.E., and three consecutive years, 1823, 1824 and 1825 C.E., are depicted as extremely cold and warm years, respectively. Such a transition from cold to warm temperatures may be the result of the Tambora (Indonesia) eruption in April 1815 C.E. (Sigurdsson and Carey, 1992). This was one of the largest volcanic eruptions in recorded history and dispersed a tremendous amount of ash globally. Studies related to the impact of volcanic eruptions on tree growth (Yadav*et al*. 2007; Cook *et al*. 2013; Esper *et al*. 2013; Krusic *et al*. 2015) have noted a significant post-eruption cooling response in years t+1 and t+2, followed by an increase in temperature 2-3 years later. It is believed that the significant decrease in global temperature during the two-three years following the Tambora eruption was followed by significant warming, which represented the wide-spread impact of the eruption.

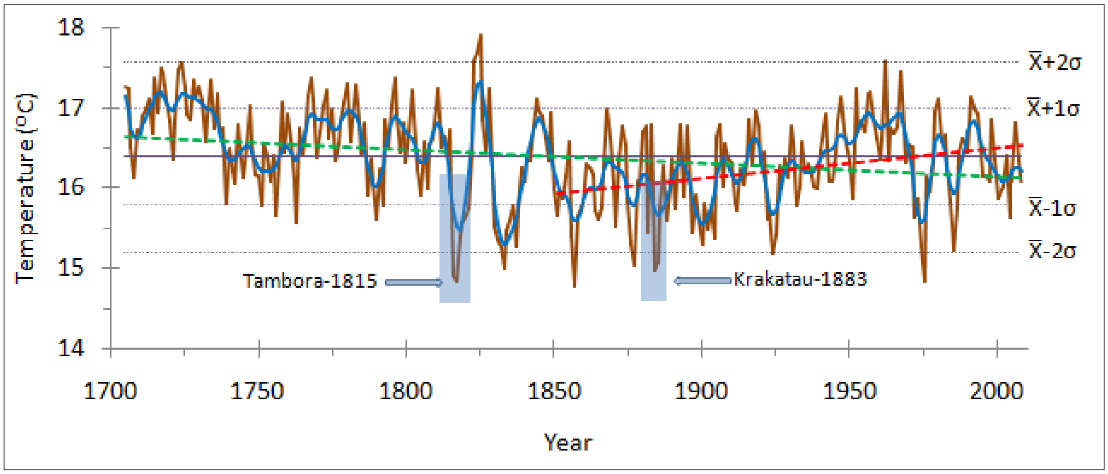

Figure 1: Sikkim summer temperature reconstruction for the period 1705–2008 C.E. derived from *Tsuga dumosa* tree-ring chronology. Green and red dotted lines indicate trend for full reconstructed period and for the period 1850–2008 C.E. respectively.

Other consecutive extreme cold year events were observed during 1884 and 1885 C.E., which were probably the result of another intense eruption (Krakatau; Indonesia) in August 1883. A noticeable cooling impact due to the Tambora eruption was also seen in summer temperature reconstructions of east Asia, Nepal, Bhutan and Sikkim (Figure 2). The temperature decrease after the Tambora eruption in Sikkim and Nepal was sharp compared to that in Bhutan and East Asia. A temperature reversal started after 1817 C.E. at these two places. Post-eruption cooling in Bhutan and East Asia was gradual compared to that in Sikkim and Nepal. A reversal of temperatures also occurred gradually after 1818 C.E.

