

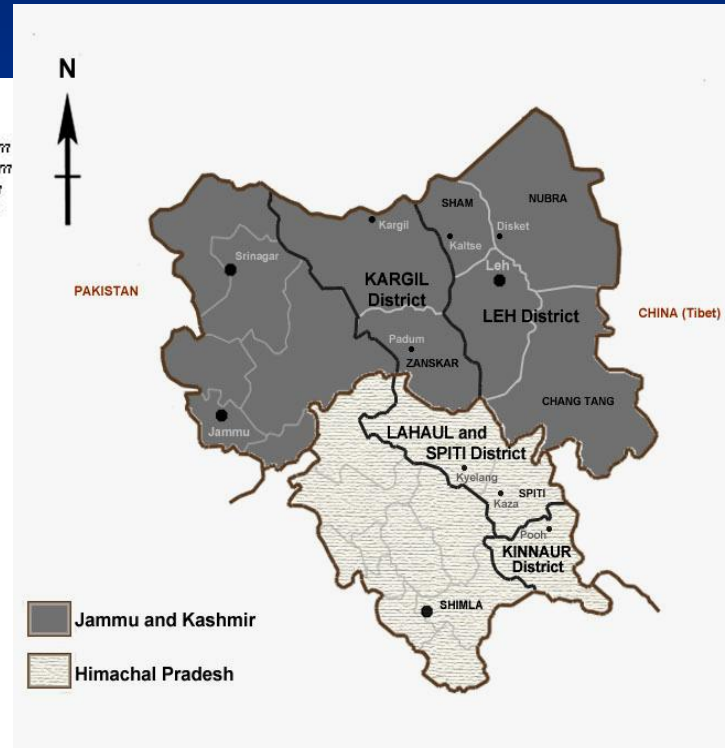
Impacts of Climate Change in Ladakh (Indian Himalayas)

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Context

The region falls in the rain shadow area of the Indian Himalayas which blocks the monsoon winds thereby causing meager rainfall



Context

- Altitude: 3000- 5000 meters above sea level
- Climate: The climate is cold (-30°C in peak winters) and dry (average rainfall of 50 mm per annum), thereby limiting the growth of natural vegetation.
- The region has many small glaciers(literally one above each village) and these glaciers and snowmelt water is the only source of water for irrigation, domestic purpose, etc





Methodology to assess impact

- **An amalgam of three approaches was used for assessing the impacts of Climate change :**
 - **Analysis of meteorological data from 1973 to 2008 at Leh (Temperature and Precipitation)**
 - **Impact interviews with villagers and prominent persons (especially aged people) in eight representative villages**
 - **Baseline survey about Temperature and Precipitation Changes among 211 villagers older than 35 years**



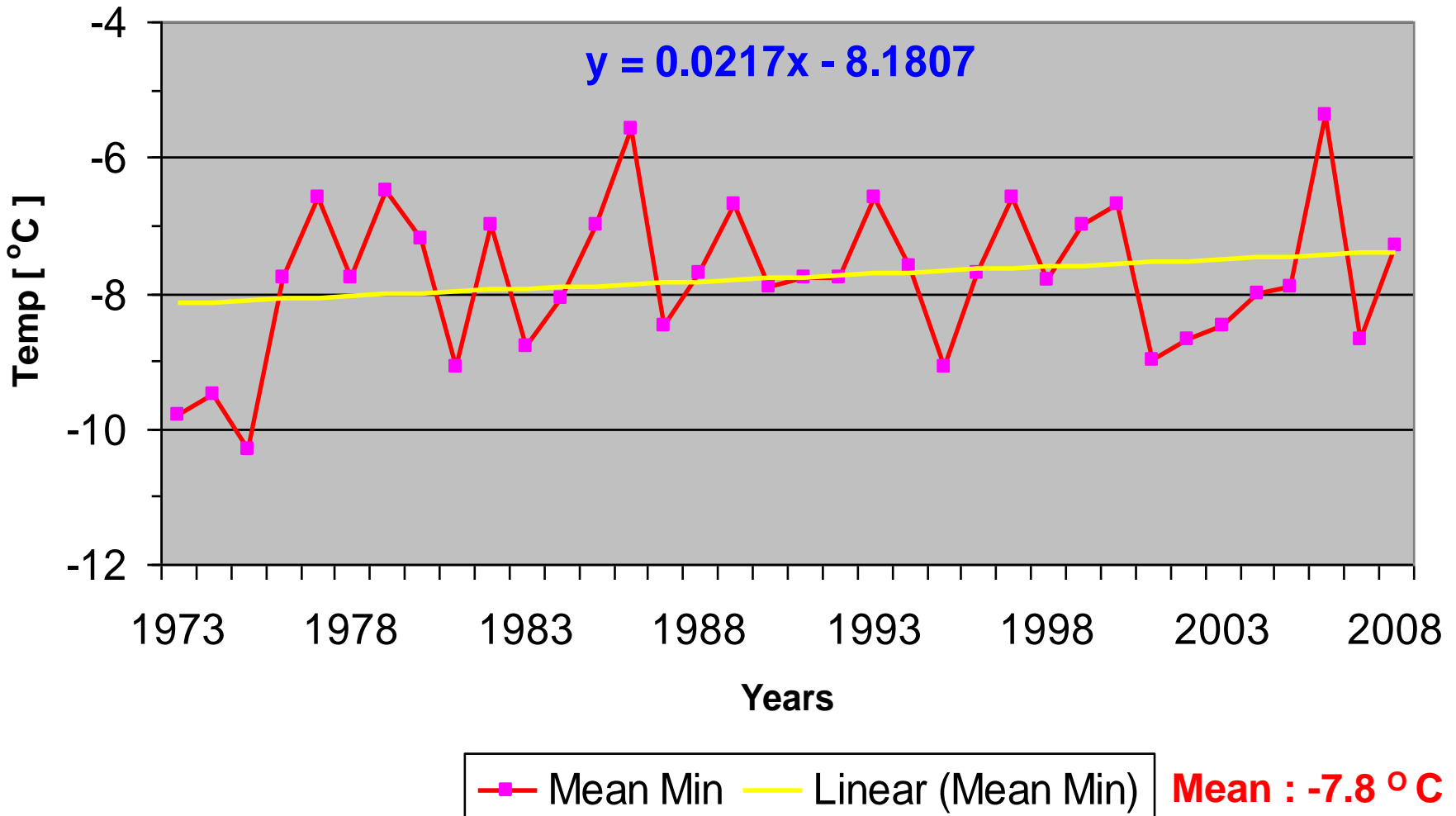
Analysis of Meteorological data

- Mean minimum temperature for all winter months 1973-2008 were analyzed to ascertain secular trends
- Similarly, Mean maximum temperature for summer months 1973-2008

