Climate Change & India

Centre for Science and Environment
New Delhi
• How has India warmed over the past 117 years?
• How the temperatures have increased seasonally?
• How far away we are from 1.5 degree C target?
Methodology

- 117 years (1901-1916) data on annual and seasonal mean, maximum & minimum temperature from IMD

- 1901-1930 average temperature considered as baseline

- Temperature anomaly calculated as departure from the baseline

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SPIRALING TEMPERATURE
SEASONAL WARMING TRENDS IN INDIA
1901 - 2017

JAN - FEB
(WINTER SEASON)
3.0°C

OCT - DEC
(POST-MONSOON SEASON)

MAR - MAY
(PRE-MONSOON SEASON)

JUN - SEP
(MONSOON SEASON)

TEMPERATURE ANOMALIES FROM 1901 - 1930 BASELINE

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DATA SOURCE: INDIA METEOROLOGICAL DEPARTMENT, PUNE
Seasonal Temperature - Winters

Temperature Anomaly in Winter Season (January-February) from 1901-1930 Baseline
Seasonal Temperature - Summers

Temperature Anomaly in Pre-Monsoon Season (March-May) from 1901-1930 Baseline
Seasonal Temperature - Monsoon

Temperature Anomaly in Monsoon Season (June-September) from 1901-1930 Baseline
Seasonal Temperature – Post-Monsoon

Temperature anomaly during Post-Monsoon Season (October-December)
Who is emitting how much? Who is responsible?
CO₂ concentration highest in 2016 - 403.3 ppm

Carbon dioxide concentrations have reached record levels

CO₂ parts per million (annual mean figures)
## Total CO₂ Emissions, 2016: 35.8 billion tonnes

<table>
<thead>
<tr>
<th>Countries</th>
<th>Total CO₂ emission (MT CO₂ eq)</th>
<th>Share of world population</th>
<th>Share of global CO₂ emission</th>
<th>Per capita emission (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>10,432</td>
<td>18.5</td>
<td>29.2</td>
<td>7.4</td>
</tr>
<tr>
<td>USA</td>
<td>5,011</td>
<td>4.3</td>
<td>14.0</td>
<td>15.6</td>
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<tr>
<td>EU-28</td>
<td>3,431</td>
<td>6.8</td>
<td>9.6</td>
<td>6.7</td>
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<tr>
<td>India</td>
<td>2,533</td>
<td>17.7</td>
<td>7.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Russia</td>
<td>1,661</td>
<td>1.93</td>
<td>4.7</td>
<td>11.5</td>
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<tr>
<td>Japan</td>
<td>1,239</td>
<td>1.70</td>
<td>3.5</td>
<td>9.7</td>
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<td>Germany</td>
<td>775</td>
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<td>2.2</td>
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<td>Canada</td>
<td>675</td>
<td>0.48</td>
<td>1.8</td>
<td>18.6</td>
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<tr>
<td>Iran</td>
<td>642</td>
<td>1.07</td>
<td>1.7</td>
<td>8</td>
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<td>South Korea</td>
<td>604</td>
<td>0.68</td>
<td>1.6</td>
<td>11.8</td>
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<td>Indonesia</td>
<td>530</td>
<td>3.50</td>
<td>1.5</td>
<td>2</td>
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<tr>
<td>Saudi Arabia</td>
<td>517</td>
<td>0.43</td>
<td>1.4</td>
<td>16</td>
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<td>Mexico</td>
<td>441</td>
<td>1.71</td>
<td>1.2</td>
<td>3.4</td>
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<td>Australia</td>
<td>441</td>
<td>0.32</td>
<td>1.2</td>
<td>18.3</td>
</tr>
<tr>
<td>Brazil</td>
<td>462</td>
<td>2.79</td>
<td>1.3</td>
<td>2.2</td>
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<td>South Africa</td>
<td>390</td>
<td>0.75</td>
<td>1.1</td>
<td>6.9</td>
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<td>United Kingdom</td>
<td>367</td>
<td>0.87</td>
<td>1.0</td>
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<td>Italy</td>
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<td>0.81</td>
<td>1.0</td>
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<td>France</td>
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<td>0.89</td>
<td>0.9</td>
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<td>Poland</td>
<td>296</td>
<td>0.51</td>
<td>0.8</td>
<td>7.8</td>
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<tr>
<td>Spain</td>
<td>251</td>
<td>0.62</td>
<td>0.7</td>
<td>5.4</td>
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<tr>
<td>Ukraine</td>
<td>233</td>
<td>0.60</td>
<td>0.6</td>
<td>5.2</td>
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<tr>
<td>Netherlands</td>
<td>163</td>
<td>0.22</td>
<td>0.4</td>
<td>9.6</td>
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<tr>
<td>Rest of world</td>
<td>6,576</td>
<td>36.5</td>
<td>18.3</td>
<td>2.4</td>
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</tbody>
</table>
Global CO₂ emissions sector-wise: 2016