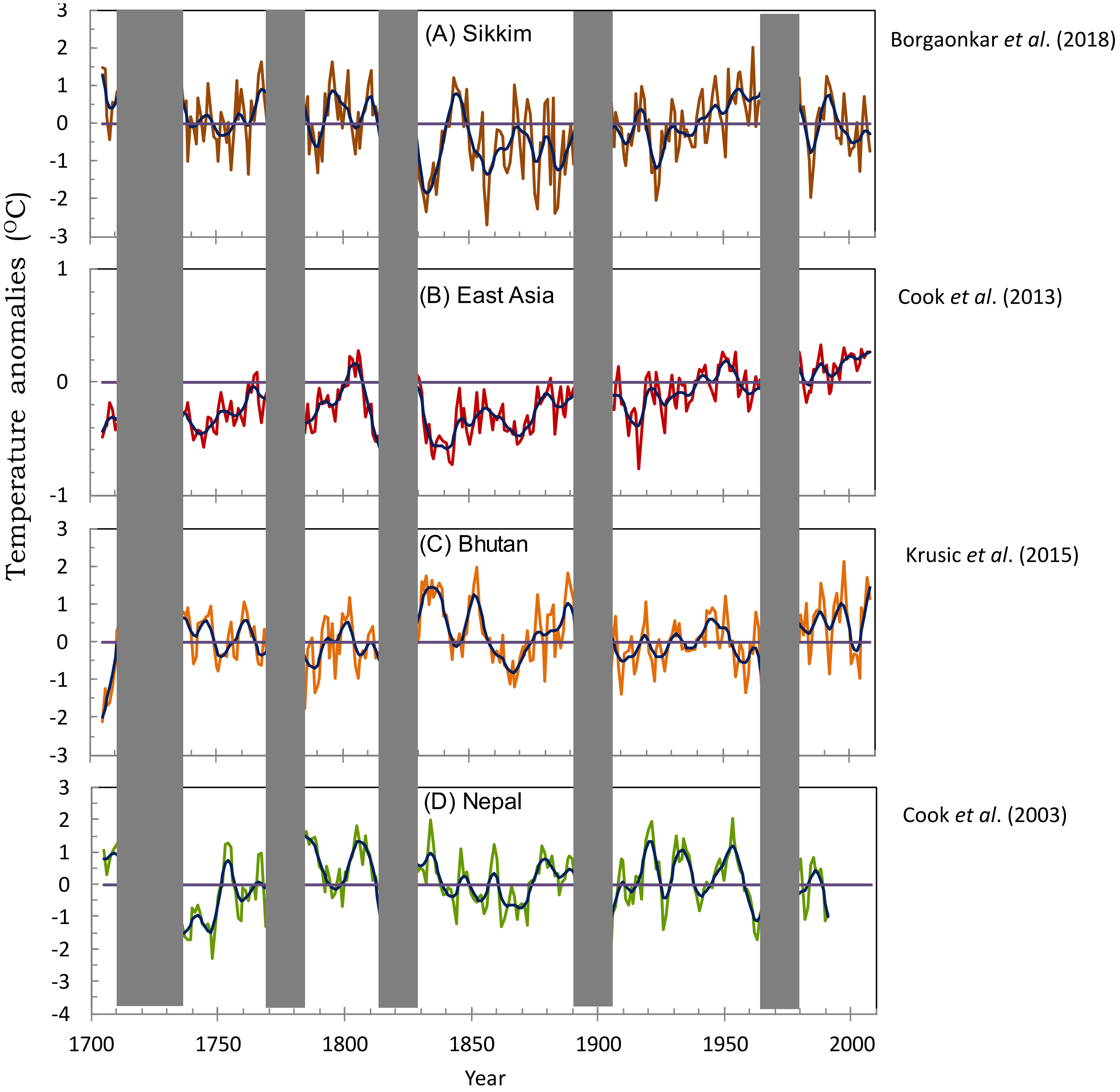

Figure 2: Four tree-ring based summer temperature reconstructions from eastern Himalaya indicate sharp cooling after Tambora eruption in 1815 C.E. Smooth blue lines indicate 10 year low pass filter.

For better understanding of ecosystems and growing concern about the environmental impacts of climate change, it is necessary to have adequate knowledge of long-term climatic conditions prevailing over the region. Information on long-term climate variability based on proxy records is important to understand the nature of different climate systems over the regions, particularly, when the observational data network is sparse.

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Important weather features in the month of December 2018

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Abstract

Important weather features in the month of December 2018 were (1) cyclonic storm Phethai over Bay of Bengal (2) below normal rainfall over most parts of India and (3) record low minimum temperatures at Niphad in the Nashik district in Madhya Maharashtra. These features are discussed in this paper.