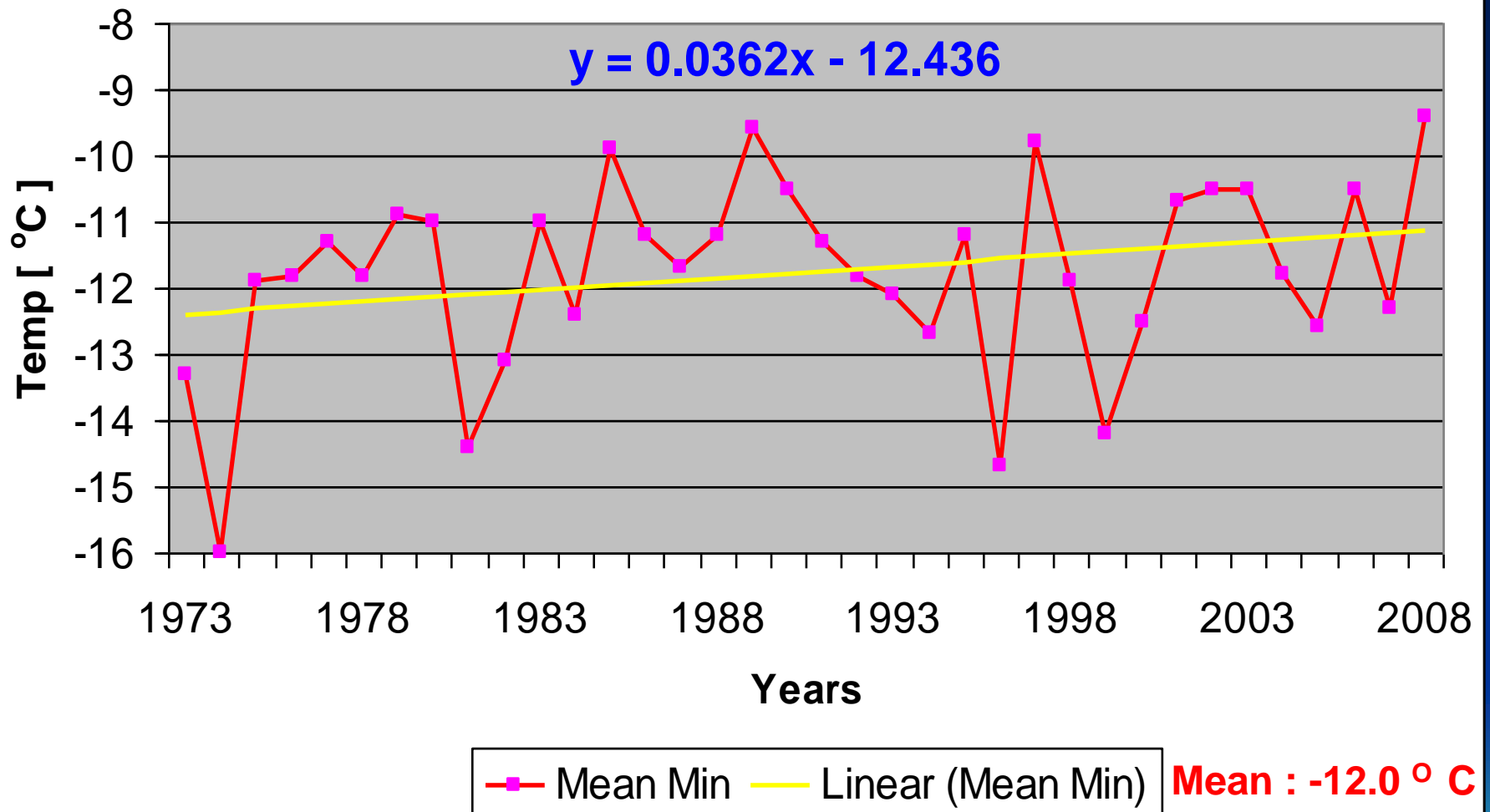


TEMPERATURE

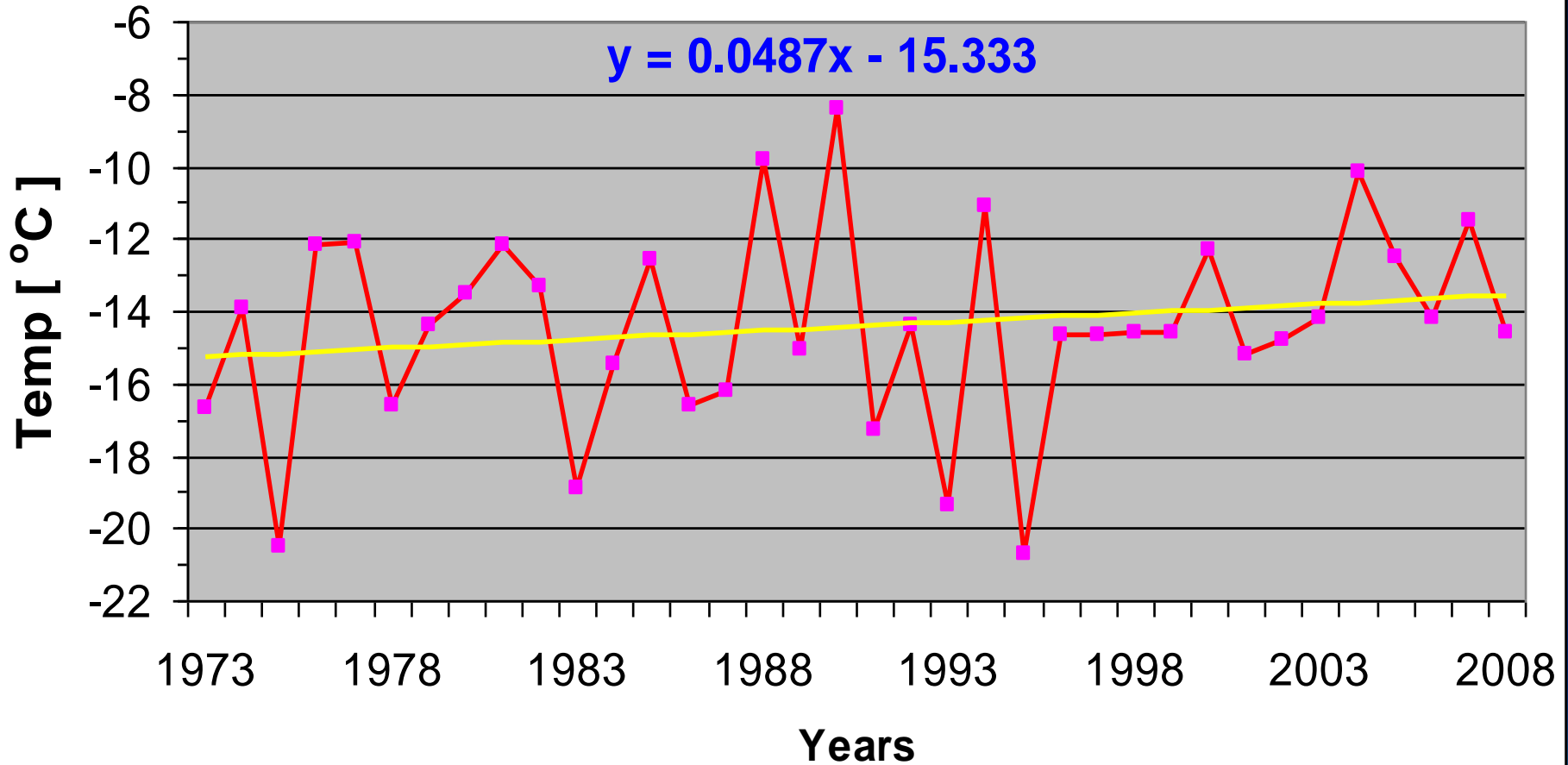
Mean Min Temp and Trend: NOV(1973-2008)



Mean Min Temp and Trend:DEC(1973-2008)

