World Cultures Portfolio/South Asia

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World Cultures South Asia Report about Rainfall

- Guidelines

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This essay came out kinda weird because of the to-be words ban. I don't think it's my best work, but time is running out...

Rainfall in South Asia varies greatly and has many effects on aspects of South Asian life. Not only does the rainfall map match closely with the climate map, but with the population map. Monsoons have a great deal of effects on the population, morale, and agriculture. India, a large nation, made up of many sections gets affected by many different climates. Dry as a desert, the western side lies, but rain ravages the eastern side. India's rain falls seasonally and unpredictability. But when it differs from it's norm, problems such as floods and droughts emerge.

Various regions and countries make up South Asia. In the north-east lies Afghanistan and Pakistan. Both are very dry, similar to the rest of the Middle East. The Thar Desert exists here, a large dry region in Rajasthan (an Indian state) and Pakistan (Wikipedia). The desert covers 92,200 square miles and receives less then 40 inches of rain per year (WWF via Wikipedia; Ahmad et al). Few people wish to live in this region and thus it's sparsely populated, similar to deserts around the world.

The north-west portion of South Asia contains Nepal, and Bangladesh, among others. The northern part of this region, the part bordering the plains of China, does not receive as much rain, and gets designated "temperate humid" on the Encarta climate map. The region then gets divided into further smaller sub-regions. The largest sub-region climate appears as "winter drought, hot summer." Small different sub-variations with different drought seasons and summer temperatures border this.

As one moves south-west towards Southwest Asia, one moves into the tropics. This region gets wetter and receives significantly more rain. Larger populations also crowd this wetter region. For the most part this region borders Southeast Asia and receives about 200-400 inches per year with some spots receiving up to 400 inches per year (Ahmad et al).

The western ghats also receive a lot of rain (Ahmad et al). This occurs because of the normal rain-trapping properties of the mountains, which can be seen all over the globe.

In the middle of Sri Lanka, Mount Pidurutalagala receives an excess of 400 inches of rain per year (Ahmad et al). On the map a small spot of dark green shows the mountain's peak (Ahmad et al). Again the mountains are what cause this small spot of heavy rain.

The rain levels in India vary along with the season. In January, India receives almost no rain except in the southern and north-eastern corners of the country (Encarta Map). However, the story in July differs greatly (Encarta Map). Rain falls heavily during the summer, especially in the north-eastern corner of South Asia. However, there's one

fluke. A dry patch exists just west of the northern tip of Sri Lanka (Encarta Map). Unfortunately no explanation could arise to why this abnormality occurs.

When one thinks of monsoons, one usually only thinks about the heavy rains which occur in India during the summer. However, a monsoon, properly defined, represents a wind pattern which reverses direction with the seasons and can occur in other regions (Wikipedia). However, back to the common definition, the monsoons rains provide almost all of India's water for the entire year. This makes India very reliant on the rains which occur from July to September each year (Baldauf).

Agriculture powers 70% of India's economy (Baldauf). So when the rains come late, everyone suffers. This causes starvation among the poor villages and hardship in the cities. The rain also partially abates the heat, so when it's missing, everyone feels it (Baldauf). This heat causes a massive demand for air-conditioning, one which the power company can not keep up with (Baldauf). So once again, the lack of rains affect the Indian people.

But as a lack of water brings hardship, so does flooding. Floods, such as the ones near Nepal in 2004 left thousands homeless (Baldauf). Just as flood waters do in the United States, flooding wipes out houses in India, gutting everything in their paths.

So, India need a balance of rain each year. Not too much, but at the same time, not too little. But when this balance gets upset, Indians suffer. Floods, drought, famine, and power outages can all result from India's haphazard rainfall. However, the rains also affect the climate and population distribution in South Asia. Different sections of Asia receive different amounts of rain. These factors all affect the daily life of many Indians, just as they do worldwide.

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- "South Asia Population Map." Encarta. Microsoft. 17 Dec 2006 <http://encarta.msn.com/encnet/features/MapCenter/MapPrintPreview.aspx?lat=18.3870980570115&long=78.
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In the middle of Sri Lanka, Mount Pidurutalagala receives an excess of 400 inches of rain per year. On the map a small spot of dark green shows the mountains peak. Again the mountains are what cause this small sport of heavy rain.

