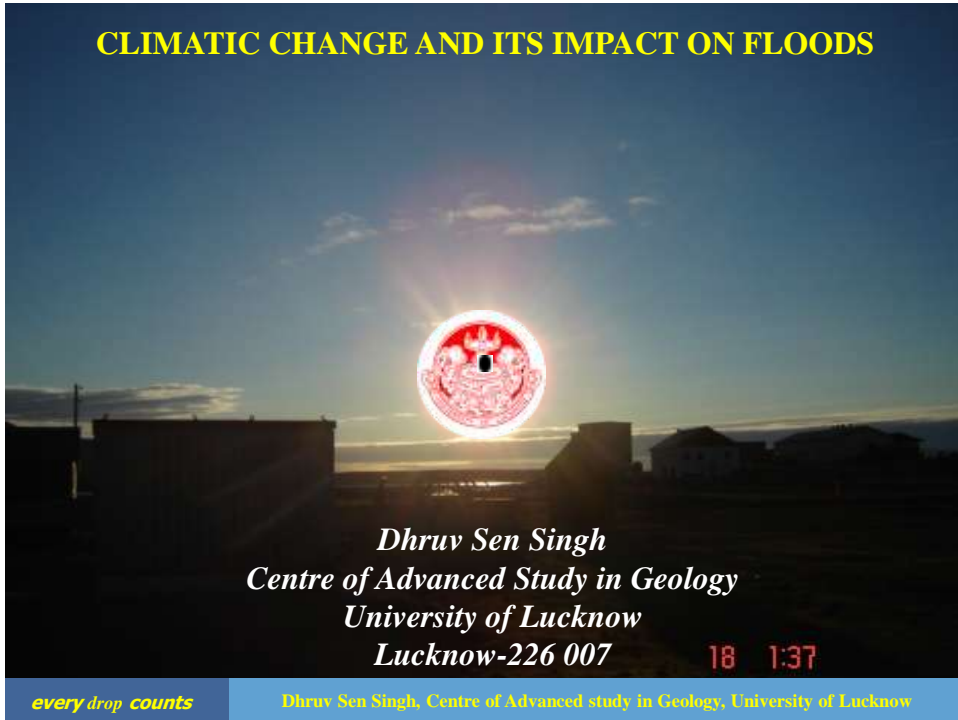


CLIMATIC CHANGE AND ITS IMPACT ON FLOODS



CLIMATE CHANGE

Climate change is one of the major challenges in the 21st century faced by the citizen of planet earth.

It has affected the social, cultural, political and economical aspects of the society.

The climate change has affected the agriculture, environment, and enhanced the natural hazards.

It requires the change in the energy resources from Non-renewable to renewable. The developing countries are not yet ready for this change.

Social awareness and adaptive capacity for climate change needs to be strengthened to solve all the above critical issues.

GLOBE



every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

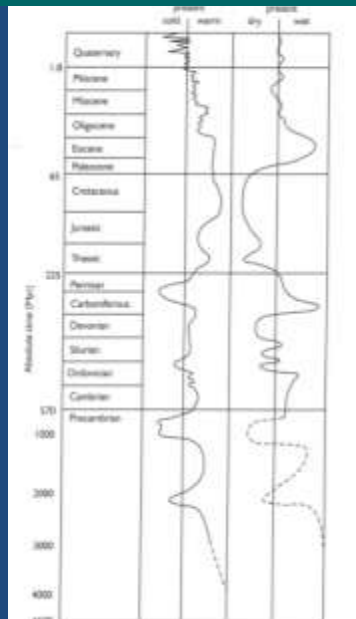
TIME FRAME OF CLIMATE CHANGE ON PLANET EARTH

TIME FRAME

Earth- 4.6 b y

Man- 10 k a

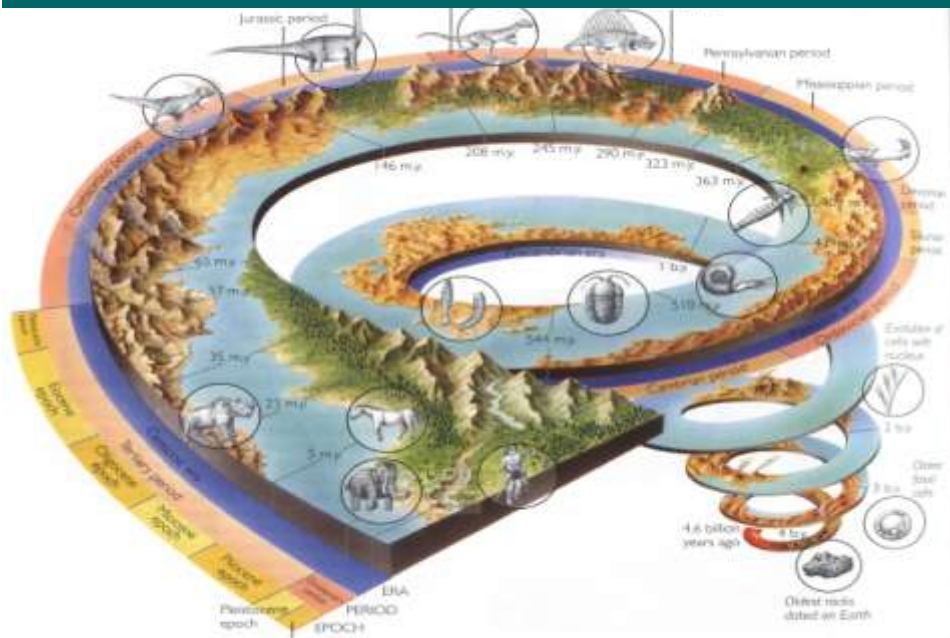
Industry- 300 y



every drop counts

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EVOLUTION OF LIFE ON THE EARTH



every drop counts

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GANGOTRI GLACIER AND IPCC



every drop counts

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GANGOTRI GLACIER AND OUR VIEW



every drop counts

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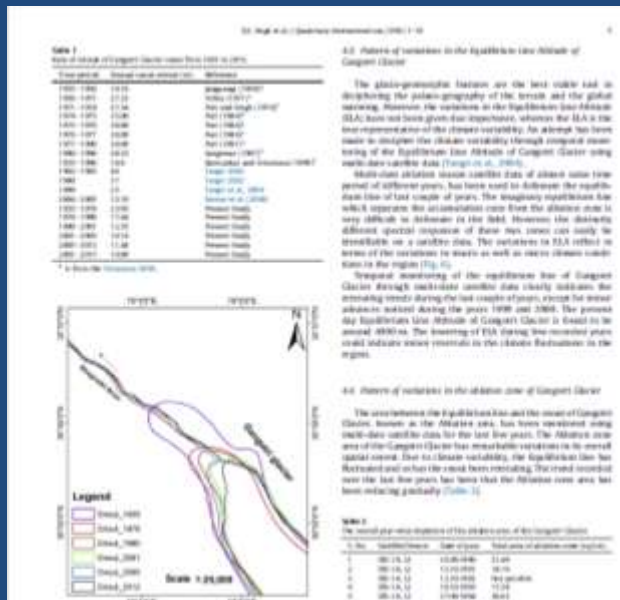
PATTERN OF RETREAT MORPHOLOGICAL ZONES IN THE GANGOTRI GLACIER



every drop counts

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PATTERN OF RETREAT



every drop counts

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MORAINES OF GANGOTRI GLACIER



every drop counts

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GANGOTRI GLACIER REGION*every drop counts**Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow***LAUNCHING OF FIRST INDIAN EXPEDITION TO THE ARCTIC***every drop counts**Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow*

INTERNATIONAL SCIENCE CITY, NY-ALESUND IN ARCTIC

*every drop counts**Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow*FLAG HOISTING FOR THE FIRST TIME IN THE HISTORY
OF INDIA ON 15TH AUGUST 2007 IN NORTH POLE REGION*every drop counts**Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow*

TIRANGA WAS HOISTED FOR THE FIRST TIME IN INDIAN
HISTORY IN HIMADRI ARCTIC 15 AUGUST, 2008



every drop counts

Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow

LAND OF MID NIGHT SUN
SIX MONTHS DAY IN POLAR REGIONS

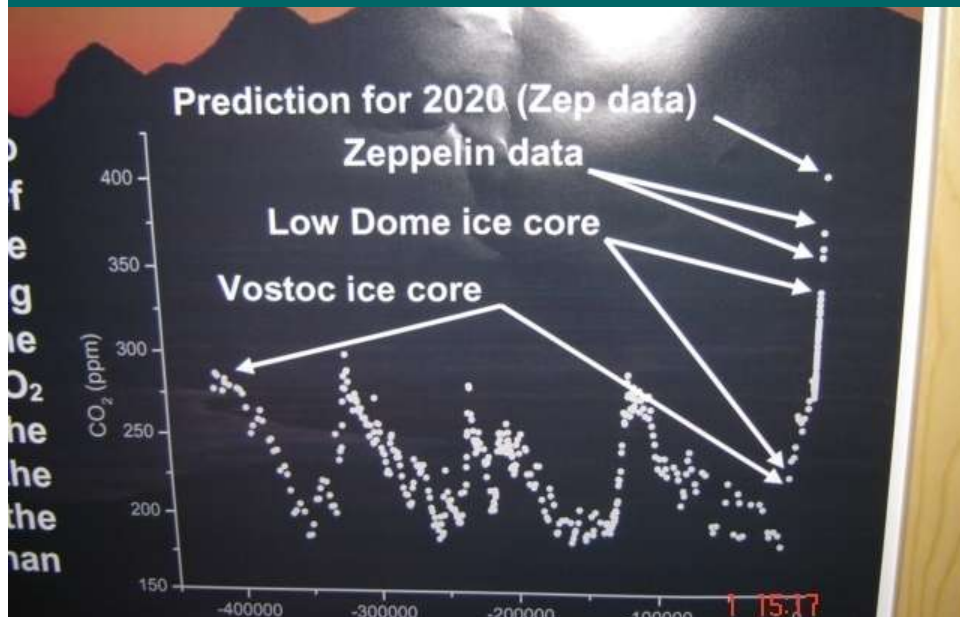


every drop counts

Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow

TIDAL GLACIERS WITH CREVASSES*every drop counts**Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow***TIDAL GLACIERS***every drop counts**Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow*