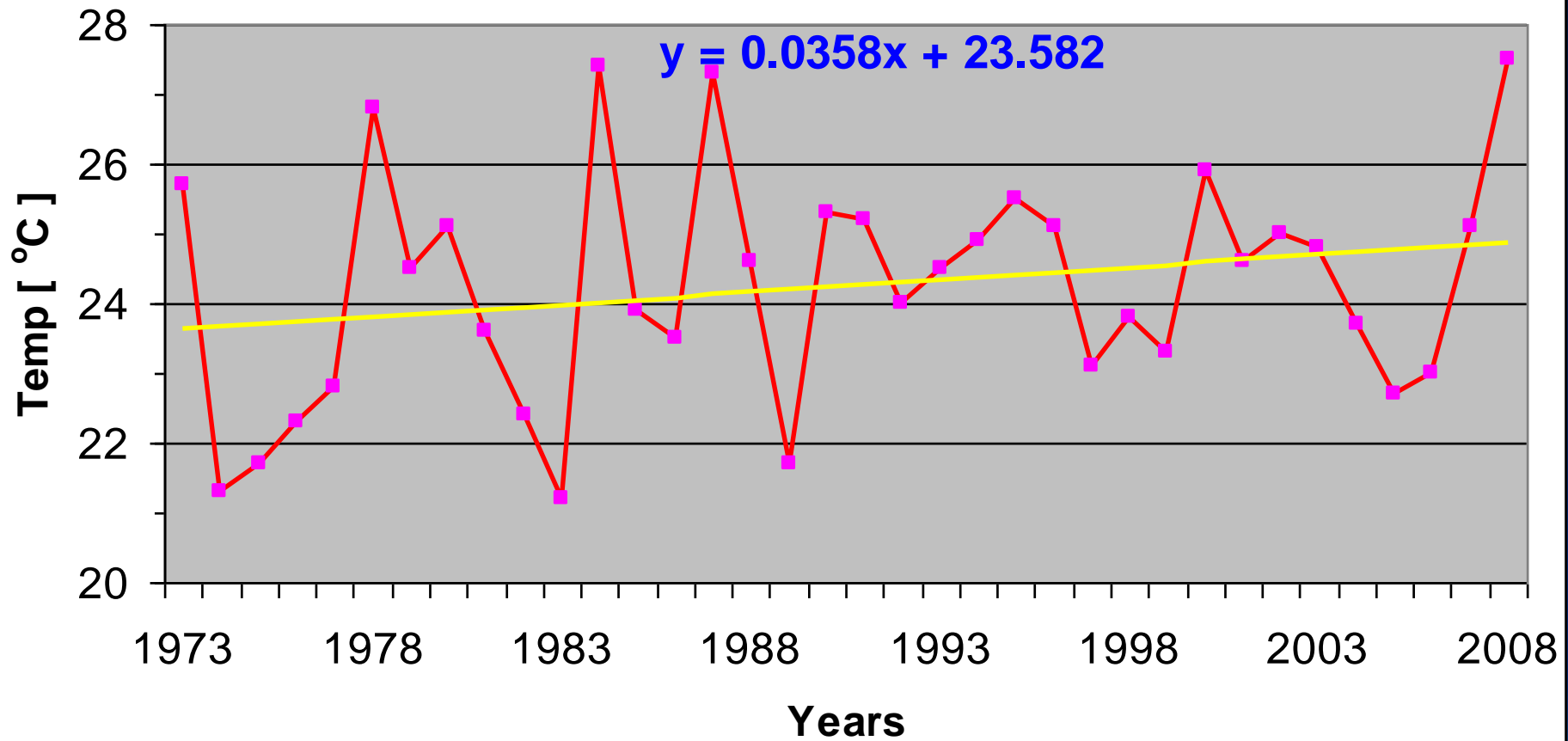


Mean Min Temp and Trend: JAN(1973-2008)



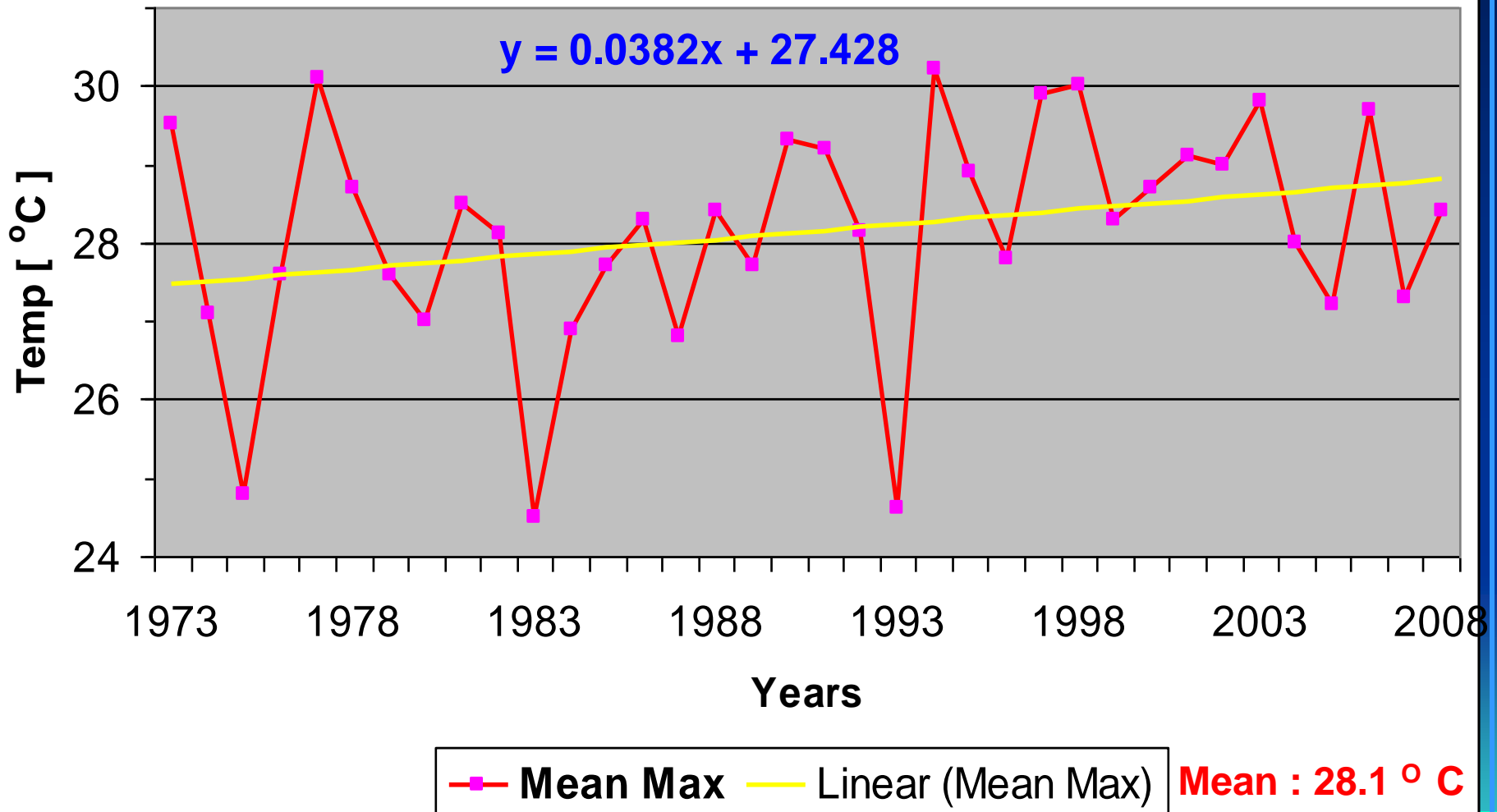
—■— Mean Min — Linear (Mean Min) **Mean : -14.2°C**

Summer:Mean Max Temp and Trend:JUN(1973-2008)

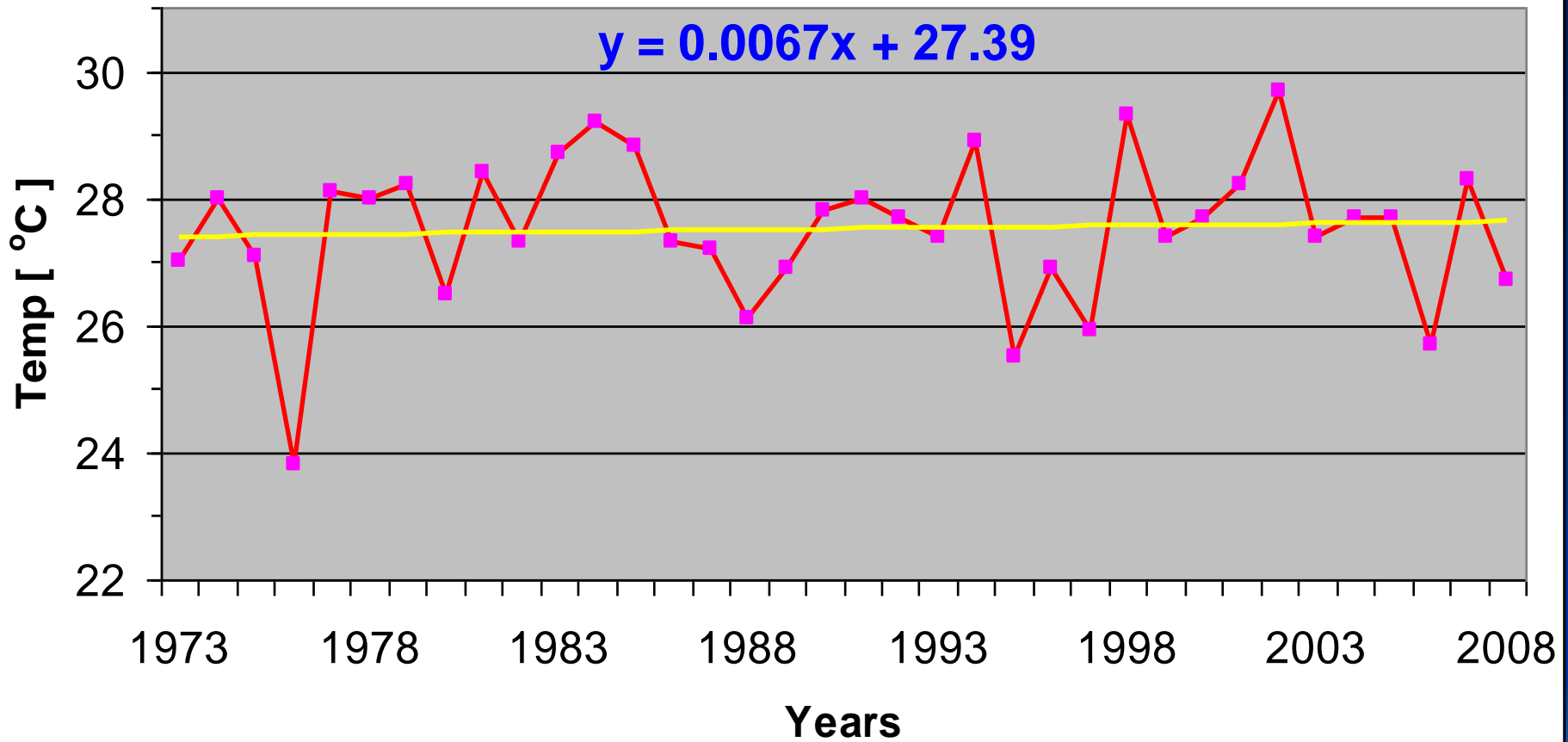


—■— **Mean Max** — **Linear (Mean Max)** **Mean : 24.0 ° C**

Mean Max Temp and Trend: JULY(1973-2008)