1) Cyclonic storm "Phethai"

Cyclonic storm "Phethai" developed over Bay of Bengal (BoB) and moved towards Andhra coast during the period 15-16 December 2018. Low pressure system was formed over BoB on 14 December 2018. It intensified into deep depression on 15 December morning over southeast BoB. It moved northwestwards with a speed of 10 Kmph and was located at 1130 hrs IST of 15th December, 2018 over southwest & adjoining southeast BoB near 9.4°N and 85.1°E, about 430 km eastnortheast of Trincomalee (Sri Lanka), 670 km east-southeast of Chennai (Tamilnadu) and 870 km south-southeast of Machlipatnam (Andhra Pradesh). It intensified in to cyclonic storm "Phethai" on 17 December 2018. Figure 1 shows visible satellite picture of the cyclone on 16 December 2018.

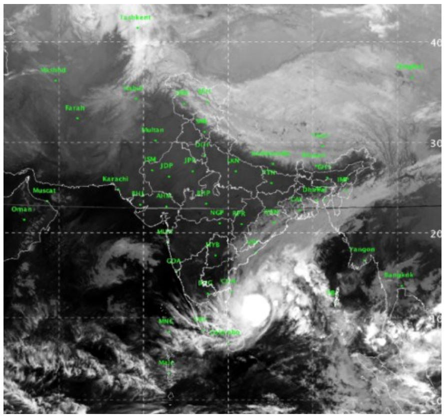

Figure 1 Visible satellite picture of Phethai cyclone on 16 December 2018 (From IMD.gov.in)

Figure 2 shows lower level convergence and upper level divergence fields and track forecast of the cyclone Phethai on 16 December 2018.

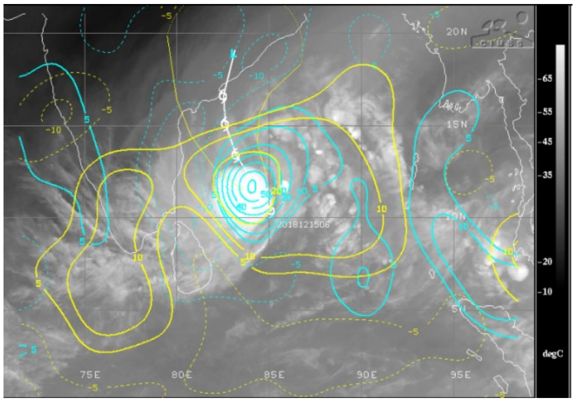

Figure 2 Low level convergence (green), upper divergence (yellow) and forecast track of the cyclone on 16 December 2018 (from website Tropical cyclone Cooperative Institute for Meteorological Studies (CIMSS) University of Wisconsin-Madison)

A strong convergence is seen concentrated over the cyclone area at low levels. There is weak convergence area over west coast of India. The upper level divergence extends over the broad area extending from BoB to Arabian Sea (AS). The land area over central and north India is cloud free (Figure 1 and 2) due to subsidence associated with the upper level divergent field of the cyclone. Figure 3 shows skewT plot of Nagpur on 12 z 15 December 2018. It shows dry area in the middle and upper troposphere and subsidence inversion in the layer 850- 700 hPa.