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during the summer, especially in the north-eastern corner. However, there's one fluke. A dry patch exists just west of the northern tip of Sri Lanka (Encarta Map). Unfortunately there seems to be no explanation.

Commonly a monsoon gets defined as the rain and wind which comes from southwest India during different seasons (Wikipedia). However, a monsoon, properly defined, represents a wind pattern that reverses direction with the seasons (Wikipedia). And change with the seasons it does, as it can pour inches of rain in the few months from July to September (Baldauf). This provides almost all of India's water for the entire year.

Agriculture powers 70% of India's economy (Baldauf). So when the rains come late, everyone suffers. This causes starvation among the poor villages and hardship in the cities. The rain also partially abates the heat, so when it's missing, everyone feels it (Baldauf). This heat causes a massive demand for air-conditioning, one which the power company can not keep up with. So once again, the lack of rains affect the Indian people.

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So Indians demand a balance of rain each year. But when too much falls, or too little, or not at the right time, Indians suffer. Floods, drought, famine, and power outages can all result from India's haphazard rainfall. In addition, different sections of Inida receive different amounts of rain. This also happens to correspond to the population levels in certain regions.

Sources

- Ahmad, Ifikhar, Herbert Brodsky, Marylee Susan Crofts, and Elisabeth Gaynor Ellis. World Cultures: A Global Mosaic. Upper Saddle River, New Jersey: Prentice Hall, 2001.
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Seasons too affects rainfall in South Asia.

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- global warming
- closing

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[1] (http://encarta.msn.com/encnet/features/MapCenter/MapPrintPreview.aspx?lat=18.3870980570115&long=78.9589470696392&alt=2&mapsize=Medium&mapstyle=precipitationannual&ma 20Asia%20(region),%20Asia) [2] (http://encarta.msn.com/encnet/features/MapCenter/MapPrintPreview.aspx?lat=18.3870980570115&long=78.9589470696392&alt=2&mapsize=Medium&mapstyle=climate&mapstyleselecte 20Asia%20(region),%20Asia) [3] (http://encarta.msn.com/encnet/features/MapCenter/MapPrintPreview.aspx?lat=18.3870980570115&long=78.9589470696392&alt=2&mapsize=Medium&mapstyle=population&mapstylesel 20Asia%20(region),%20Asia)

- precip jan
- july

Monsoon

From Wikipedia, the free encyclopedia

A **monsoon** is a wind pattern that reverses direction with the seasons. The term was originally applied to seasonal winds in the Indian Ocean and Arabian Sea. The word is also used more specifically for the season in which this wind blows from the southwest in India and adjacent areas that is characterized by very heavy rainfall, and especially, for the rainfall associated with this wind.

In terms of total precipitation, total area covered and the total number of people affected, the monsoon affecting the Indian Subcontinent dwarfs the North American monsoon (also called the "Mexican", "southwest", "desert", or "Arizona" monsoon).

Monsoon in the Vindhya mountain range, central India

Contents

Monsoon clouds over Lucknow, India

History

Strengthening of the Asian monsoon has been linked to the uplift of the Tibetan Plateau after the collision of India and Asia around 50 million years ago. Evidence for when this first happens has remained controversial. Many geologists believe that the monsoon first became strong around 8 million years ago based on records from the Arabian Sea and the record of wind blown dust in the Loess Plateau of China. More recently plant fossils in China and new long duration sediment records from the South China Sea lead Peter Clift to propose a much older monsoon starting around 24 million years ago and linked to early Tibetan uplift. Testing of this hypothesis awaits deep ocean sampling by the Integrated Ocean Drilling Program. The monsoon has varied significantly in strength since this time, largely linked to global climate change, especially the cycle of the Pleistocene ice ages.

Processes

Monsoons are caused by the larger amplitude of the seasonal cycle of temperature over land as compared to the adjacent oceans. This differential warming results from the fact that heat in the ocean is mixed vertically through a "mixed layer" that may be 50 meters deep, through the action of wind and buoyancy-generated turbulence, whereas the land surface conducts heat slowly, with the seasonal signal penetrating perhaps a meter or so.