Mean Max Temp and Trend:AUG(1973-2008)



—■— Mean Max — Linear (Mean Max) **Mean : 27.7 ° C**

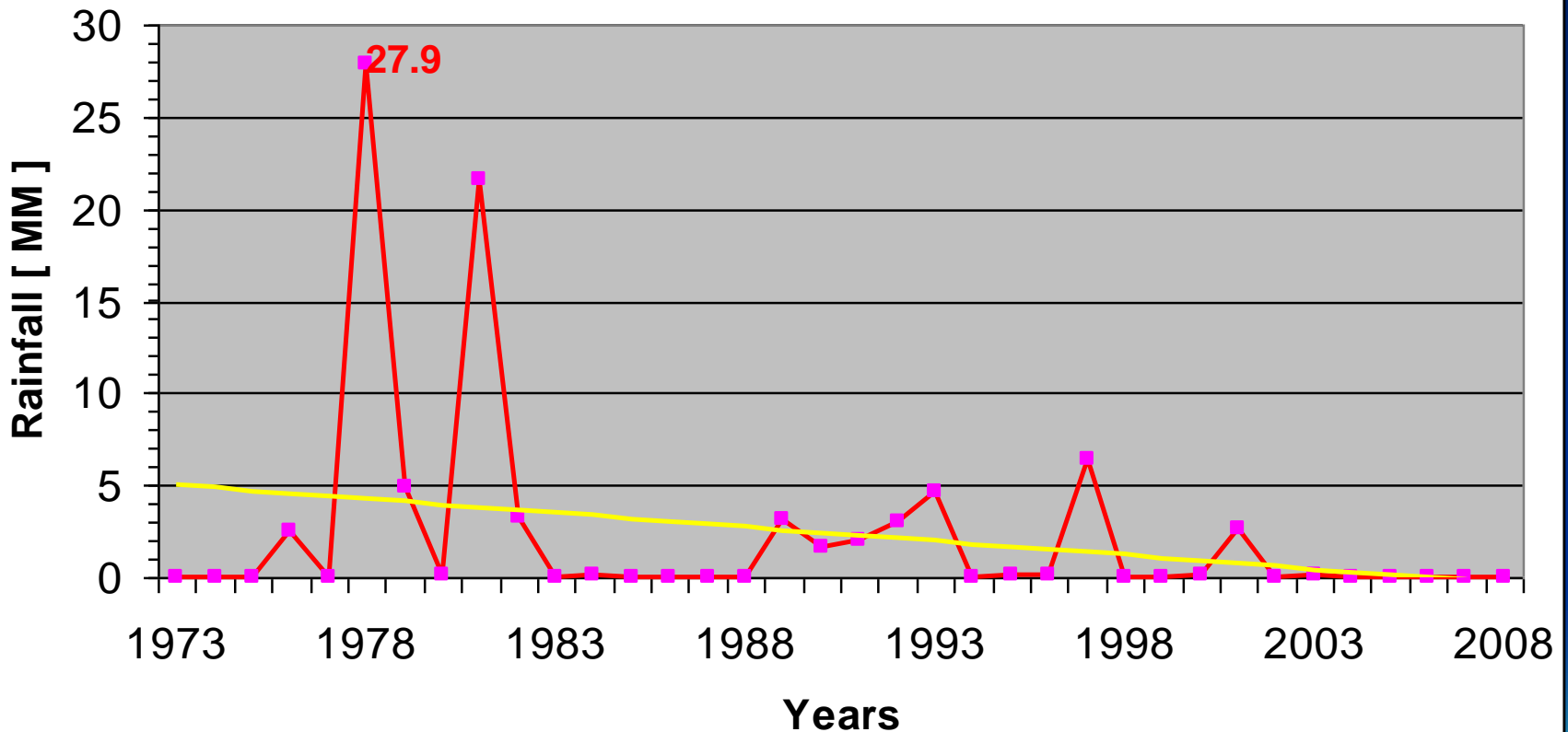
Inferences

- Trend analysis clearly indicates that there is rising trend of minimum temperature at Leh and the rise is of the order of nearly 1°C for all the winter months.
- The maximum temperature for summer months shows rising trend of nearly 0.5°C in last 35 years.
- Though, the rising trend is more sharp in min temp of winter months.



PRECIPITATION

Snowfall:NOV(1973-2008)

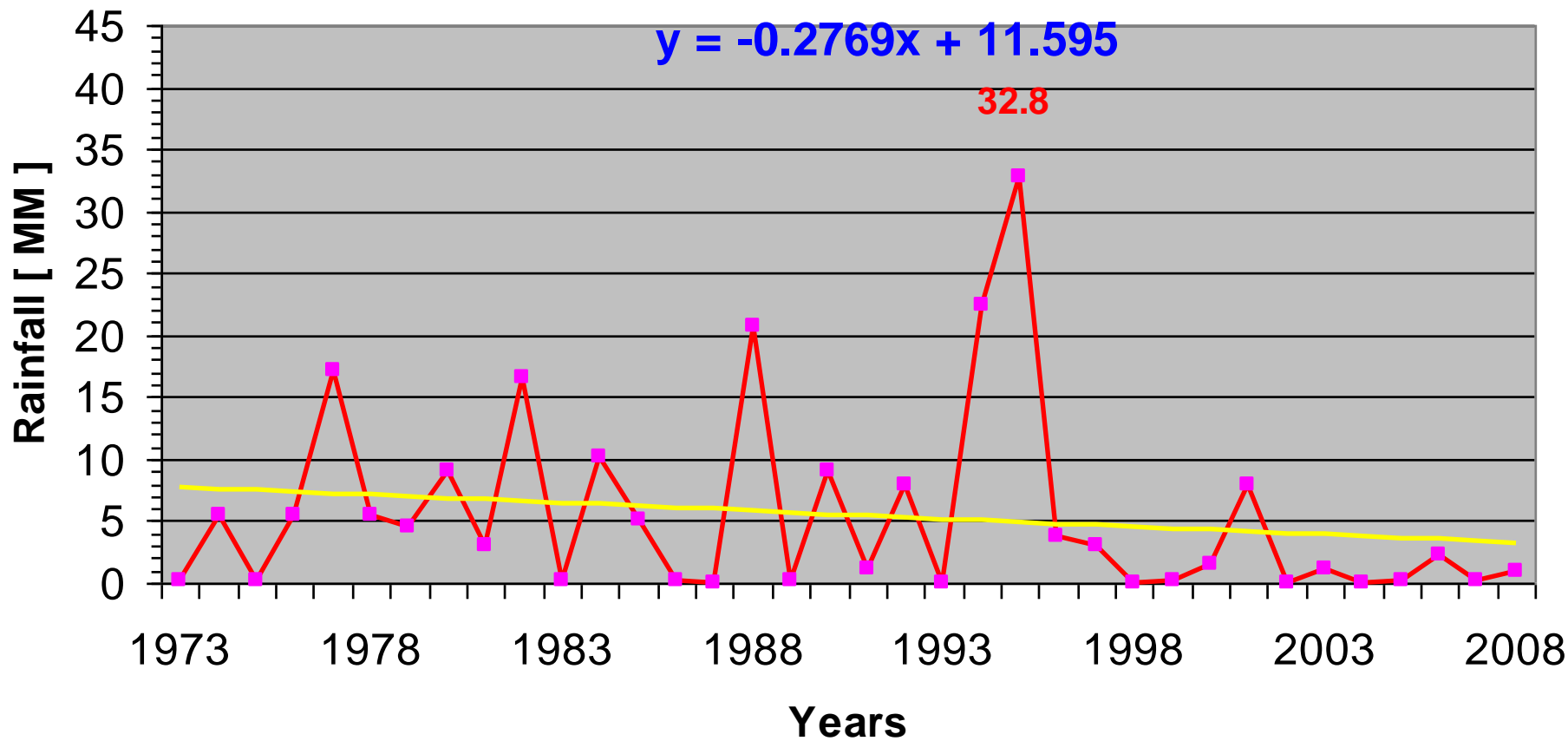


**Max Rainfall in 24 hrs :
21.1 MM (04 NOV 81)**

—■— Rainfall **— Linear (Rainfall)**

Mean : 2.5 MM

Snowfall Trend:DEC(1973-2008)