- Power industry: 41%
- Other industrial combustion: 21%
- Transport: 18%
- Non-combustion: 10%
- Buildings: 10%

*Industrial process and agriculture and waste; **Industrial manufacturing and fuel production
Source: The EDGARv4.3.2 database, EC-JRC/PBL, 2017
Sector-wise CO2 emissions in India: 2016

- Power industry 52%
- Other industrial combustion 22%
- Non-combustion 8%
- Buildings 8%
- Transport 10%

*Industrial process & agriculture & waste; **Industrial manufacturing & fuel production

Source: The EDGARv4.3.2 database, EC-JRC/PBL, 2017
Contribution of fuel types and sectors in CO2 emissions in India: 2015

Source: The EDGARv4.3.2 database, EC-JRC/PBL, 2017
Who has contributed how much to climate change?

% of global CO₂ emissions: Past and present (1850-2011)

- USA: 21.2
- China: 10.7
- EU-28: 18.4
- India: 2.8
- Japan: 3.3
- Rest of the world: 28.7
- Brazil: 4.4
- Canada: 2.2
- Russia: 7.4
- South Africa: 0.9

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1 American = 4 Indians in 2030

Per capita emissions: Present and future

Source: WRI CAIT 2 version, 2014

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Impacts
2,843 climate disasters, affected 4.8 billion people, mostly in developing countries.
Climate disasters on the rise

- 306 disasters recorded on an average between 2007 and 2016; a 46 per cent increase compared to the 1990-99 average, (Lancet 2017)
- More than 90 per cent of all disasters have been associated with weather-related events in the last 20 years
- Asia being the continent most affected
- But developed countries are also facing the brunt
Developing countries most impacted

<table>
<thead>
<tr>
<th>Ranking 2015 (2014)</th>
<th>Country</th>
<th>CRI score</th>
<th>Death toll</th>
<th>Deaths per 100,000 inhabitants</th>
<th>Absolute losses (in million US$ PPP)</th>
<th>Losses per unit GDP in %</th>
<th>Human Development Index 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (23)</td>
<td>Mozambique</td>
<td>12.17</td>
<td>351</td>
<td>1.25</td>
<td>500.07</td>
<td>1.499</td>
<td>180</td>
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<tr>
<td>2 (138)</td>
<td>Dominica</td>
<td>13.00</td>
<td>31</td>
<td>43.66</td>
<td>611.22</td>
<td>77.369</td>
<td>94</td>
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<tr>
<td>3 (60)</td>
<td>Malawi</td>
<td>13.83</td>
<td>111</td>
<td>0.61</td>
<td>907.98</td>
<td>4.451</td>
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<tr>
<td>4 (10)</td>
<td>India</td>
<td>15.33</td>
<td>4317</td>
<td>0.33</td>
<td>40,077.22</td>
<td>0.501</td>
<td>130</td>
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<tr>
<td>5 (29)</td>
<td>Vanuatu</td>
<td>20.33</td>
<td>11</td>
<td>4.09</td>
<td>278.86</td>
<td>40.650</td>
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<tr>
<td>6 (94)</td>
<td>Myanmar</td>
<td>20.83</td>
<td>173</td>
<td>0.33</td>
<td>1,359.65</td>
<td>0.479</td>
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<tr>
<td>7 (138)</td>
<td>The Bahamas</td>
<td>22.83</td>
<td>33</td>
<td>9.07</td>
<td>80.64</td>
<td>0.904</td>
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<tr>
<td>8 (118)</td>
<td>Ghana</td>
<td>23.33</td>
<td>267</td>
<td>0.99</td>
<td>306.28</td>
<td>0.265</td>
<td>140</td>
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<tr>
<td>8 (34)</td>
<td>Madagascar</td>
<td>23.33</td>
<td>118</td>
<td>0.49</td>
<td>228.04</td>
<td>0.642</td>
<td>154</td>
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<tr>
<td>10 (62)</td>
<td>Chile</td>
<td>25.17</td>
<td>39</td>
<td>0.22</td>
<td>2,652.69</td>
<td>0.627</td>
<td>42</td>
</tr>
</tbody>
</table>

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Developed facing the brunt as well

In 2017, 15 weather and climate disaster events with losses exceeding $1 billion each across the United States.