Additionally, the specific heat of liquid water is significantly higher than that of most materials that make up land. Together, these factors mean that the heat capacity of the layer participating in the seasonal cycle is much larger over the oceans than over land, with the consequence that land warms faster and reaches a higher temperature than the ocean. The hot air over the land tends to rise, creating an area of low pressure. This creates a steady wind blowing toward the land, bringing the moist near-surface air over the oceans with it. Associated rainfall is caused by the moist ocean air being lifted upward by mountains, surface heating, convergence at the surface, divergence aloft, or from storm-produced outflows at the surface. However the lifting occurs, the air cools due to adiabatic expansion, which in turn produces condensation.

In winter, the land cools off quickly, but the ocean retains heat longer. The hot air over the ocean rises, creating a low pressure area and a breeze from land to ocean while a large area of high pressure is formed over the land, intensified by wintertime radiational cooling.

Monsoons are similar to sea breezes, a term usually referring to the localized, diurnal (daily) cycle of circulation near coastlines everywhere, but they are much larger in scale, stronger and seasonal.

Monsoon systems

As monsoons have become better understood, the term monsoon has been broadened to include almost all of the phenomena associated with the annual weather cycle within the tropical and subtropical land regions of the earth.

Even more broadly, it is now understood that in the geological past, monsoon systems must have always accompanied the formation of supercontinents such as Pangaea, with their extreme continental climates.

Northeast Winter Monsoon (Asia)

In Asia, the northeastern winter monsoons take place from December to early March. The temperature over central Asia is lower, creating a zone of high pressure there. The jet stream in this region splits into the southern subtropical jet and the polar jet. The subtropical flow directs northeasterly winds to blow across south Asia, creating dry air streams which produce clear skies over India from the months of November to May.

Meanwhile, a low pressure system develops over northern Australia and winds are directed toward Australia known as a monsoon trough.

During the Northeast Winter Monsoon, Australia and southeast Asia receive large amounts of rainfall.

Low lying clouds before rainfall in Singapore

Southwest Summer Monsoon

The Southwestern Summer Monsoons occur from June to August, and are drawn towards the Himalayas, creating winds blowing rain clouds towards India, some areas of which receive up to 10,000 mm of rain.

Indian Ocean Monsoon

The southwest monsoon is generally expected to begin around the middle of June and dies down by September. It begins first in the coastal state of Kerala and moves upwards at a rate of roughly 1-2 weeks per state. The monsoon accounts for 80 percent of the rainfall in the country. Indian agriculture (which accounts for 25 percent of the GDP and employs 70 percent of the population) is heavily dependent on the rains, especially crops like

cotton, rice, oilseeds and coarse grains. A delay of a few days in the arrival of the monsoon can, and does, badly affect the economy, as evidenced in the numerous droughts in India in the 90s.

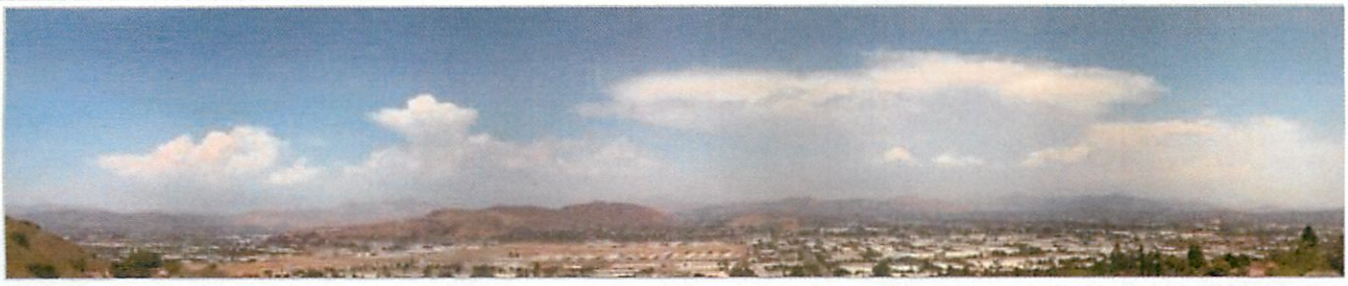
The monsoon is widely welcomed and appreciated by city dwellers as well, for it provides relief from the climax of summer in June. However, because of the lack of adequate infrastructure in place, most major cities are often adversely affected as well. The roads, already shoddy, take a battering each year; houses and streets at the bottom of slopes and beside rivers are waterlogged, slums are flooded, and the sewers and the rare hurricane drain start to back up and pour out toxic filth rather than drain it away. This translates into various minor casualties most of the time (although a large number of people in rural areas are struck dead by lightning while working in their fields); however, this lack of city infrastructure coupled with changing climate patterns also causes severe damage to and loss of property and life, as evidenced in the Mumbai floods of 2005. Also, in the recent past, areas in India that receive scanty rainfall throughout the year, like the Thar Desert, have surprisingly ended up receiving floods due to the prolonged monsoon season.