CO₂ CURVE IN PPM IN ATMOSPHERE



every drop counts

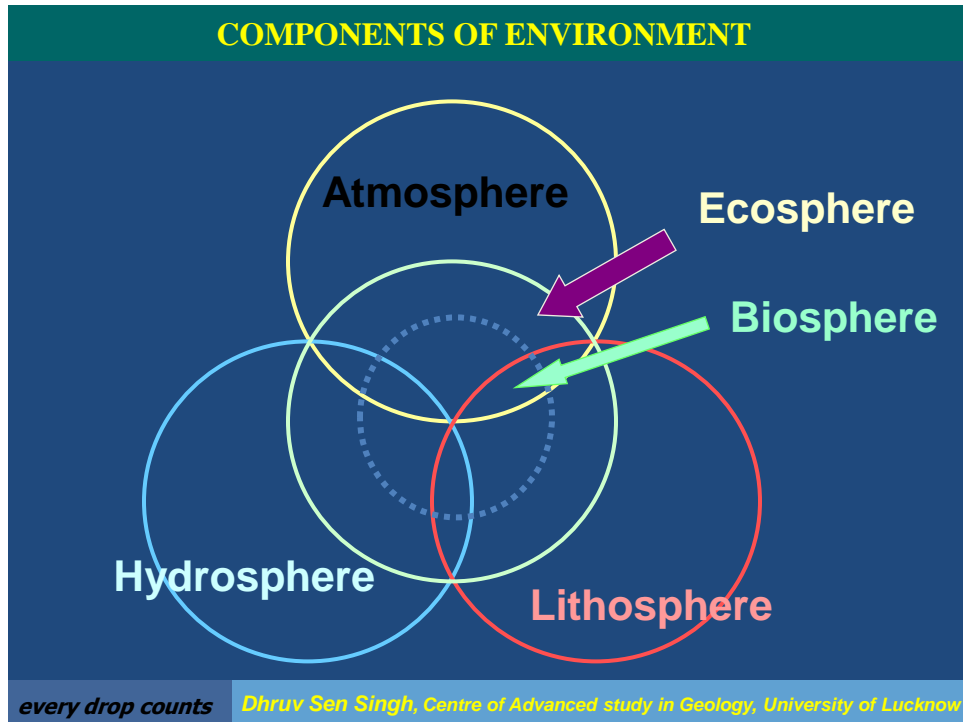
Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow

ENVIRONMENT

Environment provides the Life Support System, Air, Water and Food.

every drop counts

Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow



PLANETS

Planets with very little greenhouse effect are either very cold...

Pluto's average temperature is -370°F



every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

PLANETS

...or they have huge temperature swings from day to night.

On Mars, there is about a 300 degree F difference between high and low temperatures

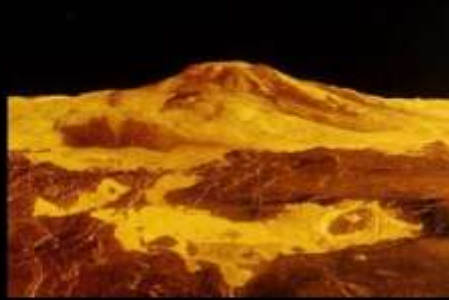


every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

PLANETS AND GREEN HOUSE GASES

Planets with abundant greenhouse gases are very hot



The average temperature on Venus is about 855° F!

every drop counts

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GREEN HOUSE GASES

A number of greenhouse gases occur naturally in the Earth's atmosphere

- Water vapor
- Carbon dioxide
- Methane
- Nitrous oxide

every drop counts

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GREEN HOUSE GASES



With no greenhouse gases at all in its atmosphere, scientists estimate that Earth's average atmospheric temperature would be about -18°C , or about 0°F

<http://plan.afl.edu/efhsung/project2/cause.html>

every drop counts

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EARTH AND CLIMATE CHANGE

...and then there's Earth....



...which is just right...

...for the moment, anyway.

every drop counts

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CONFLUENCE OF YAMUNA AND GANGA AT ALLAHABAD



every drop counts

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PATH CHANGE OF RAPTI NEAR GORAKHPUR



every drop counts

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CONFLUENCE OF RAPTI AND GHAGHARA



every drop counts

Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow

CONFLUENCE OF CHHOTI GANDAK AND GHAGHARA



every drop counts

Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow

CONFLUENCE OF GANGA AND GHAGHARA AT CHHAPRA



every drop counts

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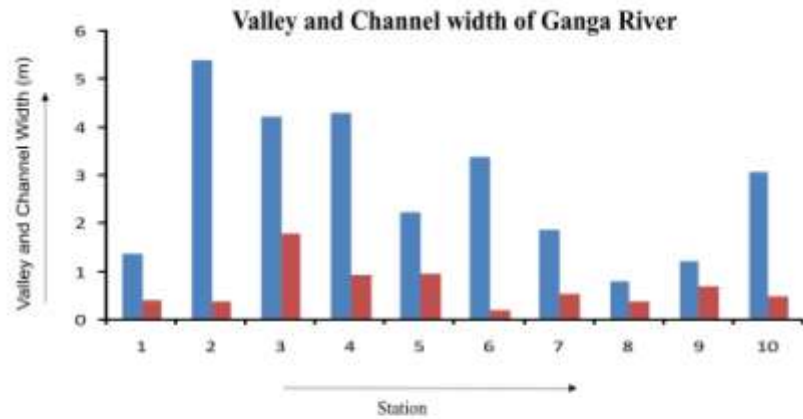
BROAD VALLEY OF GANGA NEAR KANPUR



every drop counts

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GANGA RIVER



Stations:

1. Bijonore, 2. Kannauj, 3. Kowana, 4. Kanpur, 5. Near Unchahar,
6. Hauteswar, 7. Allahabad, 8. Mirzapur, 9. Varanasi, 10. Balia

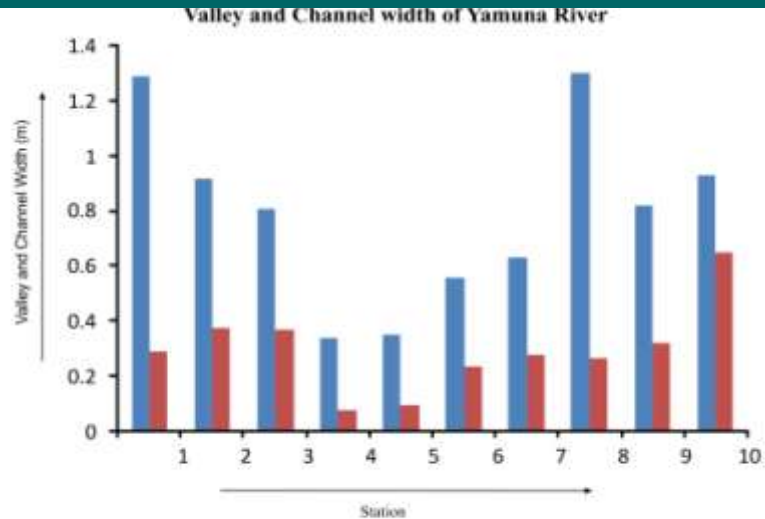
■ Valley Width (km)

■ Valley Width (km)

every drop counts

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YAMUNA RIVER



Stations:

1. Mathura, 2. Raigra Int, 3. Agara, 4. Firozabad,
5. Etawah, 6. Near Hamirpur, 7. Near Azamgarh,
8. Khatmipur, 9. Rajapur, 10. Allahabad

■ Valley Width (m)

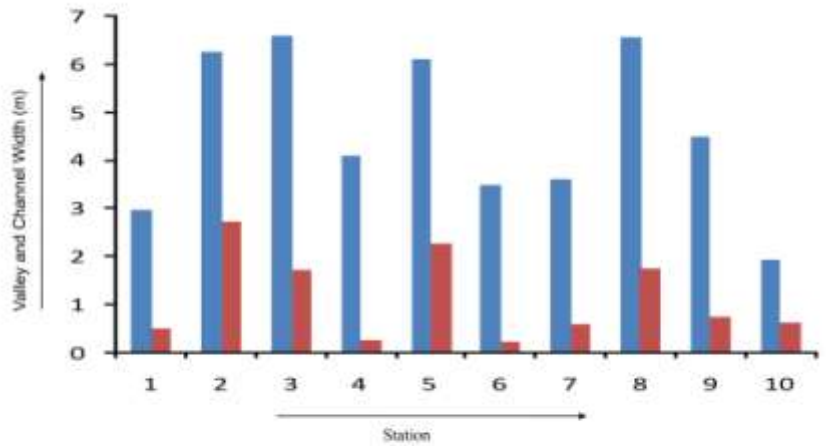
■ Channel Width (m)

every drop counts

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GHAGHARA RIVER

Valley and Channel width of Ghaghara River



Stations:

1. Near Tigla, 2. Fakurpur, 3. Near Jarwal Road,
4. Near Basantpur, 5. Near Sidhauri, 6. Near Ayodhya,
7. Elhefogari, 8. Tandi, 9. Barhulga, 10. Dauli