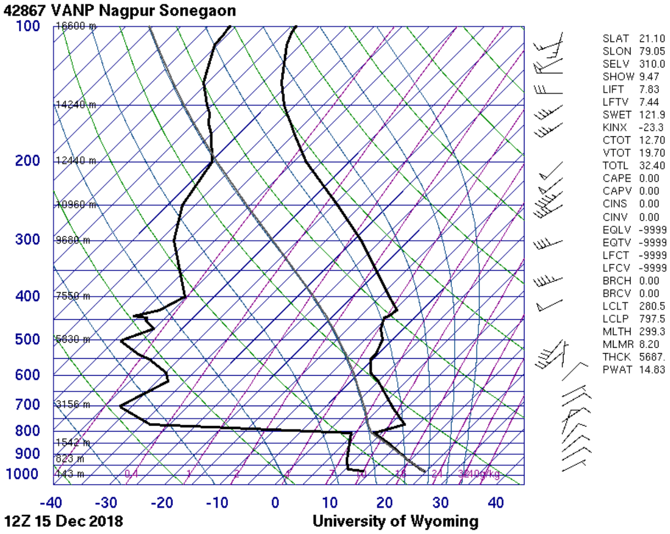

Figure 3 SkewT plot of Nagpur on 12 UTC 15 December 2018 (From Atmospheric Data University of Wyoming)

Due to the impact of the cyclone widespread rainfall occurred over coastal Andhra Pradesh, Odisha, Telangana. No rainfall occurred over central and north India.

There was another cyclone “Kenanga” over the Indian Ocean (IO) south of equator. Figure 4 shows twin cyclones over BoB and IO.

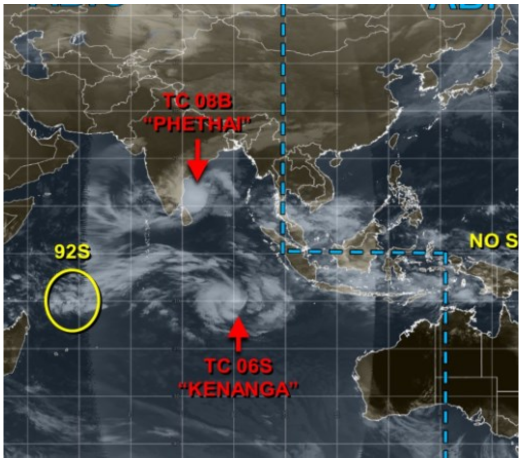

Figure 4 Twin cyclones Phetai over BoB and Kenanga over IO on 16 December 2018 (from website Tropical cyclone Cooperative Institute for Meteorological Studies (CIMSS) University of Wisconsin-Madison)

Associated with the cyclone, the cyclonic circulation was extended up to 500 hPa level. No circulation was seen above 200 hPa level. The winds at 500 hPa level were southeasterly at eastern periphery which steered the cyclone northwestward towards the Andhra coast. Figure 5 shows streamlines at 500 hPa level on 16 December 2018 (from Null school. net)

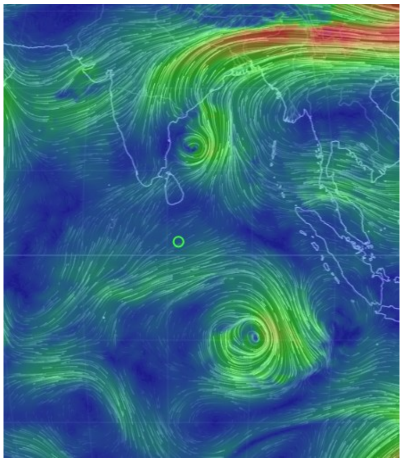

Figure 5 streamlines at 500 hPa level (From Earth School. net).

2) Rainfall distribution in the month of December 2018

All India Mean December rainfall is 11.7 mm and standard deviation (SD) is 9.3 mm with coefficient of variability (CV) 79.4%. Mean, SD and CV of December rainfalls over Madhya Maharashtra are 7.1 mm, 13.8 mm and 194.37%, over Marathwada are 9.7 mm, 26.2, 268.91%, over Vidarbha 9.5 mm, 21.4 mm, 225.41%, over Konkan subdivision 3.8 mm, 133 mm, 425.44 % respectively (Kothawale and Rajeevan 2017). The subdivisions In the state of Maharashtra receive very low rainfall in the month of December. Figure 6 (a, b) shows distribution of actual and normal rainfall (mm) in the month of December 2018 (from imd.gov.in). Tamilnadu, Kerala receive rainfall of 100-200 mm in this month.