North American Monsoon

The North American Monsoon (NAM) occurs from late May or early June into September, originating over Mexico and spreading into the southwest United States by mid July. It affects Mexico along the Sierra Madre Occidental as well as Arizona, New Mexico, Nevada, Utah, Colorado, West Texas, and California. It pushes as far west as the Peninsular Ranges and Transverse Ranges of southern California but rarely reaches the coastal strip (a wall of desert thunderstorms only a half-hour's drive away is a common summer sight from the sunny skies along the coast during the monsoon). The North American Monsoon is known to many as the *Summer*, *Southwest*, *Mexican* or *Arizona* monsoon. It is also sometimes called the *Desert Monsoon* as a large part of the affected area is desert.

The Salt Lake City Tornado, August 11, 1999, occurred during an unusually strong year for the desert monsoon. (Orange fireball is substation exploding)

The North American Monsoon is associated with an area of high pressure called the subtropical ridge that moves northward during the summer months and a thermal low (a trough of low pressure which develops from intense surface heating) over the Mexican Plateau and the desert southwest of the United States. The monsoon begins in late May to early June in southern Mexico and quickly spreads along the western slopes of the Sierra Madre Occidental, reaching Arizona and New Mexico in early July. The monsoon extends into the southwest United States as it matures in mid July when an area of high pressure, called the monsoon ridge, develops in the upper atmosphere over the four corners region, creating an easterly to southeasterly wind flow aloft. This wind flow pattern directs moisture originating in the Gulf of Mexico, Gulf of California and the tropical Pacific by way of northern Mexico into the region, setting off brief, but often torrential thunderstorms, especially over mountainous terrain. This activity is occasionally enhanced by the passage of easterly waves or the entrainment of the remnants of tropical storms.



Thunderstorms during the North American Monsoon as seen from El Cajon, California. The thunderstorms rarely push beyond

the clear skies of the coastal strip.

As much as 70% of rainfall in the region occurs during the summer monsoon. Many desert plants are adapted to take advantage of this brief wet season. Because of the monsoons, the Sonoran and Mojave are considered relatively "wet" when ranked among other deserts such as the Sahara.

Monsoons play a vital role in managing wildfire threat by providing moisture at higher elevations and feeding desert streams. Heavy monsoon rain can lead to excess winter plant growth, in turn a summer wildfire risk. A lack of monsoon rain can hamper summer seeding, reducing excess winter plant growth but worsening drought. The Southwest has been in continuous drought status since the mid-1990s.

Flash flooding is a serious danger during the monsoon season. Dry washes can become raging rivers in an instant, even when no storms are visible as a storm can cause a flash flood tens of miles away (never camp in a dry wash in the desert). Lightning strikes are also a significant danger. Because it is dangerous to be caught in the open when these storms suddenly appear, many golf courses in Arizona have thunderstorm warning systems.

The North American Monsoon affects much of the United States and Mexico. Major drought episodes in the midwestern United States are associated with an amplification of the upper tropospheric monsoon ridge, along with a weakening of the western edge of the "Bermuda high" and the low-level jet stream over the great plains[1] (http://www.clivar.ucar.edu/publications/other_pubs/iplan/iip/pg3.htm).

