Everything ‘Climate’

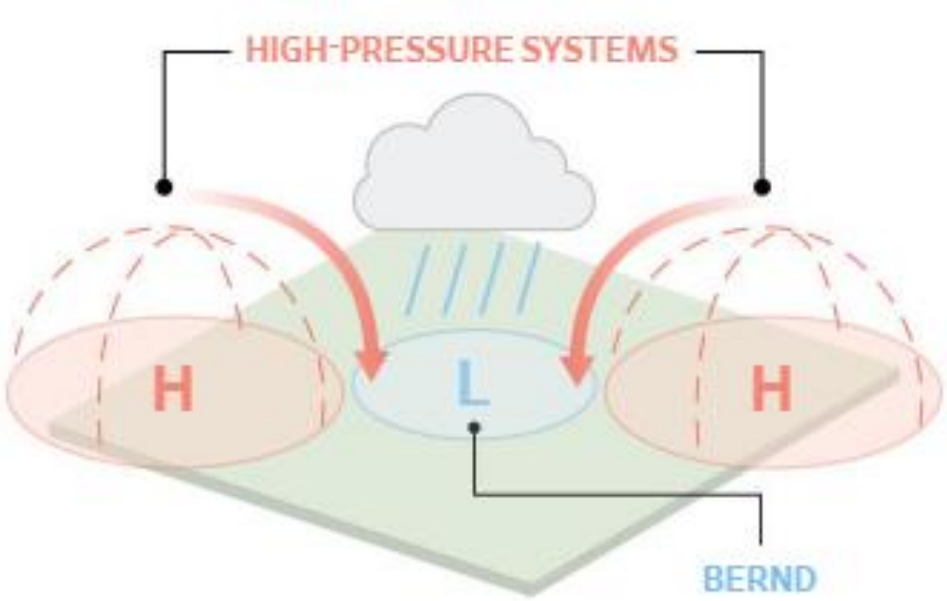
Brought to you by

Tech Curiosity

2021

Germany Flooding Explained

High-pressure areas surrounded ‘Bernd’, a low-pressure weather system, holding the system in place in what is referred to as a Rex Block. Air flows steadily from the nearly stationary high-pressure systems into cooler and wetter low-pressure systems, creating a strong flow of precipitation.



Source: National Weather Service

Germany Flooding Explained

- German Interior Minister Horst Seehofer said there was little doubt that the flooding was related to global warming. And many scientists think global warming has generally coincided with an increase in the number of extreme weather events, including heat waves and droughts.
- Andreas Marx, a climate researcher with the Helmholtz-Center for Environmental Research in Germany, says it isn't clear whether individual events such as last week's torrential rains can be blamed on climate change.

‘No one is safe’: Extreme weather batters the wealthy world **By Somini Sengupta** New York Times,Updated July 17, 2021

- Somini Sengupta - "The extreme weather disasters across Europe and North America have driven home two essential facts of science and history: The world as a whole is neither prepared to slow down climate change nor live with it.“
- Friederike Otto - “The idea that you could possibly die from weather is completely alien. There’s not even a realization that adaptation is something we have to do right now. We have to save people’s lives.”
- Ulka Kelkar - “Extreme weather events in developing countries often cause great death and destruction — but these are seen as our responsibility, not something made worse by more than a hundred years of greenhouse gases emitted by industrialized countries.”
- Mohamed Nasheed - “While not all are affected equally…in the climate emergency, no one is safe, whether they live on a small island nation…or a developed Western European state.”
- Richard Betts - “We’ve got to adapt to the change we’ve already baked into the system and also avoid further change by reducing our emissions, by reducing our influence on the climate.”