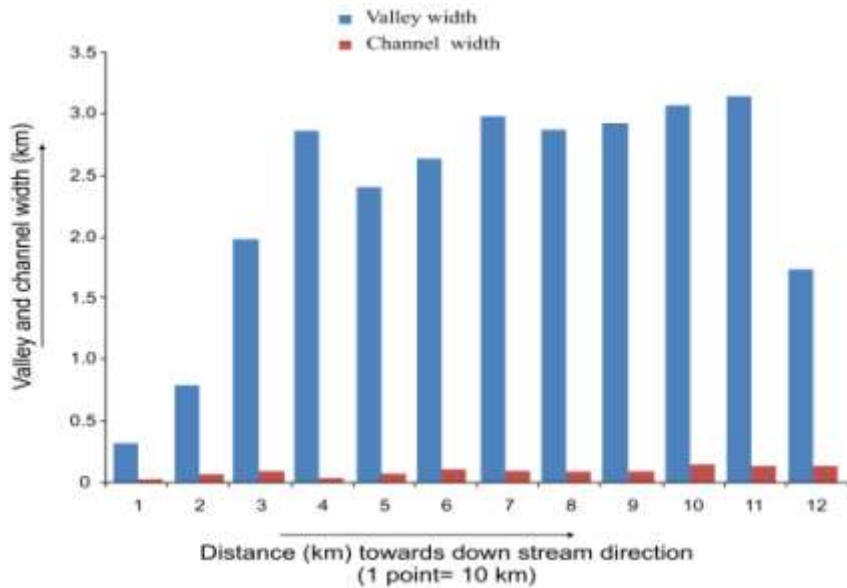
■ Valley Width (m)

■ Channel Width (m)

every drop counts

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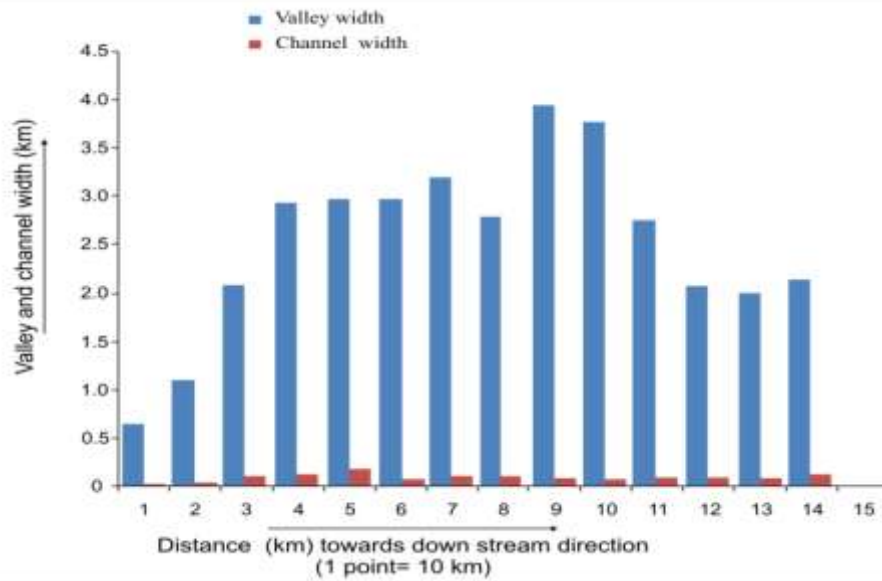
GREAT GANDAK RIVER



every drop counts

Dhruv Sen Singh, Geology Department, University of Lucknow, Lucknow

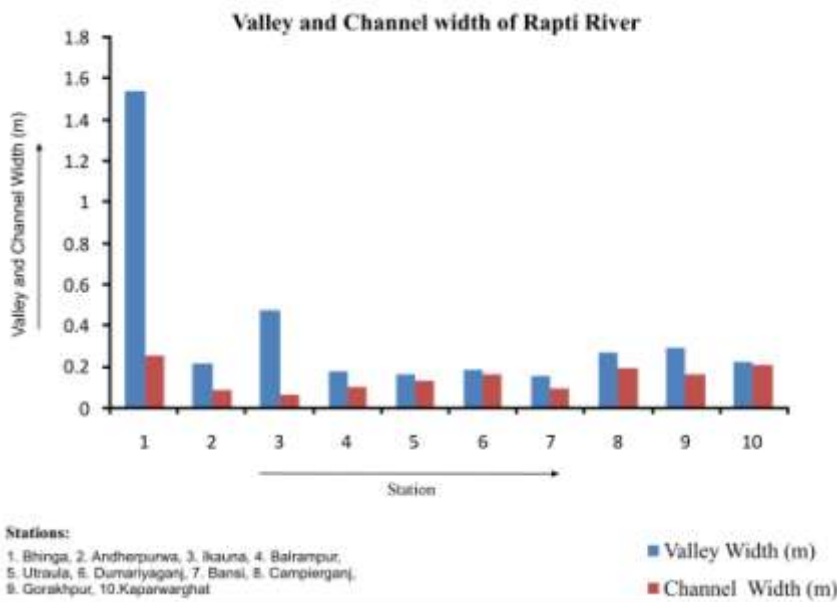
KOSI RIVER



every drop counts

Dhruv Sen Singh, Geology Department, University of Lucknow, Lucknow

RAPTI RIVER

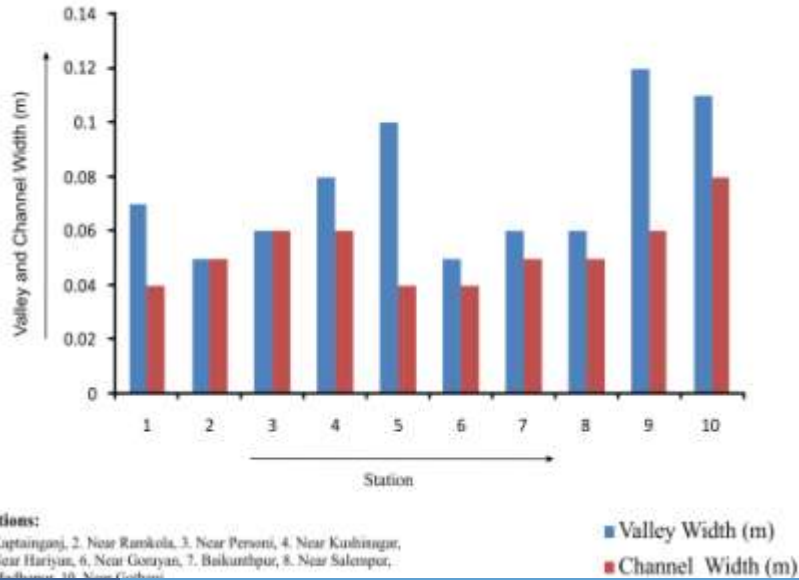


every drop counts

Dhruv Sen Singh, Geology Department, University of Lucknow, Lucknow

CHHOTI GANDAK RIVER

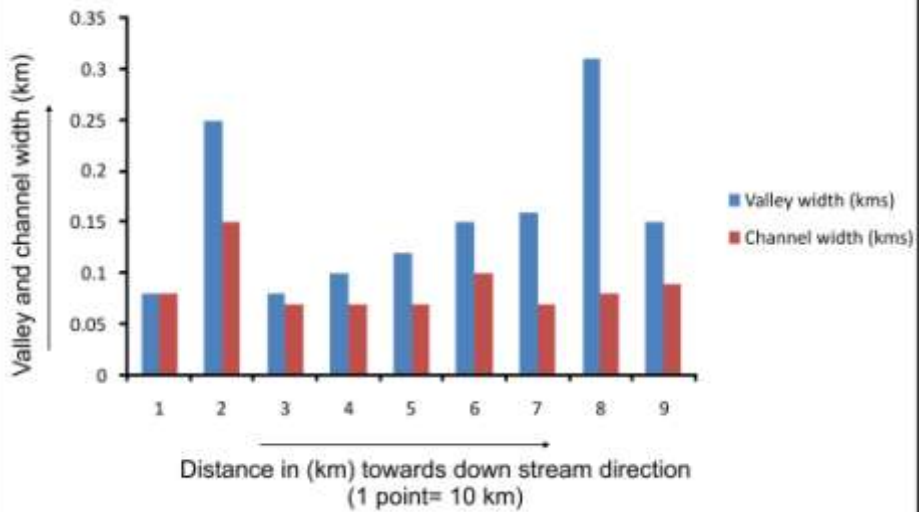
Valley and Channel width of Little Gandak



every drop counts

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GOMATI RIVER



every drop counts

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GHAGHARA RIVER



every drop counts

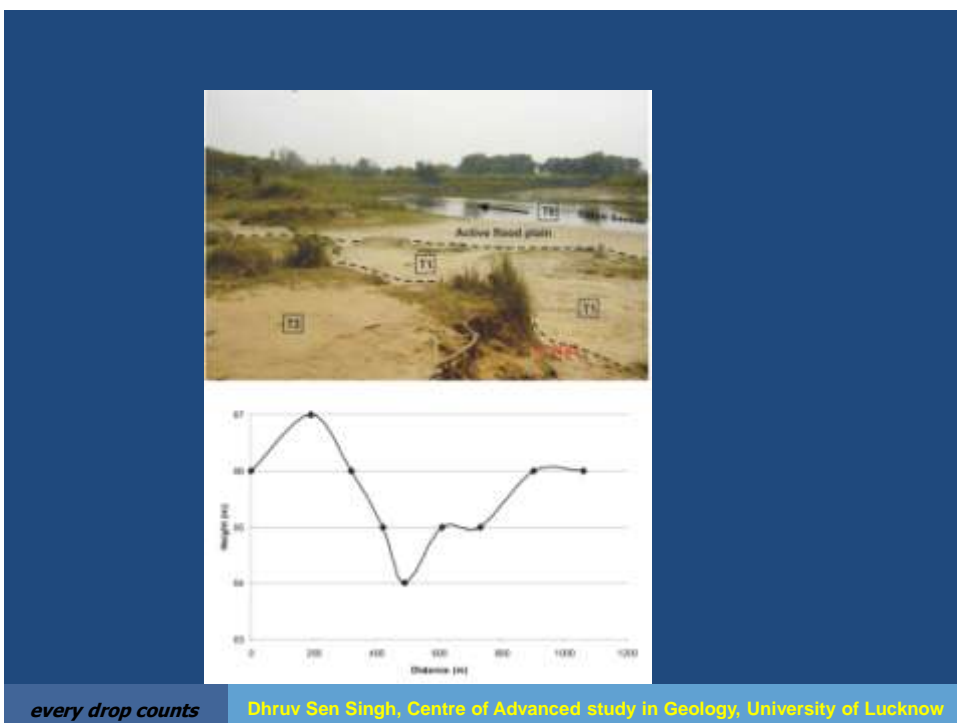
Dhruv Sen Singh, Geology Department, University of Lucknow, Lucknow