African Monsoon

The monsoon of western sub-Saharan Africa is the result of the seasonal shifts of the Intertropical Convergence Zone and the great seasonal temperature differences between the Sahara and the equatorial Atlantic Ocean. The dry, northeasterly trade winds, and their more extreme form, the harmattan, are interrupted by the northern shift in the ICZ and resultant southerly, rain-bearing winds during the summer. The semiarid Sahel and Sudan depend upon this pattern for most of their precipitation.

South American Monsoon

Much of Brazil experiences seasonal wind patterns that bring a summer maximum to precipitation. Rio de Janeiro is infamous for flooding as a result of monsoon rains.

See also

- Climate of India
- Monsoon trough

Reference and external links

- National Weather Service: The North American Monsoon (http://www.wrh.noaa.gov/fgz/science/monsoon.php?wfo=fgz)
- Initial text from the Goddard Space Flight Center's public domain Distributed Active Archive Center (http://daac.gsfc.nasa.gov/)
- North American Monsoon Experiment (http://earthobservatory.nasa.gov/Newsroom/Campaigns/NAME_Mission.html)
- Meet the Indian monsoons at PBS.org (http://www.pbs.org/wnet/nature/monsoon/html/intro.html)
- Arizona Central monsoon page (http://www.azcentral.com/weather/monsoon/)

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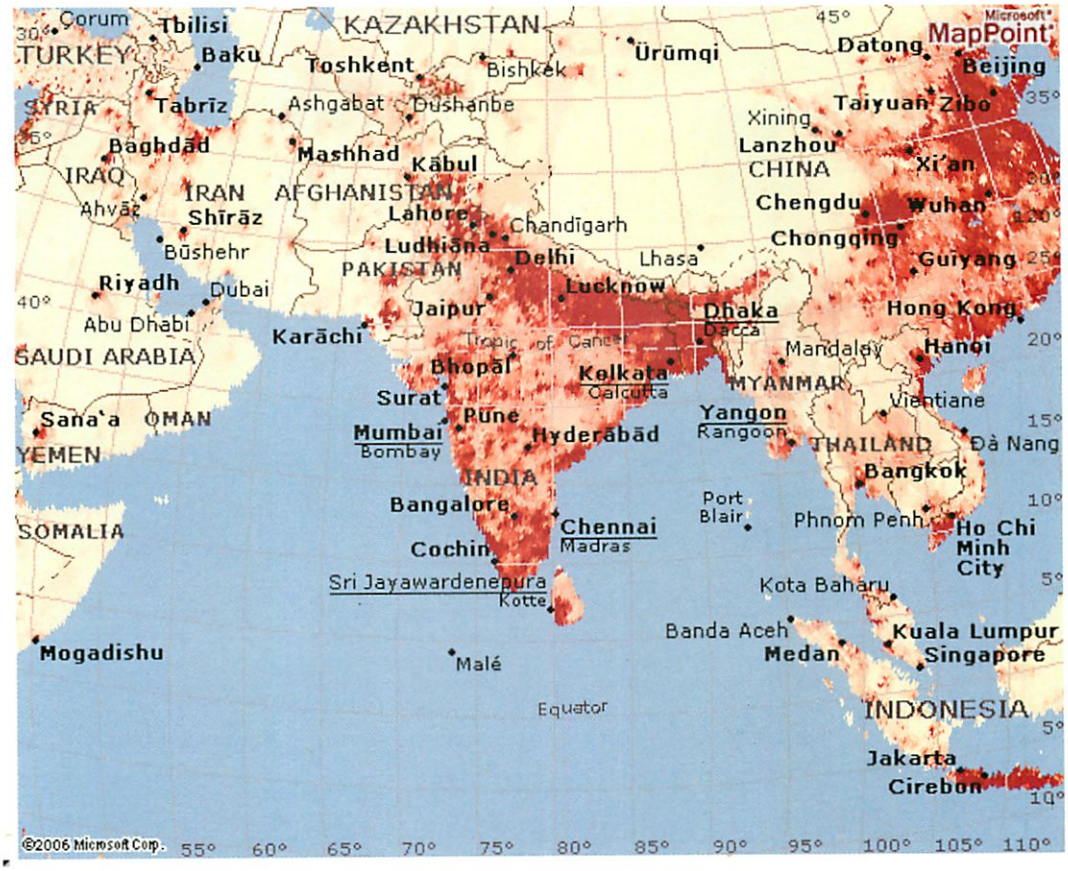
~~Another region of interest~~ is the western ghats also recive ~~Co~~ a lot of rain. (why)