- Read also: Daily Briefing ***19.07.2021***

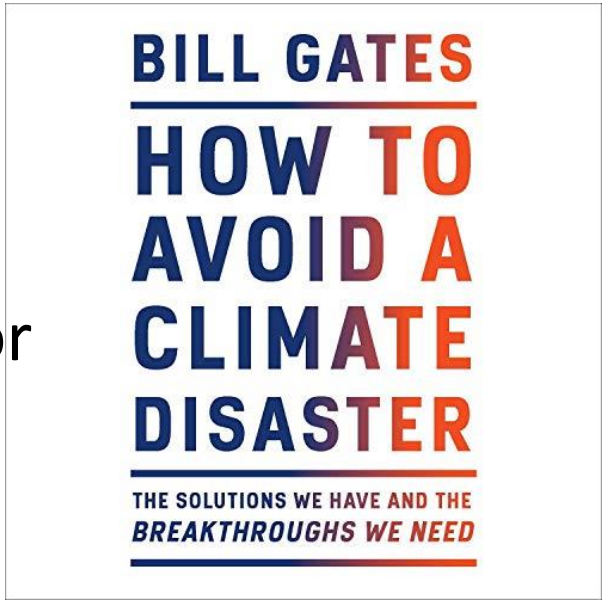
No one is safe

- Climate models have warned of the ruinous impact of rising temperatures. An exhaustive scientific assessment in 2018 warned that a failure to keep the average global temperature from rising past 1.5 degrees Celsius, compared to the start of the industrial age, could usher in catastrophic results, from the inundation of coastal cities to crop failures in various parts of the world.
- As the average temperature has risen, it has heightened the frequency and intensity of extreme weather events in general. In recent years, scientific advances have pinpointed the degree to which climate change is responsible for specific events.

How to Avoid a Climate Disaster: The Solutions We Have and the Breakthroughs We Need

- Bill Gates has a plan - how to get to 'zero'
  - Quintuple clean energy and climate-related R&D over the next decade
  - Make bigger bets on high-risk, high-reward R&D projects
  - Match R&D with our greatest needs
  - Work with industry from the beginning

- Bill says "It's easy to feel powerless in the face of a problem as big as climate change," but we all have "influence as a citizen, a consumer, and an employee or employer."



The innovations we need to avoid a climate disaster | Bill Gates (8:50 min)

Earth at the Crossroads: Understanding the Ecology of a Changing Planet

14:The Ecology of Global Climate Change

Earth at the Crossroads

Global and regional climates are changing rapidly, most likely in response to human drivers. We first examine the link between the physical aspects of climate change and the ecology of the species on the planet.

A. Climate drives long-term pulses of energy and precipitation.

B. Climate change has the capacity to reconfigure the basic aspects of our ecosystems.

C. Living systems will adapt to this change, but the human cost is likely to be profound.

Earth at the Crossroads

One of the most vexing aspects of climate change is the way the timing of natural events changes as the biosphere heats up.

A. Phenology is the study of the annual timing of natural events, such as the emergence of leaves on deciduous trees, the arrival of migratory species, and the onset of breeding activity.

B. Animal migrations are often timed to coincide with food availability along the way; if these systems are not in sync, there can be dire consequences for both the migratory species and their prey.

Earth at the Crossroads

Earth goes through normal cyclical warming and cooling patterns. To better understand the impact of global warming, we'll discuss how heat moves around the globe.

A. In the Hadley cell model, the circulation of air dominates Earth's climate.

B. Solar heating at the equator causes the air to expand, travel up or down in latitude, and ultimately diverge at the poles.

C. This model was improved by William Ferrel, who proposed a 3-cell model, in which the 3 cells churn and generate a grand movement of heat around Earth.

D. The movement of air in the atmosphere is what causes our weather.

Earth at the Crossroads

To understand the notion of climate change, we need to investigate greenhouse gases and the so-called greenhouse effect.

A. Greenhouse gases—including water vapor, carbon dioxide, methane, and ozone—occur naturally in the atmosphere.

B. Their primary physical function with respect to global climate is to help absorb and emit the Sun's infrared radiation.

C. But levels of greenhouse gas are changing, largely as a result of human activity.

D. The amount of greenhouse gas grew consistently between 1970 and 2004, from about 28.7 gigatons of carbon equivalence per year up to almost 50 gigatons.

Earth at the Crossroads

Sea level rise is another critical component to consider when we think about global warming and greenhouse gases.

A. Since 1961, sea level has risen an average of about 1.8 millimeters per year, and since 1993 that average has accelerated to about 3.1 millimeters per year.