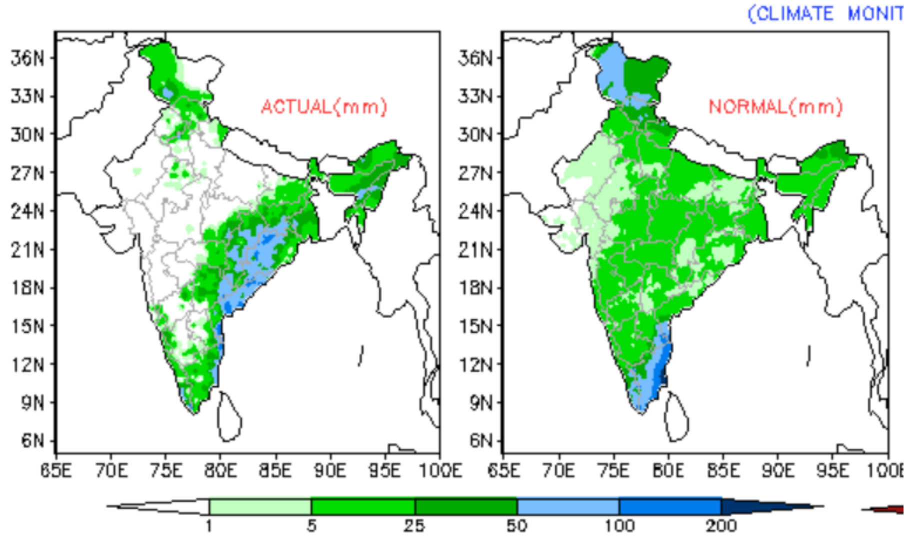

Figure 6 Actual and normal rainfall (mm) distribution over India in the month of December 2018 (from IMD.gov.in)

Figure 7 shows distribution of rainfall anomaly over India. Negative rainfall anomalies

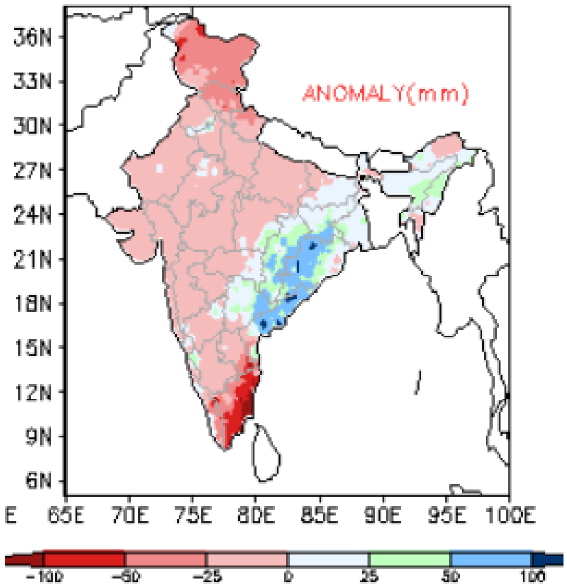

Figure 7 Rainfall anomaly (mm) over India in the month of December 2018 (from imd.gov.in)

are seen over entire India except over coastal Andhra Pradesh and adjoining Odisha. The positive rainfall anomalies over these states are due to existence of cyclone Phethai in this month. The large negative anomalies occurred over Kerala and Tamilnadu. The synoptic, dynamic studies are required to understand these anomalies over major part of India.

3. Niphad in Maharashtra recorded lowest minimum temperature of 1.6^0 C on 27 December 2018

On 27 December 2018, Niphad, a taluka place in the district of Nashik in Maharashtra recorded lowest minimum temperature of 1.6^{0}C. The area near Niphad is grape grown area. The grapes farms suffered heavy losses due to cold temperatures. The lowest temperature has been due to combined effect of cold northerly winds, clear sky and katabatic winds. Niphad is surrounded by small hills. Mean sea level height of Niphad is 543m . The surrounding area is at 581 m height. The cold air in the night slides down causing accumulation of cold mass air at Niphad resulting in to the lowest temperature. Nashik city which is at 40 km from Niphad is at height of 581 m and recorded minimum temperature of 5.8^{0}C.