In the middle of Sri Lank, among ~~our~~ average rain levels, exists a spot which recives an excess amount of rain in excess of 400 inches per year.

World Atlas

Encarta

South Asia (region), Asia



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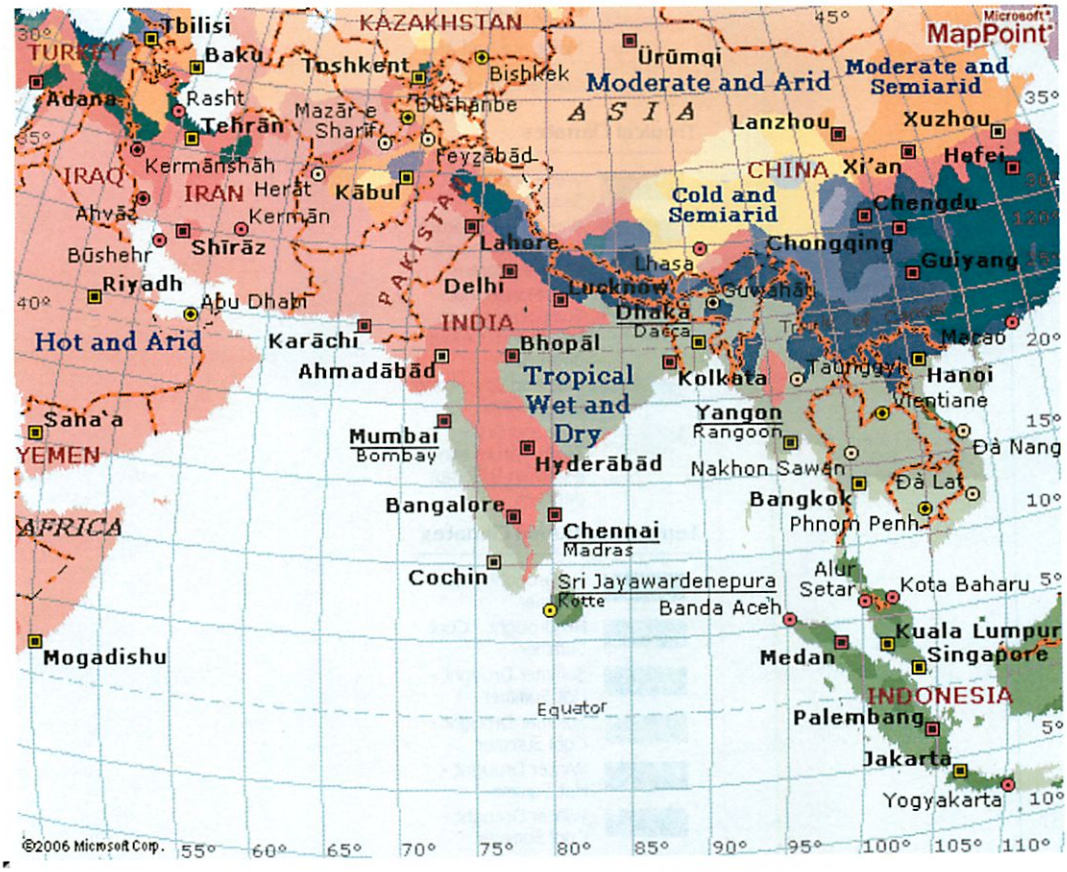
South Asia (region), Asia