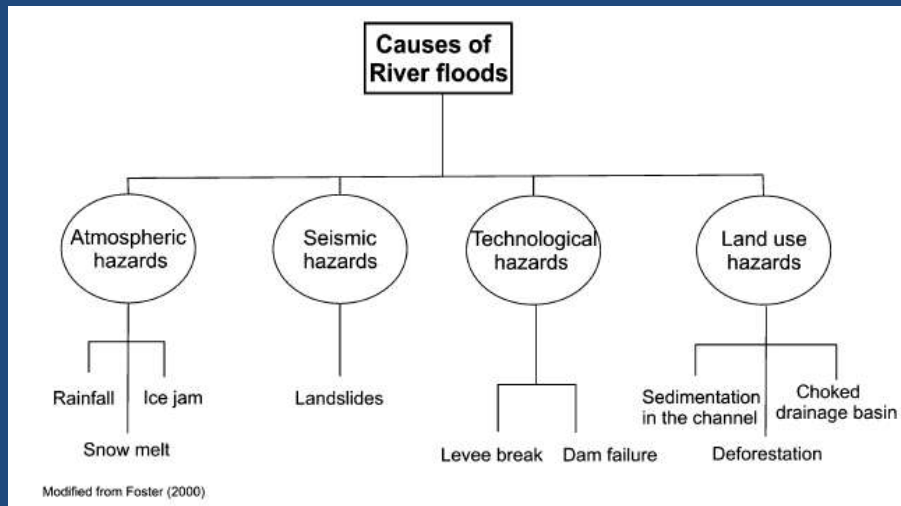
GHAGHARA RIVER



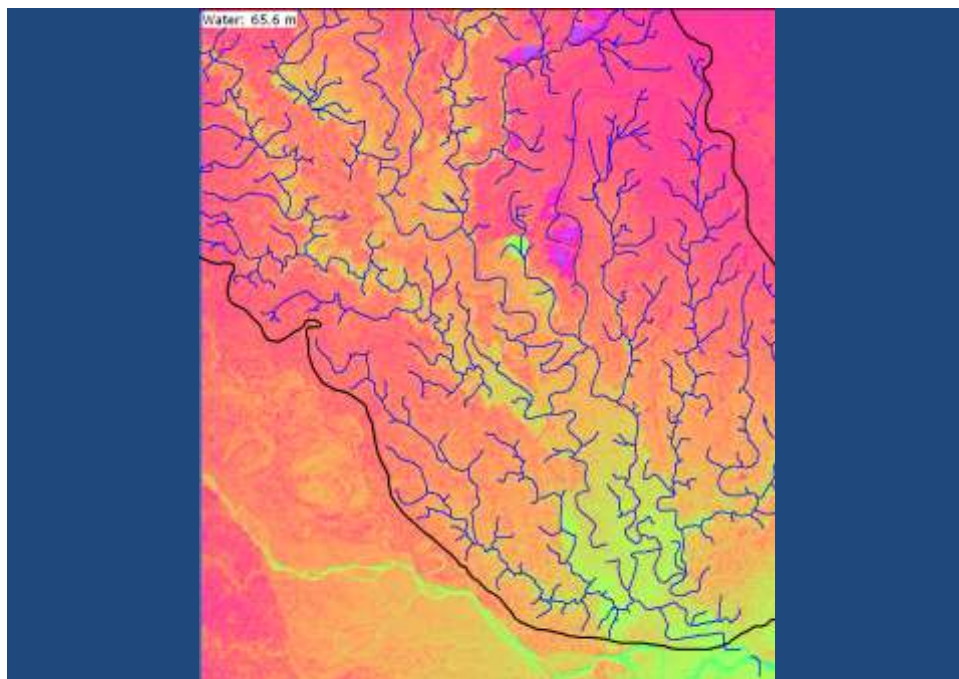
every drop counts

Dhruv Sen Singh, Geology Department, University of Lucknow, Lucknow

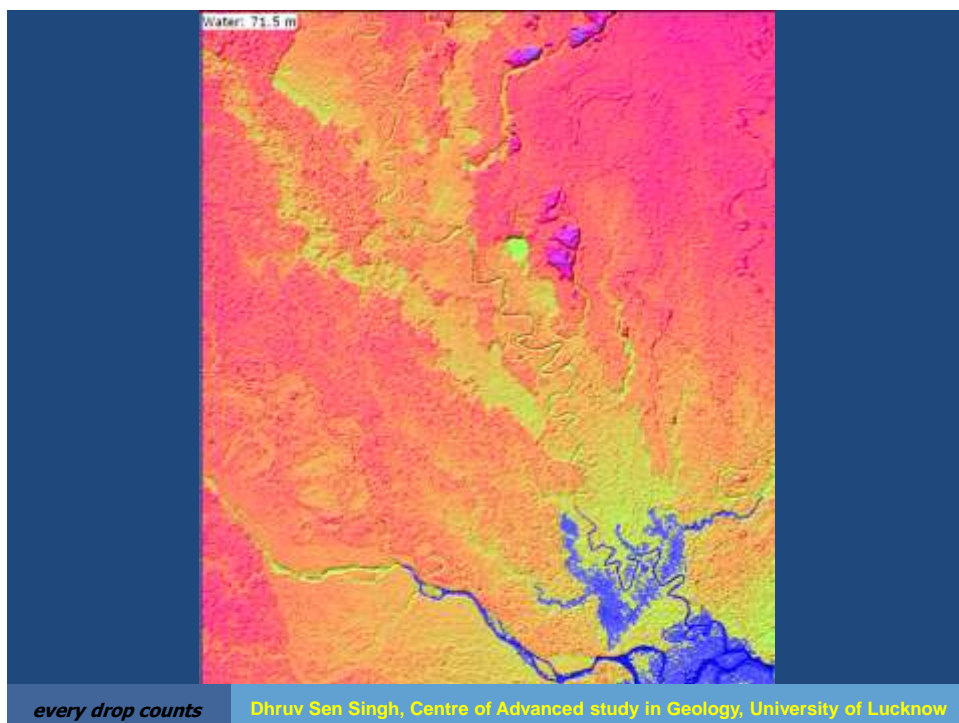
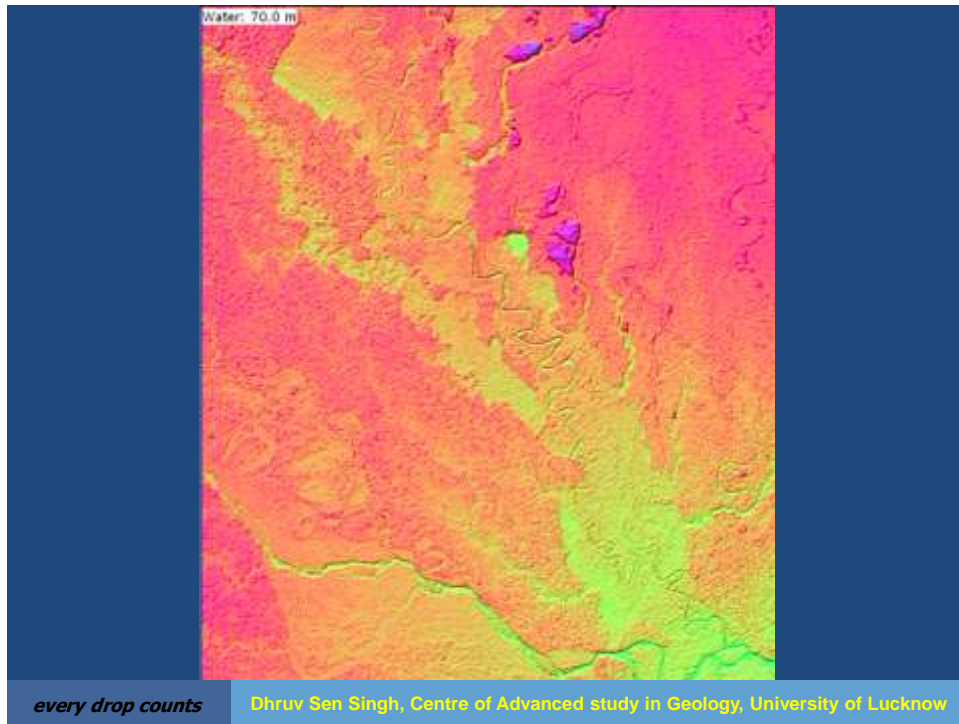