B. Sea level temperatures have increased by 1°C in the 20th century.

C. The result of this additional heating is that the Northern Hemisphere's spring and summer sea ice extent has decreased by about 10%–15% since the 1950s.

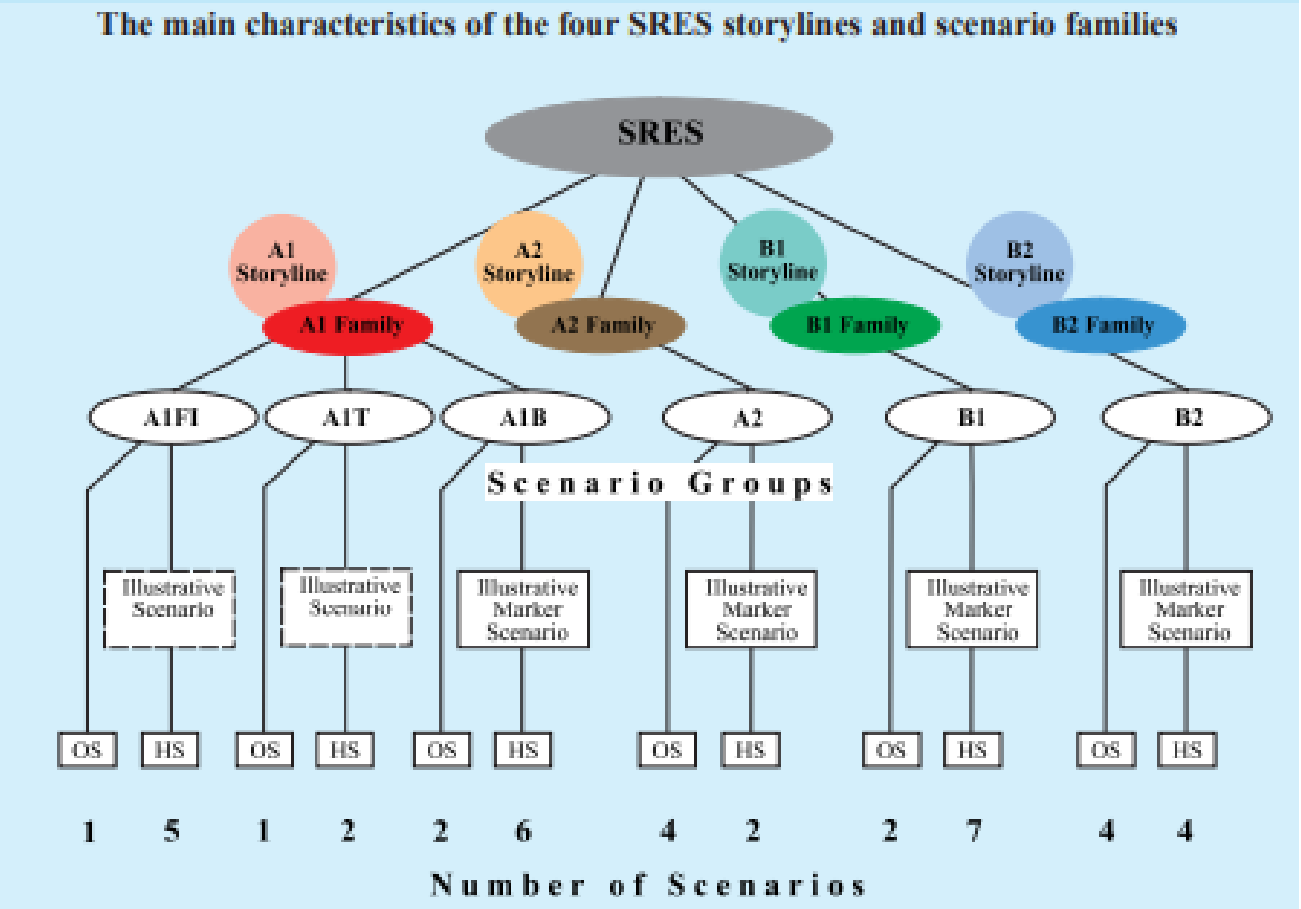
D. The amount of water we have stored in reservoirs is dropping as well.