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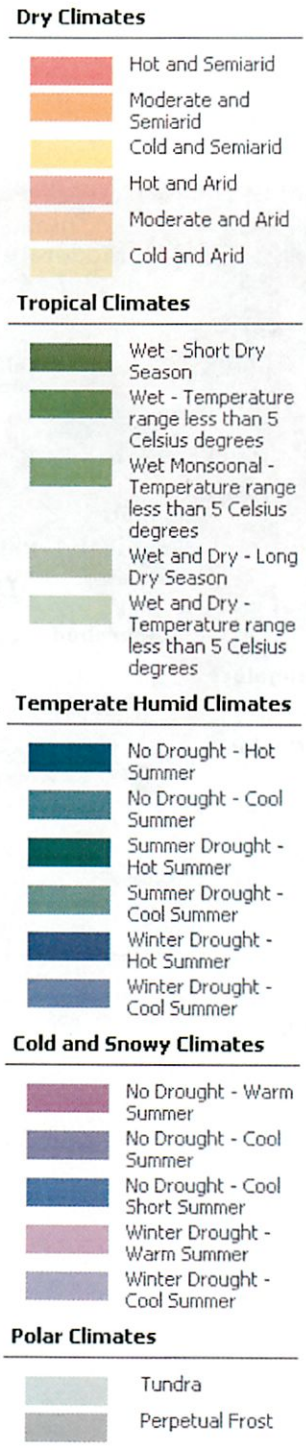
Dry Climates
Hot and Semiarid
Moderate and Semiarid
Cold and Semiarid
Hot and Arid
Moderate and Arid
Cold and Arid
Tropical Climates
Wet - Short Dry Season
Wet - Temperature range less than 5 Celsius degrees
Wet Monsoonal - Temperature range less than 5 Celsius degrees
Wet and Dry - Long Dry Season
Wet and Dry - Temperature range less than 5 Celsius degrees
Temperate Humid Climates
No Drought - Hot Summer
No Drought - Cool Summer
Summer Drought - Hot Summer
Summer Drought - Cool Summer
Winter Drought - Hot Summer
Winter Drought - Cool Summer
Cold and Snowy Climates
No Drought - Warm Summer
No Drought - Cool Summer
No Drought - Cool Short Summer
Winter Drought - Warm Summer
Winter Drought - Cool Summer
Polar Climates
Tundra
Perpetual Frost

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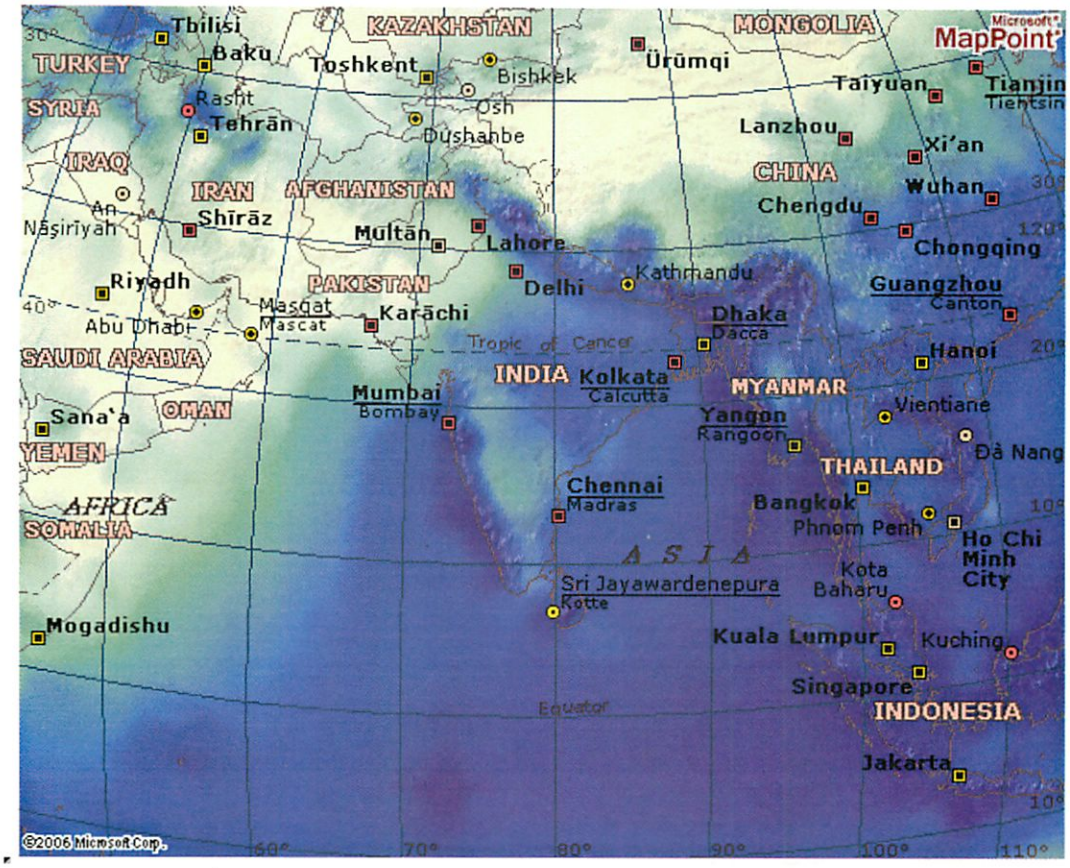