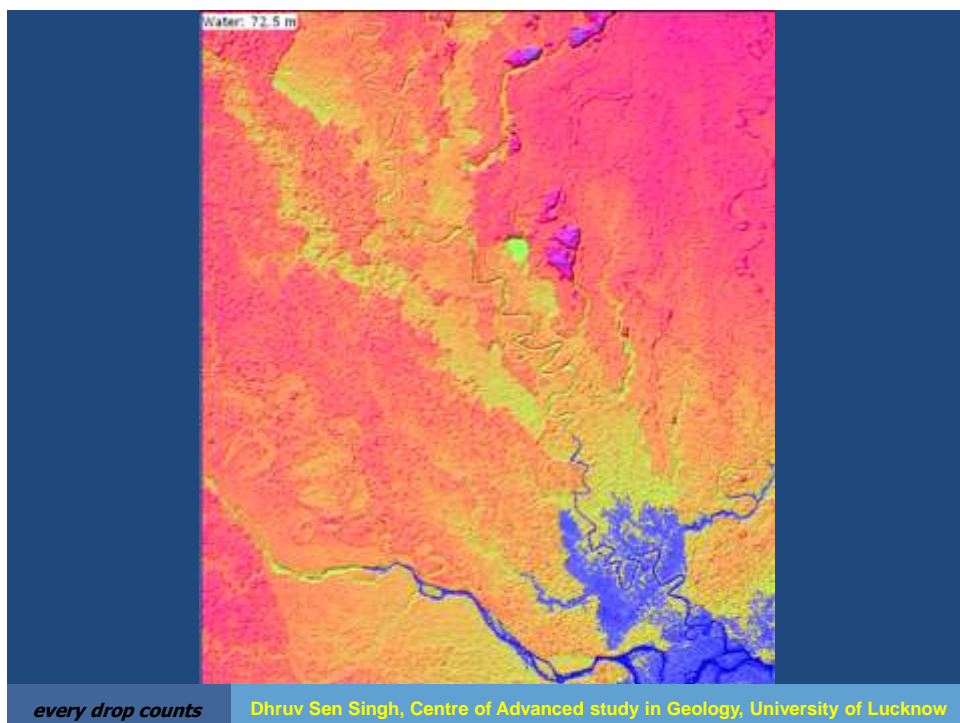
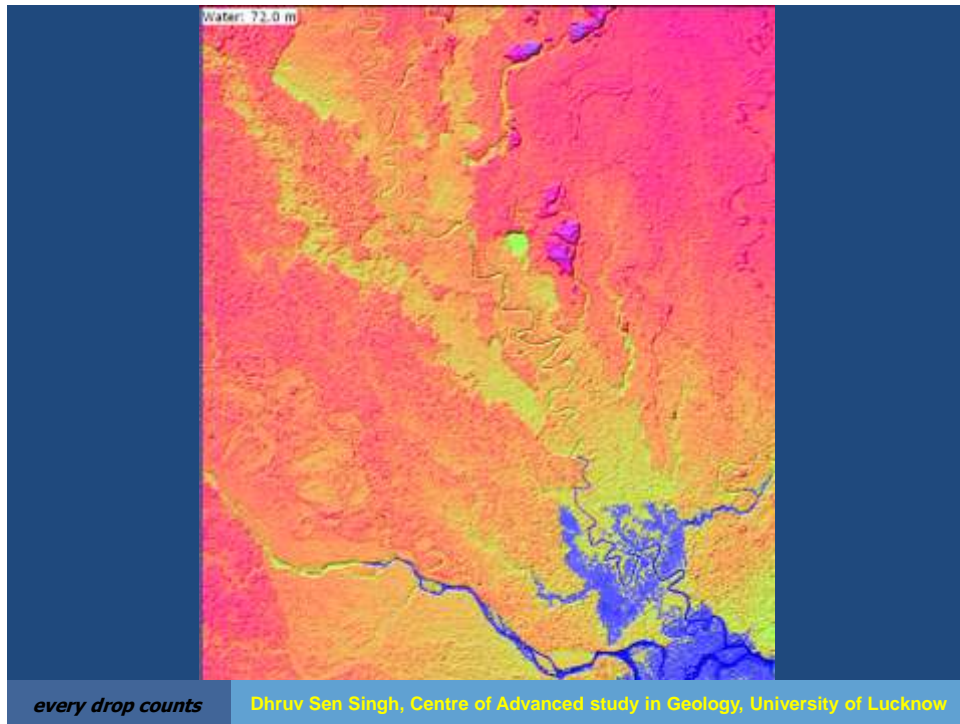
*every drop counts*

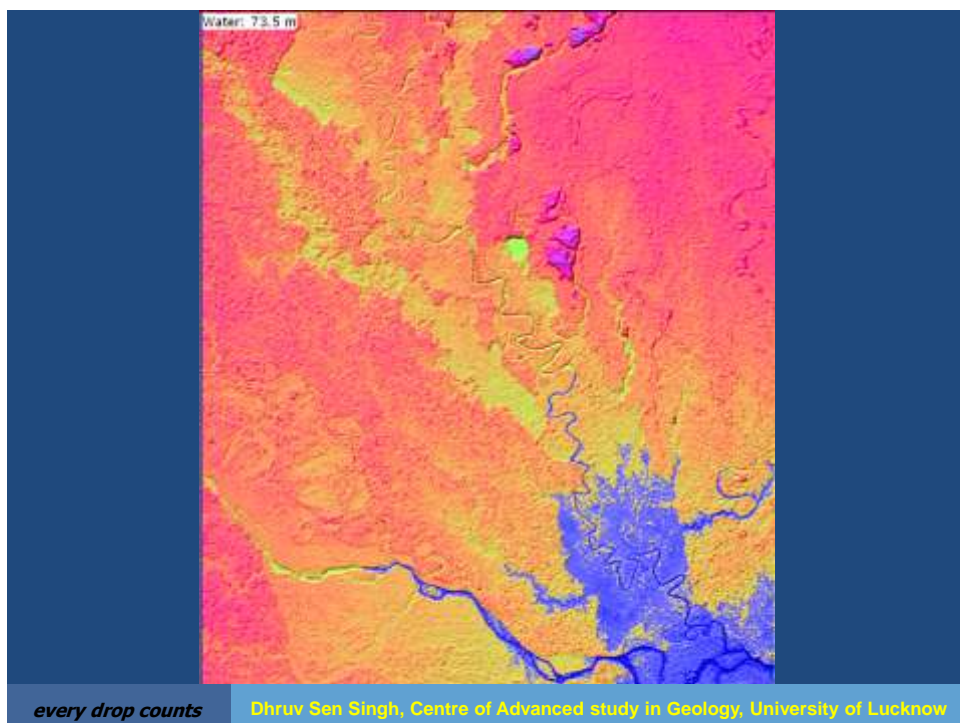
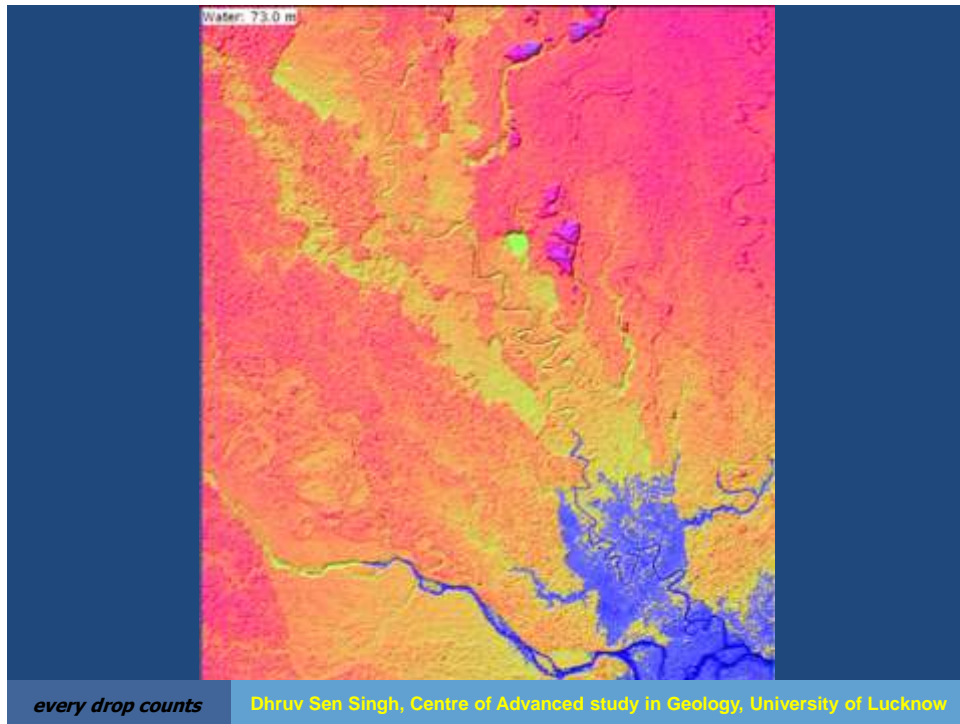
Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow