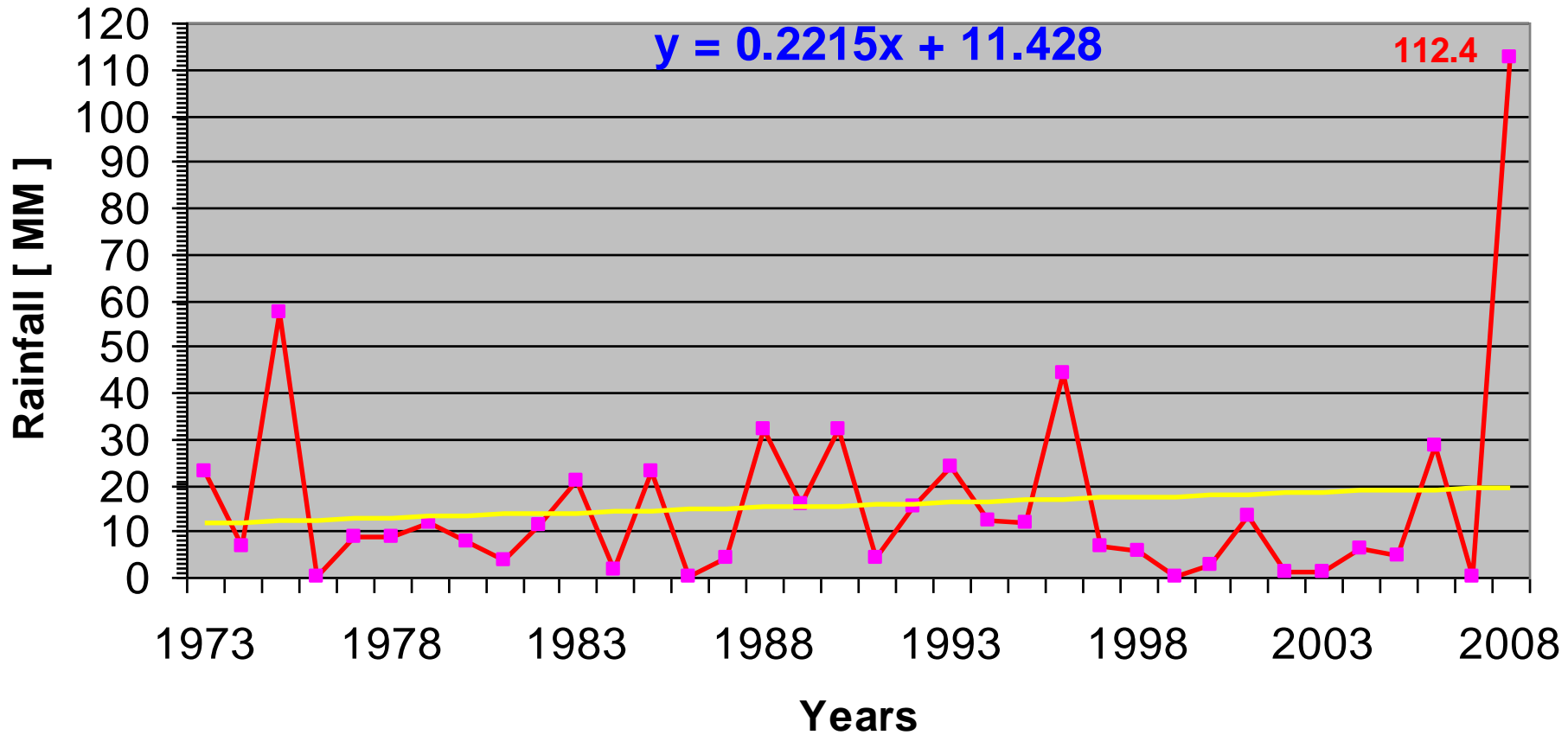


**Max Rainfall in 24 hrs :
21.1 MM (04 DEC 81)**

—■— Rainfall — Linear (Rainfall)

Mean : 5.4 MM

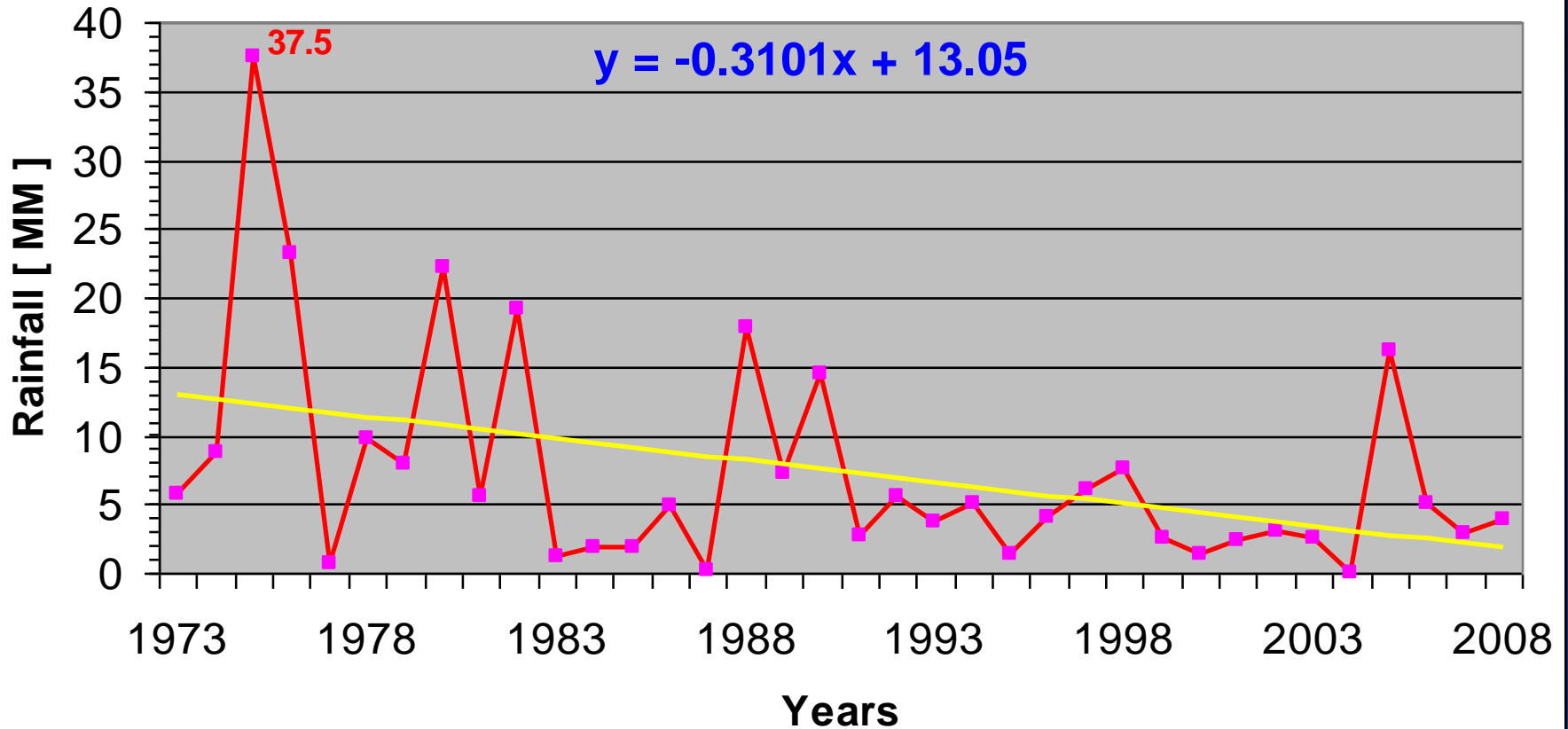
Snowfall Trend: JAN(1973-2008)