E. Desertification in India and other parts of the world is also increasing.

IPCC SPECIAL REPORT EMISSIONS SCENARIOS

The A1 storyline and scenario family describes a future world of very rapid economic growth, global population that peaks in mid-century and declines thereafter, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income.

- fossil intensive (A1FI)
- non-fossil energy sources (A1T)
- balance across all sources (A1B)



- The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines.
- The B1 storyline and scenario family describes a convergent world with the same global population that peaks in midcentury and declines thereafter, as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, including improved equity, but without additional climate initiatives.
- The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability. It is a world with continuously increasing global population at a rate lower than A2, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines.

Earth's Changing Climate

09:Impacts of Climate Change

The most obvious effect of climate change is a rise in the global average temperature.

Future climate change depends on human activities, such as greenhouse gas emissions and patterns of land use. For this reason, projections of future climate take the form of different scenarios based on different assumptions about human behavior.

1. A set of scenarios used by the Intergovernmental Panel on Climate Change (IPCC) describes the future of human society on a two-dimensional space. One dimension is economic versus environmental emphasis; the other is globalization versus regional differences.
2. The different scenarios give different projections of future greenhouse emissions and global temperature. The projections for different scenarios are obtained by averaging over projections of many different computer models. These projections suggest a 21st-century global temperature increase in the range of 1.5°C to 4.5°C. Statistical analyses show that there's little chance of the change being much lower than 1.5°C, but there's a non-negligible chance that it could be higher than 4.5°C.

The most obvious effect of climate change is a rise in the global average temperature.

Why should a temperature rise of only a few degrees have significant effects?

1. That few degrees is a global average. The rise will be more substantial in certain areas—particularly the polar regions and over almost all land areas.
2. Only about 6°C separates the present-day climate from the depths of an ice age. Thus, a few degrees in global temperature is climatologically significant.
3. Analysis of statistical distributions shows how even a small shift in the mean value of a quantity (such as temperature) makes a significant change in the likelihood of extreme events.

Extreme weather events, such as those listed below, will become more likely with increasing temperature.

A. Heat waves. Although it's difficult to attribute any single event to anthropogenic climate change, statistical analysis of the 2003 summer heat wave in Europe that killed tens of thousands of people suggests that this event lies so far out on the normal distribution curve that there's at least a 50% chance it was caused by anthropogenic climate change.

B. Intense precipitation events.

C. Droughts.

D. Intense tropical storms. Here, as often with climate change, a number of factors complicate the picture. Warming ocean waters should contribute to rising tropical storm intensity, and as warming penetrates deeper into the ocean, storms may become more robust because they're less likely to stir up cooler water from below. On the other hand, changes in wind patterns might shear apart nascent storms before they can become fully formed.

Sea-level rise

Sea-level rise is one of the most important long-term impacts of climate change. Measuring sea level is difficult because the sea surface isn't flat, because of tidal variations, and because the continental edges are themselves rising in some places and falling in others. Earlier measurements come from tide-gauging stations; modern measurements, from satellites.

Sea-level rise (continued)

A. During the last ice age, sea level was some 120 meters (about 400 feet) below its current level. The oceans rose rapidly as ice melted, but by 6000 years ago, the rate of rise had slowed to about 0.1 to 0.2 millimeters per year.
B. Sea-level rise today is caused primarily by two factors:
    1. Thermal expansion of the ocean waters as they warm.
    2. Melting of land-based glaciers and ice sheets. Melting of floating sea ice contributes almost nothing to sea-level rise, although it may have other effects.
    3. Other contributions to sea-level rise include melting permafrost and human alteration of the water cycle. “Mining” groundwater for human use adds to sea-level rise, while dams block natural flows and keep water from reaching the oceans.
    4. As usual, there are complicating factors. For example, increased precipitation may lead to more snow in polar regions. In the very cold Antarctic interior, this effect actually removes water from the oceans, slowing the increase in sea level.