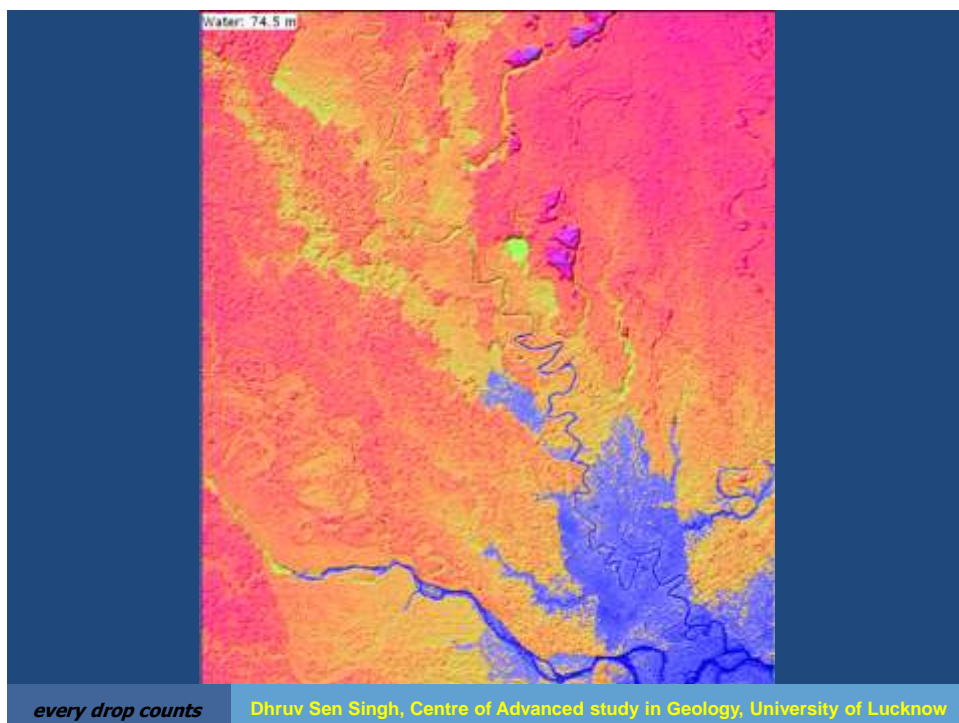
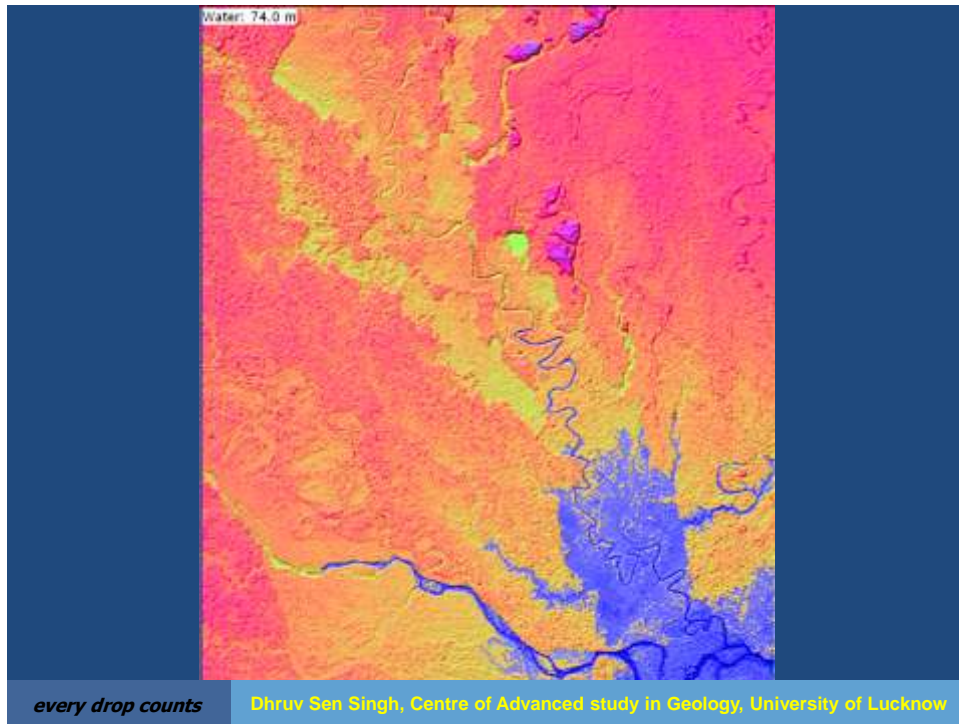
*every drop counts*

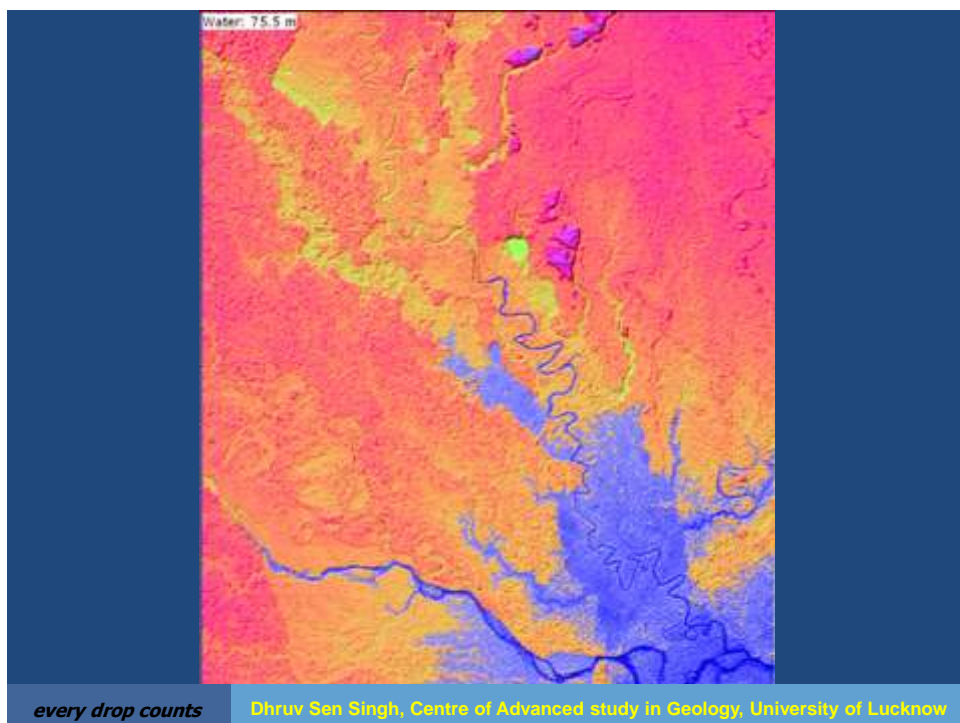
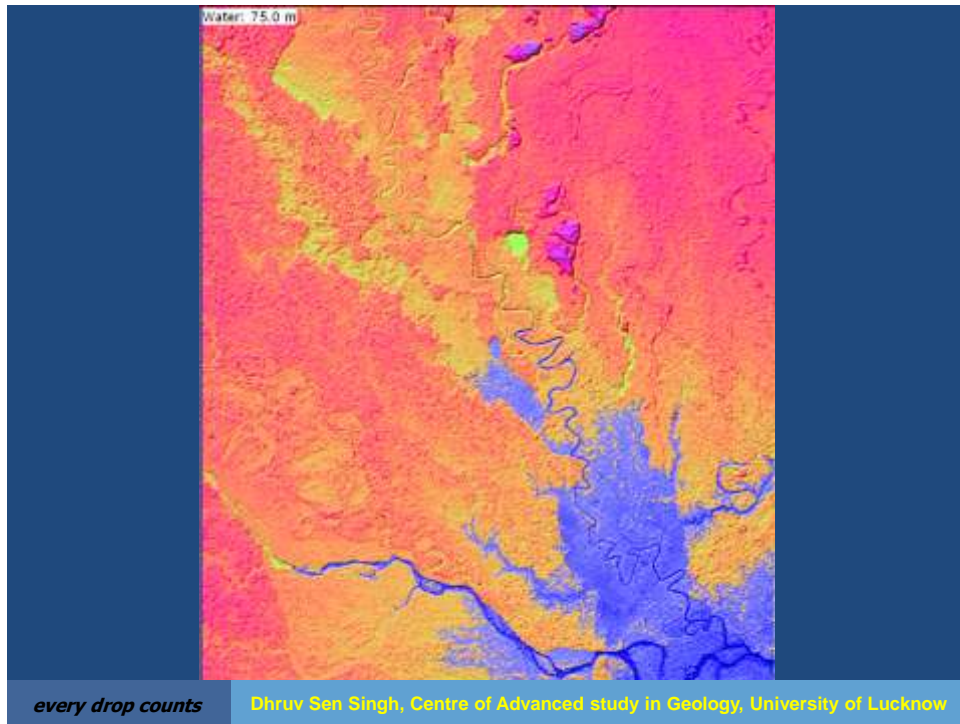
Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow

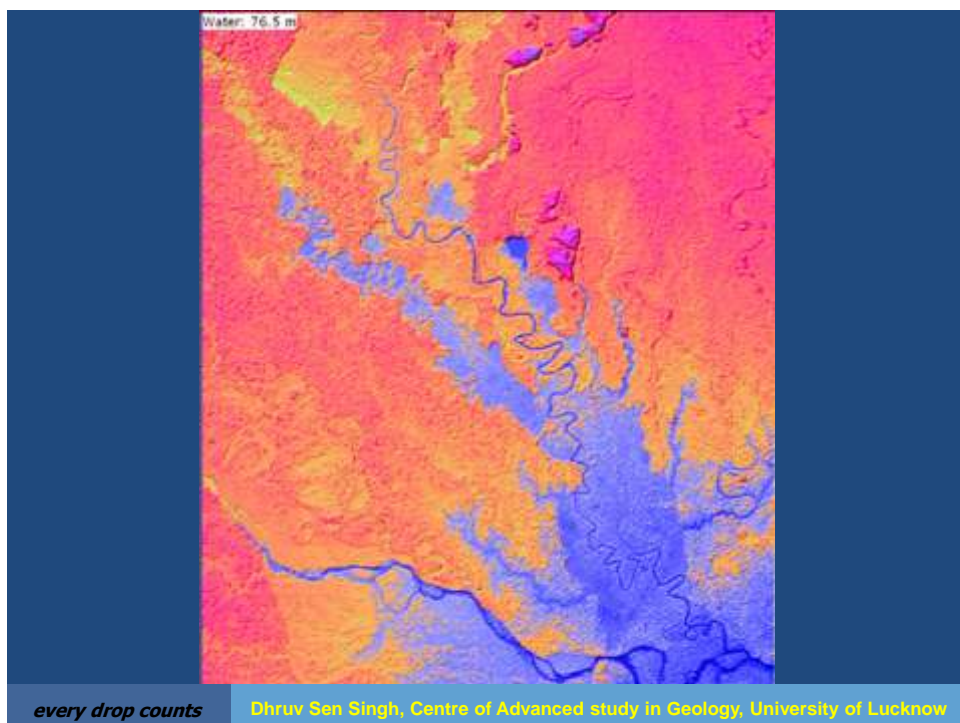
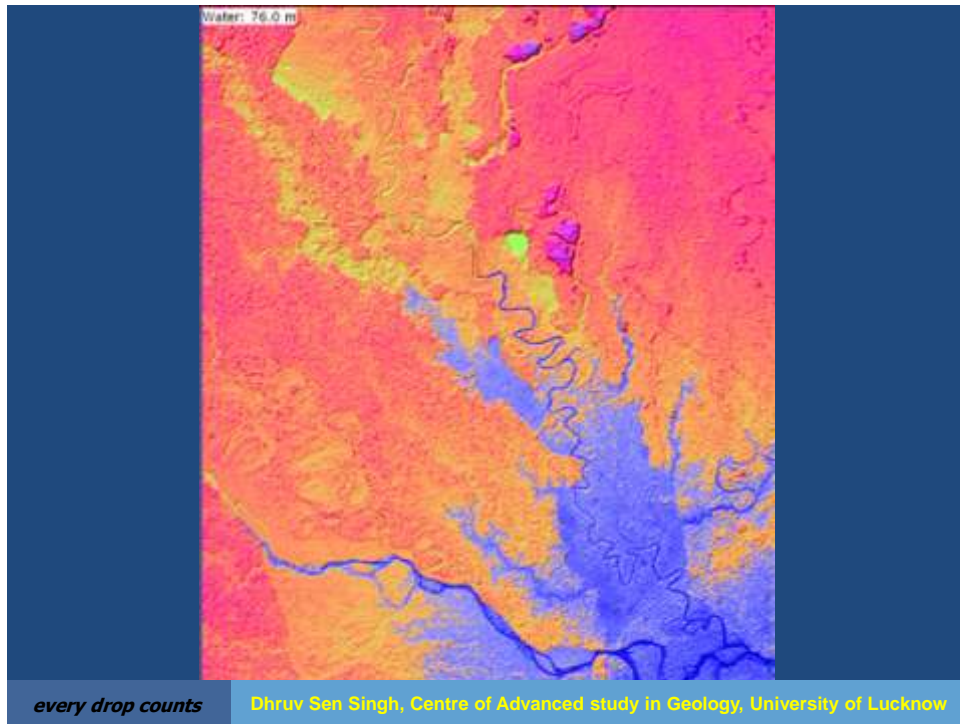


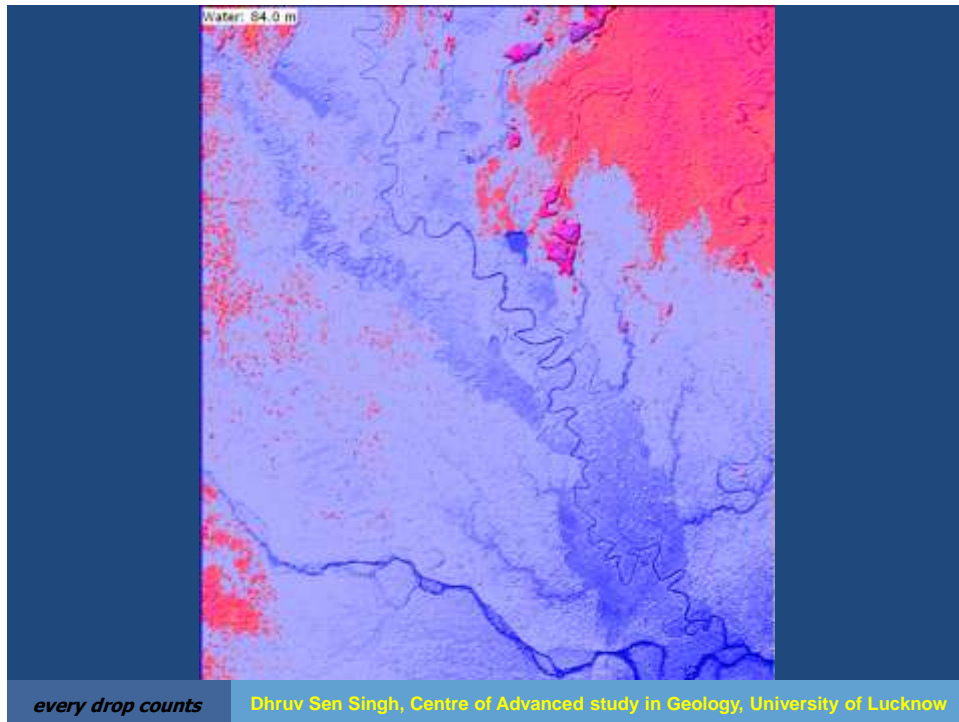




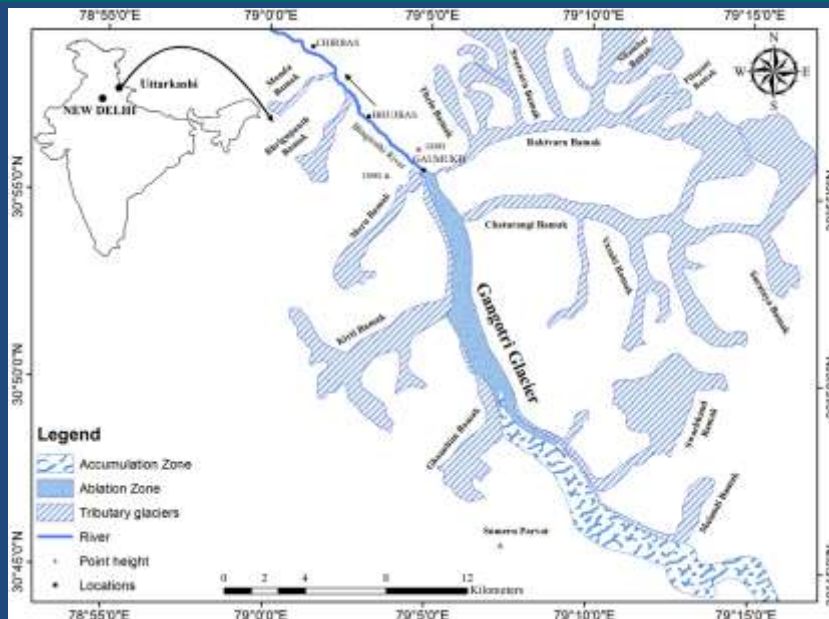








LOCATION MAP OF GANGOTRI GLACIER



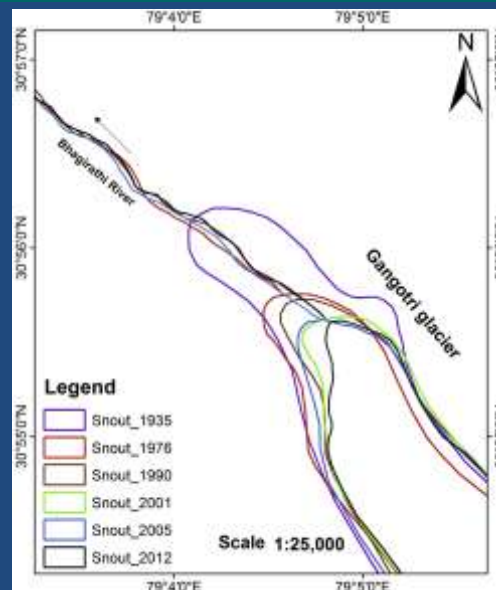
POSITION OF THE GANGOTRI GLACIER SNOUT IN 2001 (a) AND 2015 (b)



every drop counts

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POSITION OF THE SNOUT OF THE GANGOTRI GLACIER



every drop counts

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YEAR WISE DEPLETION RATE OF THE ABLATION AREA

The overall year-wise depletion of the ablation area of the Gangotri Glacier.

S. No.	Satellite/Sensor	Date of pass	Total area of ablation zone (sq km)
1	IRS-1A, L2	25.09.1990	21.49
2	IRS-1A, L2	15.10.1991	19.19
3	IRS-1A, L2	12.10.1992	Not possible
4	IRS-1A, L2	10.10.1993	17.34
5	IRS-1A, L2	27.09.1994	20.62
6	IRS-1A, L2	14.09.1995	22.77
7	IRS-1C-L3	19.10.1996	18.03
8	IRS-1C-L3	14.10.1997	Not possible
9	IRS-1C-L3	09.10.1998	21.07
10	IRS-1D-L3	16.10.1999	21.25
11	IRS-1C-L3	15.11.2000	19.97
12	IRS-1D-L3	23.09.2001	19.89
13	IRS-1D-L3	2012	17.04

CHARACTERSTIC OF GEOMORPHIC ZONES

Characteristics of morphological zones.

S. No.	Morphological zones	Sediments	Percentage of sediment (size in cm)				Roundness and sorting	
			Boulders			Matrix		
			>150 LSH	60-150 LMSB	30-60 SMSB	2.5-30 SSB		
1	Glacial	Primary	2-5	5-10	5-10	40-60	20-40	Angular, poorly sorted
2	Glacio-fluvial	Secondary	2-5	5-10	10-20	20-40	50-60	Sub rounded, poorly sorted

LSH = Large size Boulders, LMSB = Large Medium Size Boulders, SMSB = Small Medium Sized Boulders, SSB = Small Size Boulders, Matrix = Sand, Silt, Clay.