**Max Rainfall in 24 hrs :
100.2 MM (18 JAN 08)**

—■— Rainfall — Linear (Rainfall) Mean : 11.8 MM

Snowfall Trend: FEB(1973-2008)

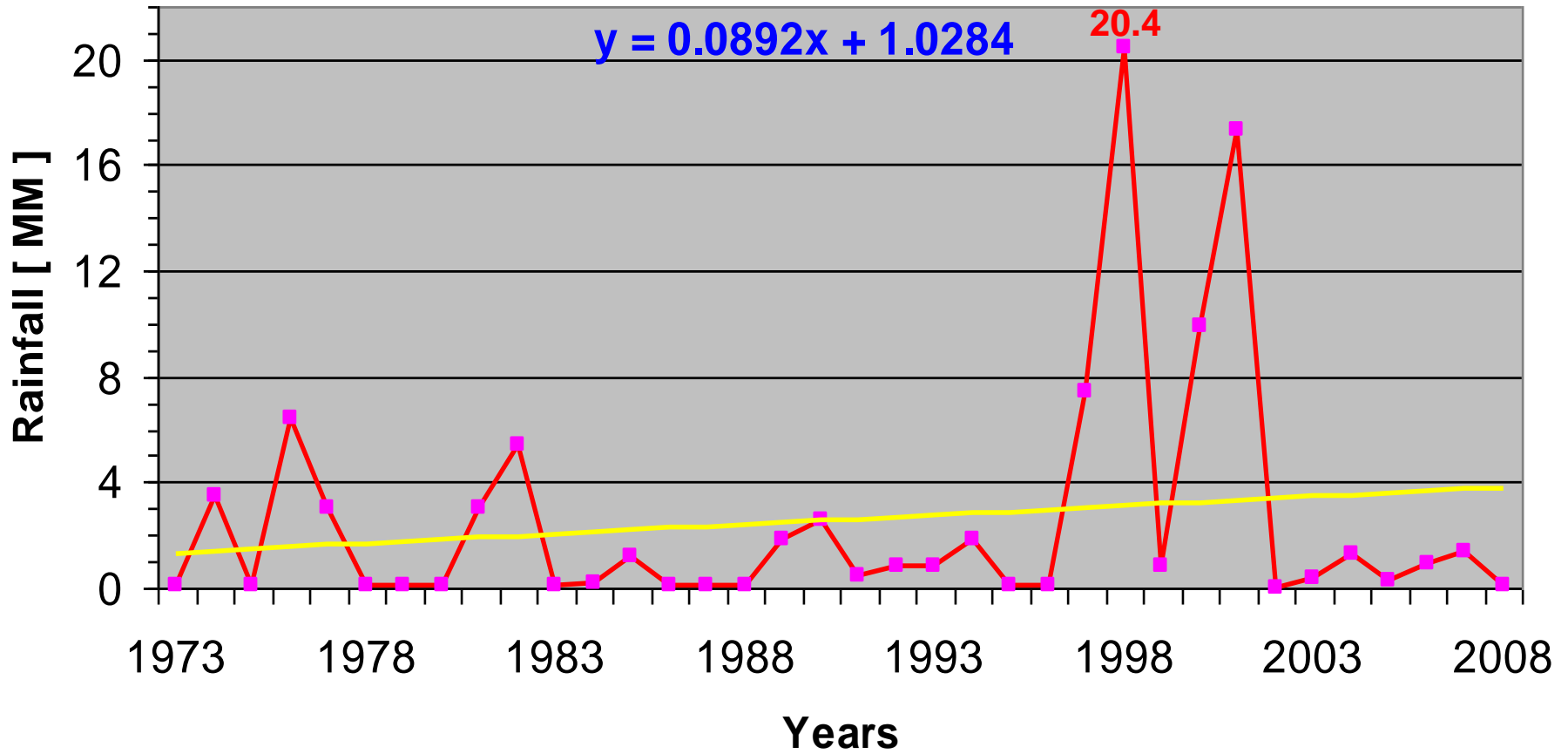


**Max Rainfall in 24 hrs :
19.4 MM (28 FEB 85)**

—■— Rainfall **— Linear (Rainfall)**

Mean : 7.9 MM

Rainfall and Trend: JUN(1973-2008)



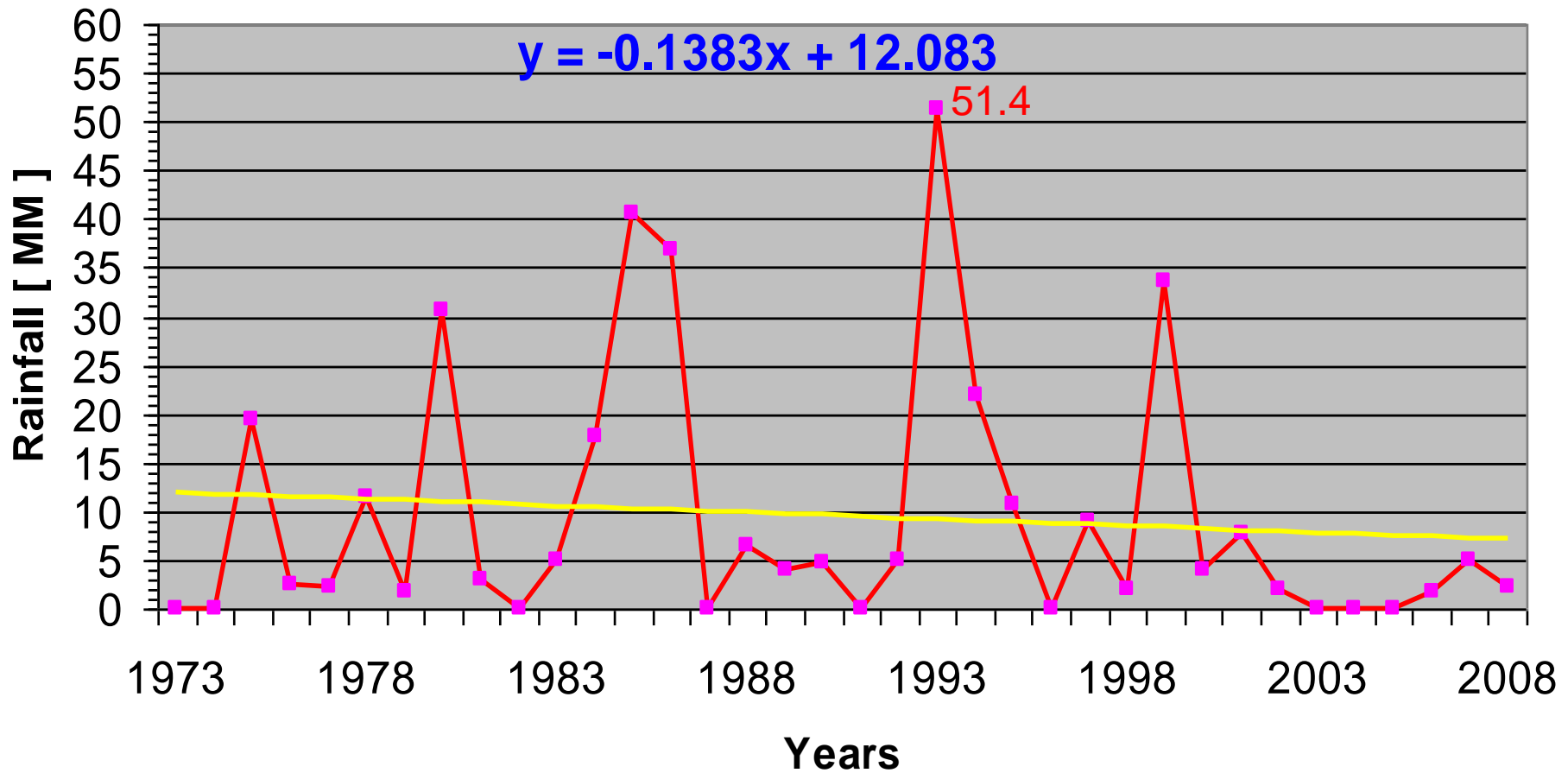
**Max Rainfall in 24 hrs :
12.8 MM (12 JUN 98)**

—■— Rainfall — Linear (Rainfall)

Mean : 2.6 MM



Rainfall and Trend: JULY(1973-2008)