This map denotes the approximate location for each of the 15 billion-dollar weather and climate disasters that have impacted the United States January through September of 2017, a record pace.
Developed facing the brunt as well

- Since 1980 to 2017, U.S. has sustained 218 weather and climate disasters where overall damages/costs exceed $1.2 trillion, NOAA (2017)

- In Europe, Weather and Climate related loss from 1980-2015 amounted to € 433 billion or € 12 billion per year, according to European Environmental Agency (EEA).
India’s climate woes

The frequency of extreme weather events have increased by 75 percent from 1950-2015 in central India.

Monsoon rainfall in central India decreased by 10 percent from 1990-2015.
Climate Impacts in India

- According to CRIDA, Hyderabad, climate change has about 4-9 per cent impact on agriculture each year.
- Causes about 1.5 per cent loss in GDP, every year
- By 2030, rice and wheat are likely to see about 6-10 per cent decrease in yields
- The World Bank projects that under 2°C warming by the 2050s, India may need to import more than twice the amount of food-grain than would be required without climate change.
Future looks grim

• According to UN Emission Gap Report, 2017, the 2°C emissions gap or 2030 is 11 to 13.5 GtCO2 e.
• The gap in the case of the 1.5°C target is 16 to 19 GtCO2 e.
• NDCs cover only approximately one third of the emissions reductions needed to be on a least cost pathway for the goal of staying well below 2°C
• Current pledges will take 80 percent of carbon budget by 2030 for 2 degree C
• If the emissions gap is not closed by 2030, achievement of 2 degree C goal highly unlikely
Issues at COP


- *Agenda Issues* - Adaptation, loss and damage, finance, agriculture

*Rule book to be formed by 2018*
- **Global Stocktake (Article 14):**
  - To assess collective progress of efforts to address climate change, to be held in 2023
  - To include mitigation, adaptation, means of support and implementation, is comprehensive, *talks of equity*

- **Facilitative Dialogue**
  - To be held in 2018
  - To assess progress and effect of NDCs ‘*towards temperature goal*’, next cycle of submission of NDCs

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Enhanced transparency framework (Article 13)

• To establish common reporting, review requirements for all Parties.
• Talks of “flexibility” for developing countries
• To be built on existing transparency mechanisms
New Market Mechanism (Art 6)

• Talks of trading units or Internationally Transferred Mitigation Outcomes (ITMOs) to help meet emission reduction targets, as part of (Nationally Determined Contributions)
• Also talks of creation of mechanism to contribute to the mitigation of greenhouse emissions and support sustainable development
• Double counting, registration of units, accounting, demand and supply are the key issues emerging in discussions
Finance

• Has ‘differentiation’, mandating developed countries to help developing countries, but “other countries” encouraged

• Green Climate Fund (GCF) has the mandate of 100 billion USD by 2020

• 10 billion USD in pledges, actual around 4US pull out further reduces it

Agriculture

• No substantive outcomes, A non-paper for discussions not released by the US and EU

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Loss and Damage (Art 8)

- Warsaw International Mechanism (WIM) to address loss and damage in 2013.
- No funds in loss and damage, Parties suggesting 50 billion USD by 2020/2022.

Adaptation

- Paris Agreement talks of Parity in mitigation and adaptation
- A ‘global goal on adaptation’ in Agreement
- Guidelines for reporting on adaptation to develop
- 80 million USD pledged for Adaptation Fund in Marrakech COP
Climate Agenda sans the US at Bonn

• US has pulled out of the Agreement but would still be part of the negotiations until late 2020, as per the lock-in clause of the Paris Agreement.

• The world must forge ahead collectively and other developed countries from G-20 must come forward and fill in the emission gap left by the US.

• The rule book of Paris Agreement must be strong, fair, equitable and ambitious.

• Critical issues like adaptation, finance, loss and damage must be duly addressed, India should take leadership on such issues.