LSB = Large Size Boulders, LMSB = Large Medium Size Boulders, SMSB = Small Medium Sized Boulders, SSB = Small Size Boulders, Matrix = Sand, Silt, Clay.

every drop counts

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CLOUD BURSTS IN GANGOTRI GLACIER ON 6 JUNE, 2000



every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

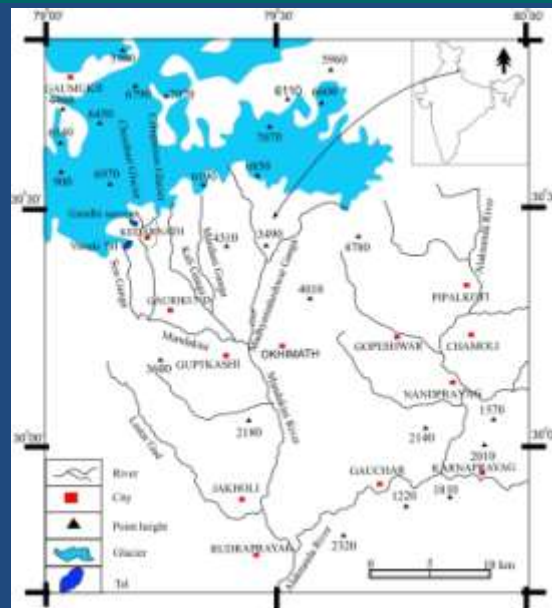
CLOUD BURSTS IN GANGOTRI GLACIER ON 6 JUNE, 2000



every drop counts

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LOCATION OF KEDARNATH AREA AND MANDAKINI RIVER



every drop counts

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CHORABARI GLACIER AND MANDAKINI RIVER



every drop counts

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SUSTAINABLE SOLUTIONS AROUND



every drop counts

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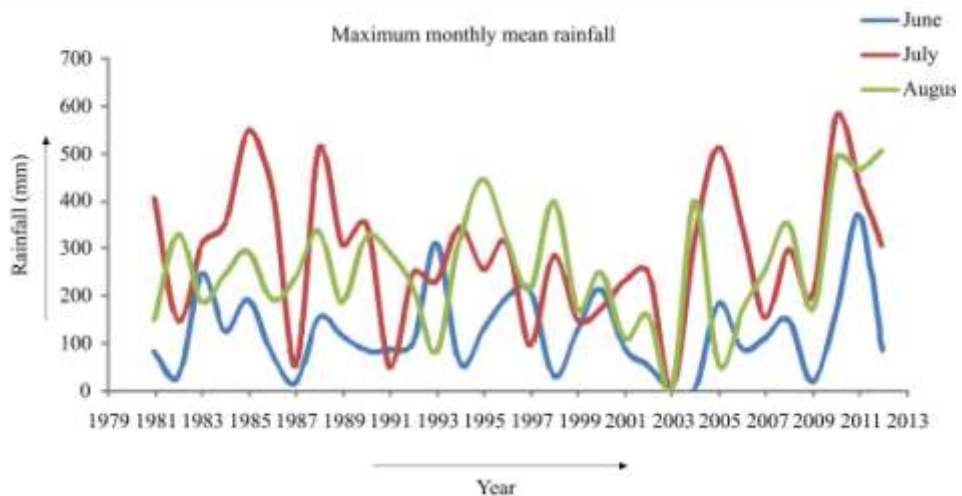
KEDARNATH DEVASTATION, 16, 17—June, 2013



every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

PRECIPITATION VARIATIONS FROM 1980-2013



IMD and India Water Portal

every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

CAUSES OF KEDARNATH TRAGEDY



every drop counts

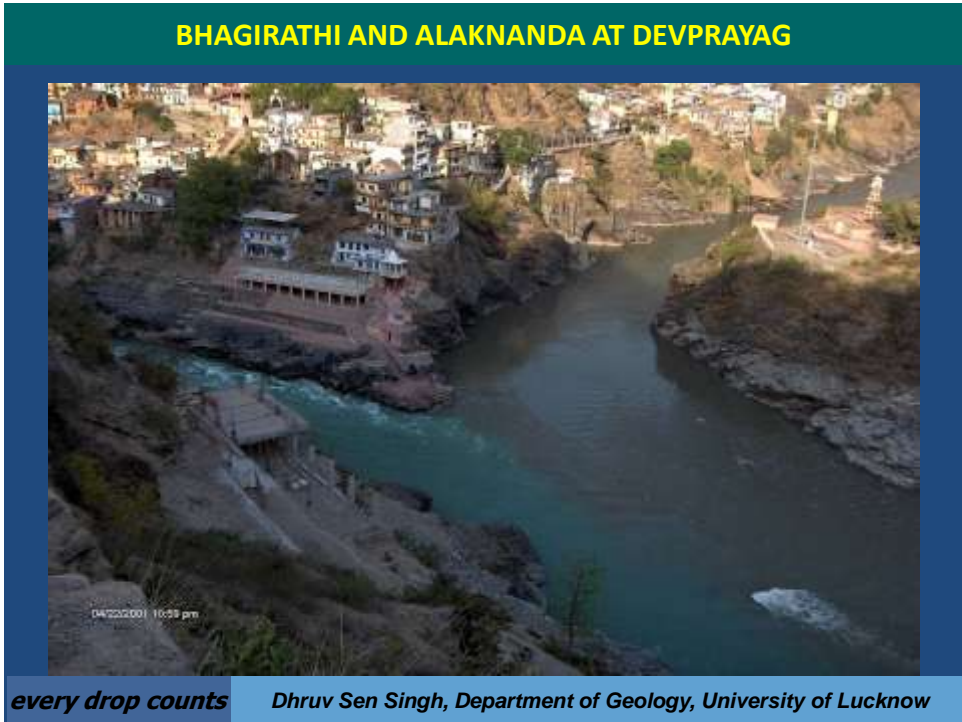
Dhruv Sen Singh, Department of Geology, University of Lucknow

DISTRUBUTION OF DEBRIS AFTER DISASTER



every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow



Keadranath

REGULARIZING GEOMORPHOLOGICAL TERMS

Surface processes during flash floods in the glacial moraine of Kedarnath, Garhwal Himalaya and their role in the modification of landscape:

Shree Sen Singh*

Department of Geology, University of Lucknow, Lucknow-226007, India.

Glaciers are considered as one of the best indicators of climate change and glacial landforms are considered as the permanent record of past glaciation. In the Himalaya, the glaciers are retreating rapidly and the landforms are being modified. The Keadranath moraine is a glacial moraine of the 18th century, which is a good example of a glacial moraine. The Keadranath moraine is a good example of a glacial moraine, which is a good example of a glacial moraine. The Keadranath moraine is a good example of a glacial moraine, which is a good example of a glacial moraine.

Keywords: Glaciation, Himalaya, flash floods, moraine, landscape, geomorphology, climate change.

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modification of primary and secondary deposits and related to the modification of glacial moraine.

The Keadranath is a glacial moraine of the Himalaya and the Keadranath is a glacial moraine of the Himalaya. The Keadranath is a glacial moraine of the Himalaya and the Keadranath is a glacial moraine of the Himalaya. The Keadranath is a glacial moraine of the Himalaya and the Keadranath is a glacial moraine of the Himalaya. The Keadranath is a glacial moraine of the Himalaya and the Keadranath is a glacial moraine of the Himalaya.

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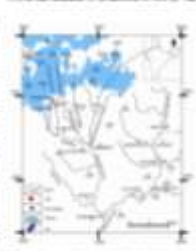


Fig. 1. Location map of Keadranath in the Garhwal Himalaya. The map shows the Keadranath moraine, the Keadranath river, and the Keadranath valley. The map is labeled with 'Keadranath' and 'Garhwal Himalaya'.

every drop counts

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Kedarnath

Causes of Kedarnath Tragedy and Human Responsibilities – Shree Sen Singh, Centre of Advanced Study in Geology, University of Lucknow (2007) (Email: shreesen@geology.lko.ac.in)

The Kedarnath tragedy of 1991 is a disaster of the Himalaya. The Kedarnath tragedy is a disaster of the Himalaya. The Kedarnath tragedy is a disaster of the Himalaya. The Kedarnath tragedy is a disaster of the Himalaya. The Kedarnath tragedy is a disaster of the Himalaya. The Kedarnath tragedy is a disaster of the Himalaya. The Kedarnath tragedy is a disaster of the Himalaya. The Kedarnath tragedy is a disaster of the Himalaya.

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Fig. 1. Kedarnath temple area after the 1991 disaster. The photograph shows the temple area surrounded by debris and the surrounding area is heavily damaged. The photograph is labeled with 'Kedarnath temple' and '1991 disaster'.

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Fig. 2. Kedarnath temple area after the 1991 disaster. The photograph shows the temple area surrounded by debris and the surrounding area is heavily damaged. The photograph is labeled with 'Kedarnath temple' and '1991 disaster'.

every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

February, 2021

Climate change has led to rise in natural disasters... ...Encroachment Of Rivers Adds To Havoc

Dhruv Sen Singh

The floods that caused the loss of lives and property in the north-eastern part of India, particularly in Assam, have been a direct result of climate change, according to a report by the United Nations.

The report, which was released in January, says that the floods in Assam were the worst in the state's history in over 100 years. It also says that the floods were caused by a combination of factors, including climate change, deforestation, and the construction of dams.

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A flooded area in Assam.

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every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

EARTH

There's no place like home...



...and there may never be again. Do your part.

every drop counts

Dhruv Sen Singh, Department of Geology, University of Lucknow

THANKS



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Dhruv Sen Singh, Centre of Advanced study in Geology, University of Lucknow