Summary

December 2018 month had three peculiar weather events over India. These were (1) Cyclonic storm Phethai, (2) below normal rainfall over most parts of India (3) record low minimum temperatures at Niphad in Madhya Maharashtra

Acknowledgments

Author used weather charts from IMD, Earth null school, Wyoming sites. Author ackonowledges the same.

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IMSP NEWS

IMSP organised meteorological important site seeing trip to Central Water Power Research Station (CWPRS), Panshet, Khadakwasala and Varasgaon dams on 20 December 2018. The trip gave an opportunity to IMSP members and others to know the working of CWPRS and see the dams which provide drinking water to Pune city. Total 32 people participated in the trip out that 16 were members of IMSP and 16 were non members.

IMSP is thankful to Director CWPRS for giving permission to visit the station, Irrigation department, State Government of Maharashtra, Sinchan Bhavan Barne Road, Pune for giving permissions to visit Panshet, Khadakwasla and Varasgaon dams.

Special thanks to Mr. Jamadar S. for getting state government permissions for visiting the dams.

1) CWPRS

CWPRS was established in 1916 as a “special Irrigation Cell” to modify irrigation practice to meet agriculture requirements. Initially it was located in a small area near Hadapsar near Pune. It was shifted to Khadakwasla, about 16 km southwest of Pune in 1925. It the principal central agency to cater to the R&D needs of the projects in the fields of water and energy resources development and water-borne transport. IT is under the Ministry of Water Resources.. CWPRS provides specialised services through physical and mathematical model studies in river training and flood control, hydraulic structures, harbours, coastal protection, foundation engineering, construction materials, pumps and turbines, ship hydrodynamics, hydraulic design of bridges, environmental studies, earth sciences, and cooling water intakes. The studies conducted by CWPRS are able to provide hydraulically sound and economically viable solutions to various problems associated with projects on water resources, energy and water-borne transport including coastal and harbour engineering. CWPRS also collaborates with other organisations like WAPCOS and educational and research institutions to complement its activities. Thanks to the Government of India's financial support, CWPRS has been able to keep pace with the rapid advancements in hydraulic research by way of updating its facilities and expertise. As the Regional Laboratory of ESCAP since 1971, CWPRS has offered its services to a number of projects in the neighbourhood countries as well as countries in Middle East and Africa. (source CWPRS website).

2) Khadkawasla Dam

Khadakwasla Dam is on the Mutha river 21 km from the centre of the city of Pune. The idea of Khadakwasla dam occurred due to the severe droughts during the 19th century in East Pune that paralysed crop growth and prompted engineers to take up major irrigation works. Captain Fife RE of the British Army recommended a high level reservoir at Khadakwasla in 1863 and subsequently carried out detailed surveys and investigations. The dam was named after him, Lake Fife. It was renamed Khadakwasla Lake shortly after independence. The work on one of the oldest masonry dams of India began in 1869 and was completed in 1879 at the cost of Rs. 65 lakhs (INR 6.5 million, then the equivalent of US$2 million and GB£600,000). The backwaters of Khadakwasla Lake, do not pass through tenanted areas, limiting induction of pollutants to natural levels. There is no discharge of effluents into these water bodies yet, therefore water quality is very good. (source Wikipedia)

3) Panshet Dam

It is also called Tanajisagar Dam. It is a dam on the Ambi river about 50 km southwest of the city of Pune. The height of the dam above its lowest foundation is 63.56 m (208.5 ft) while the length is 1,039 m (3,409 ft). The volume content is 4.190 km^3 (1.005 cu mi) and gross storage capacity is 303,000 m^3 (10,700,000 cu ft.). On 12 July 1961, the dam wall burst, causing massive flooding in Pune. An estimated 1,000 people died from the resulting flood. (source Wikipedia).

4) Varasgaon Dam

It is on Mose river. It is also called Veer Baaji Pasalkar Dam. It is located around 40 km from Pune city.

CWPRS visit by IMSP on 20 December 2018


दी की प्रतिकृती, बिहार
RIVER KOSI, BIHAR