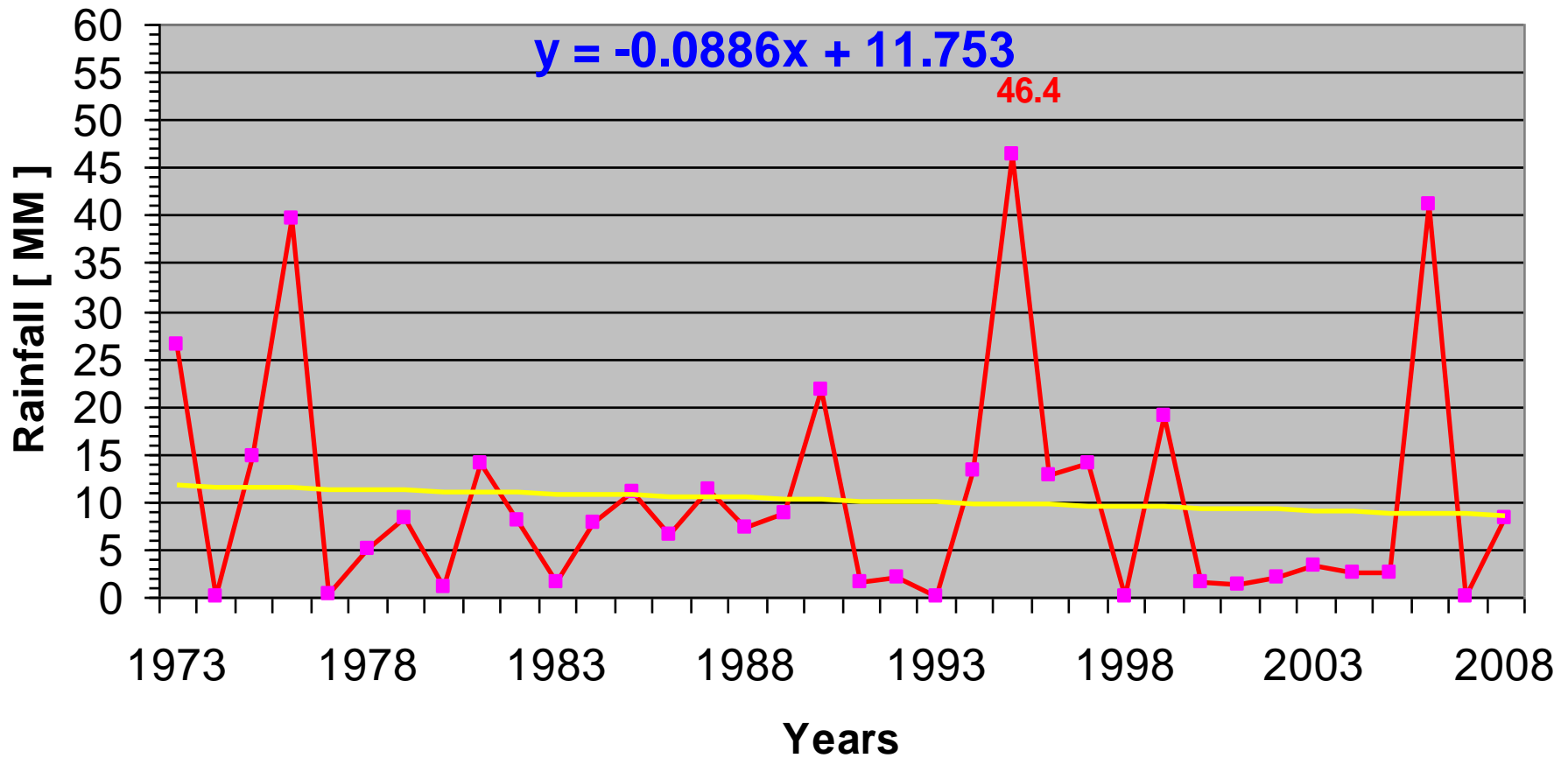


**Max Rainfall in 24 hrs :
12.8 MM (12 JULY 98)**

—■— Rainfall — Linear (Rainfall)

Mean : 10.2 MM

Rainfall and Trend:AUG(1973-2008)



**Max Rainfall in 24 hrs :
18.4 MM (1 AUG 99)**

—■— Rainfall — Linear (Rainfall)

Mean : 10.0 MM

Precipitation: Inferences

Trend analysis of precipitation suggests:

- **There is clear declining trend in precipitation amount from November to March (reduction in snow fall).**
- **This is the season for 70% occurrence of precipitation over Ladakh and mostly in the form of snow.**
- **January trend is rising due to one extreme event of snowfall during January 2008.**
- **During summer season, no significant change noticed in precipitation amount as it accounts for 30% of annual precipitation and in the form of rain.**



Impacts Interviews

The impact assessment study was carried out with village elder men and experts from the field of agriculture, horticulture etc. in the form of informal interviews.



Perceived impacts in Leh district

Bio indicators of Climate change

- Glacier retreat in almost every part like Khardong-la, Stok Kangri, etc.
- Presence of pests (coddling moth) on apple & apricots in almost every part of Ladakh which earlier was found only on Apple and lower villages like Dha-Hanu.
- Agricultural fields in many villages (Tagmachik, Alchi, Gia) have been left fallow due to unavailability of irrigation water.
- Increased incidence of floods in 2004, 2005 in Leh
- Shift in apple belt from lower Sham(9000 ft.) to Rong area(12,000 ft).
- Change in flowering of apricots and apples . (earlier end April: now mid April)
- Change in Harvest season (earlier : Oct 1-2week Now: sept 4th week)







Baseline survey

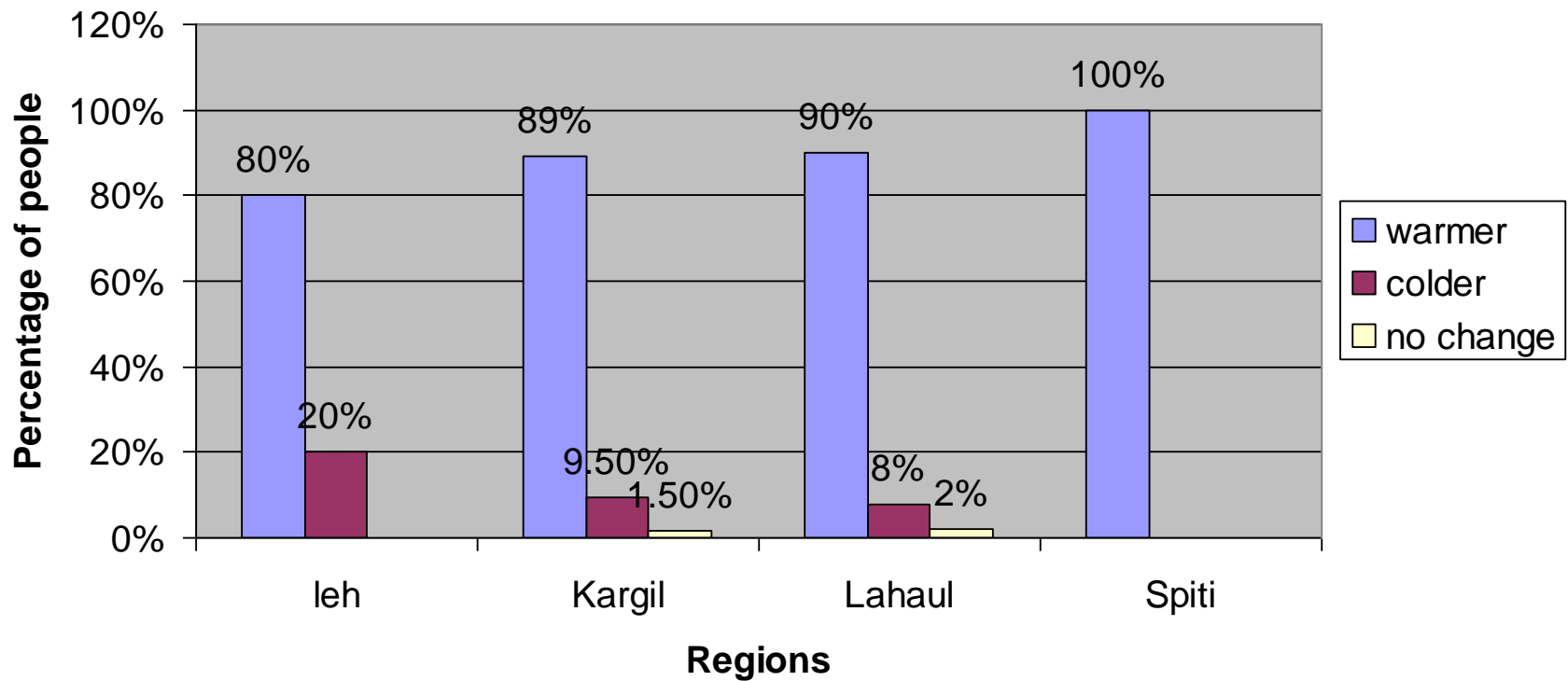
An awareness baseline survey regarding climatic changes was conducted in:

- 20 villages in four regions (Leh, Kargil)
- Total 150 people above 35 years have been interviewed.