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MapPoint Terms of Use

- monsoons
- pollution
  - global warming effects
- farming
- land types

Location: News

AIR POLLUTION AFFECTS RAINFALL IN INDIAN OCEAN REGION

Pollution has reduced rainfall in South Asia

A recent study at the Scripps Institution of Oceanography, USA, claims that the combined effect of air pollution (aerosols/particulate matter) and greenhouse gases may induce greater variability in the Indian monsoon — heightening its intensity or weakening it.

Published in the May 15, 2006, issue of the Journal of Climate (Vol 19, No 10), the study conducted by Chul Eddy Chung and V Ramanathan analyses sea-surface temperatures and other data from the Indian Ocean region. Many of the observations used were made during the Indian Ocean Experiment, a us $25-million international effort led by Scripps.

"These remarkable studies are a further demonstration that the earth's climate, the average day-to-day weather conditions that profoundly affect virtually all sectors of human activities, hangs in delicate balance between natural and man-made forces," says Jay Fein, programme director in the us -based National Science Foundation's Division of Atmospheric Sciences.

Chung and Ramanathan found that less-than-expected temperatures in the northern part of the ocean have weakened wind circulation and monsoon conditions in the region, causing a 5 to 8 per cent fall in rainfall over India since the 1950s and increasing rainfall over the Sahel, south of the Sahara in Africa.

Explaining the weakening of the Indian monsoon, the authors say it is probably an effect of the high aerosol concentration over the Indian subcontinent, which masks the heating up of the part of Indian Ocean close to the land mass. In other words, the northern Indian Ocean is not warming up as quickly as the rest of it. This causes low pressure areas to move away from the subcontinent, weakening monsoon-laden winds and causing drought conditions that could affect more than two billion people in south Asia.

The scientists warn of a possible reverse effect (more rainfall as well): "Greenhouse gases by themselves lead to large positive anomalies in the simulated Indian rainfall, which leads to the speculation that, when the South Asian aerosol pollution is cut

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down significantly, India may witness a large increase (10-20 per cent) in monsoon rainfall, but this is also related to a large surface warming due to the greenhouse gases." The scientists say that some years the aerosol effect may dominate, while sometimes it may be the greenhouse effect. "So we are concerned that in coming decades the variability between the two will become large and it will be difficult to cope with rapid changes from year to year," says Ramanathan.

Chung believes continuous, year-round aerosol observations are necessary to augment satellite data to further help researchers understand the highly variable seasonal and yearly nature of aerosol effects in Asia and elsewhere. Dust particles from Africa, which play a significant but not fully understood role in climate systems, also require further investigation and analysis.

Some experts disagree. "This is a study using a climate model. I have serious reservations about making any conclusions from a climate model study, that too, on a cloudy issue. These models are well known for not even simulating mean Indian monsoon rainfall realistically. Therefore, this study is academic," says M Rajeevan of the India Meteorological Department, Pune.

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