Sea-level rise (continued)

C. The 20th century saw sea level rise at about 1–2 millimeters/year— some 10 times its rate in the past few millennia.

D. Projections suggest a global sea-level rise in the range of 6 to 18 inches by 2100 for the A1 balanced scenario.

   1. Sea-level rise will be greater if we continue with a fossil fuel– intensive economy.
   2. Sea-level rise has a long lag time; thus, even if greenhouse emissions stopped, we would be committed to another roughly half a meter (20 inches) over the next few centuries.

E. A rise of a foot or so doesn't sound like much, but this adds to already high tidal levels and storm surges.

   1. Sea-level rise will have a significant impact in low-lying areas, such as barrier islands, Florida, and Bangladesh—which could lose some 10% of its land area.
   2. Rising sea level forces saltwater into underground aquifers and marine estuaries, contaminating water supplies in coastal areas and damaging the "nurseries" for many marine species.

Other Factors

The poleward advance of species ranges will accelerate.

A. Some species, especially trees, may not be able to keep up with the changes. They, and ecosystems that depend on them, may cease to exist in many areas and some may even go extinct.
B. Tropical species, including disease vectors, will spread into temperate regions. Such diseases as malaria, Lyme disease, West Nile virus, and Dengue fever may become more widespread.

Other Factors (continued)

Uptake of anthropogenic carbon dioxide in the oceans results in acidification of the ocean water. This may affect the survival of shell-forming marine plankton, which serves as the basis of marine food chains. Such effects will first occur at high latitudes, and then spread equatorward.

“Surprise” events may occur if the climate system responds with nonlinear “tipping point” behavior.

A. An example of nonlinear behavior is a light switch: Moving the lever gradually doesn’t do anything for a while; then, the switch suddenly jumps to the “on” position and the light goes from off to full brightness.
B. Catastrophic “surprise” events aren’t considered likely during the 21st century, but their probability will rise considerably after the year 2100.
C. One such nonlinear “surprise” could be the sudden slipping of a large land-based ice sheet into the sea.
    1. Possible causes include the lubrication of the ice-land interface by increased meltwater flowing below the ice and the melting or breakup of sea ice that helps keep land-based ice from sliding into the sea.
    2. The West Antarctic ice sheet is of particular concern; this would raise sea level abruptly by some 3 meters, or about 10 feet.

“Surprise” events may occur if the climate system responds with nonlinear “tipping point” behavior.

D. A second nonlinear “surprise” would be a major upset in patterns of ocean circulation.
   1. One possible cause would be the injection of freshwater into the northern North Atlantic as a result of the melting of sea and land ice. This effect is already weakening the so-called thermohaline circulation that transports warm surface water toward northern Europe.
   2. An abrupt shutdown of the thermohaline circulation could, ironically, cause Europe to cool in response to global warming. However, images of a European deep freeze are probably unrealistic. Nonetheless, we still have a lot to learn about ocean circulation.

Effects on human society and the global economy

One recent study suggests that climate change in the coming decades could reduce the global economy by some 20% unless major steps are taken to curb greenhouse emissions and other climate-changing activities. Acting now might cost just 1% of global economic output.

Earth's Changing Climate

01:Is Earth Warming?

Earth at the Crossroads: Understanding the Ecology of a Changing Planet

And a Wobbling Moon! Really?

- ‘Wobbling’ moon (aka lunar libration) will cause devastating worldwide flooding in 2030s, Nasa warns
  - Coastal cities under threat from ‘rapidly increasing high tide floods’ which could occur in clusters lasting a month or more, say scientists

A Wobbling Moon (continued)

- The wobble in the moon's orbit takes 18.6 years to complete.
- For half of that time, regular daily tides on Earth are suppressed, meaning high tides are lower than normal, and low tides are higher than normal.
- During the other half of the cycle tides are amplified, meaning high tides get even higher, and low tides get even lower. As global sea levels rise, the amplification effect will be increased.
- The next time this "lunar assist" to high tides comes around will be in the mid-2030s. By that time global sea levels will have been rising for another decade.
- It will have passed a "tipping point" and the result will be a "leap in flood numbers on almost all US mainland coastlines," Nasa said.

Numbers of floods could quadruple as the gravitational effects of the lunar cycle combine with climate change to produce "a decade of dramatic increases" in water disasters.

Have a Great Day!