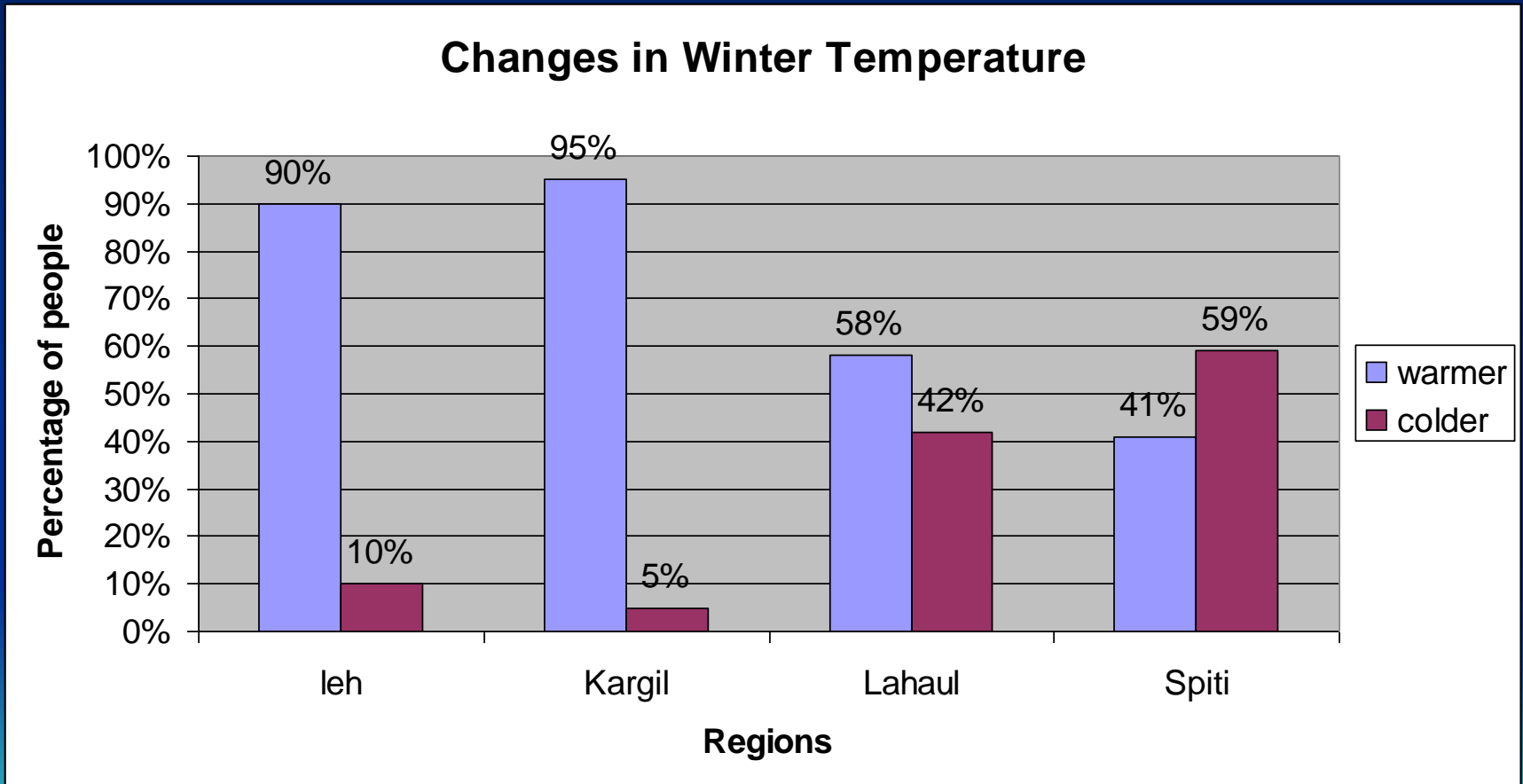


Findings of Baseline Survey

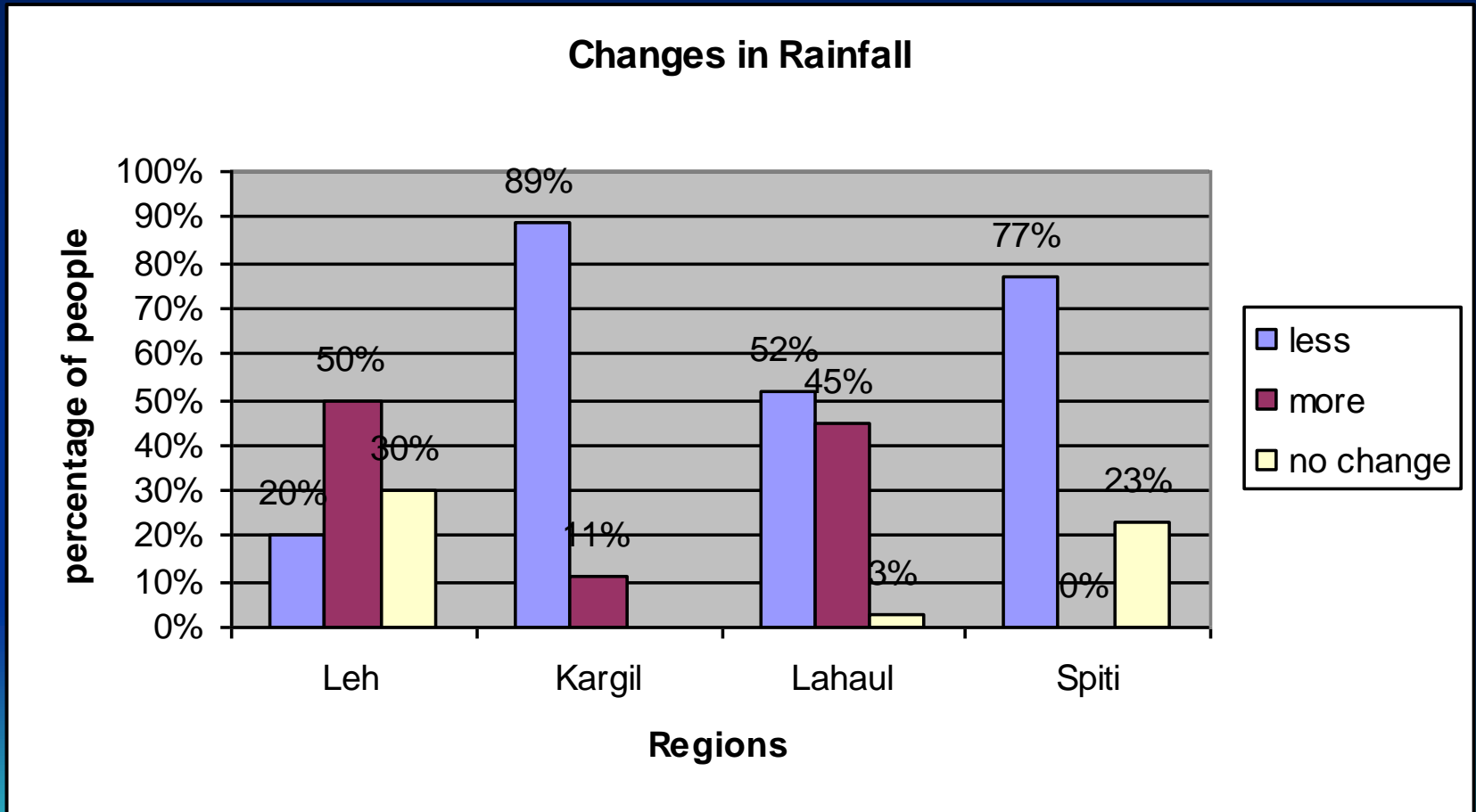
Changes in summer Temp



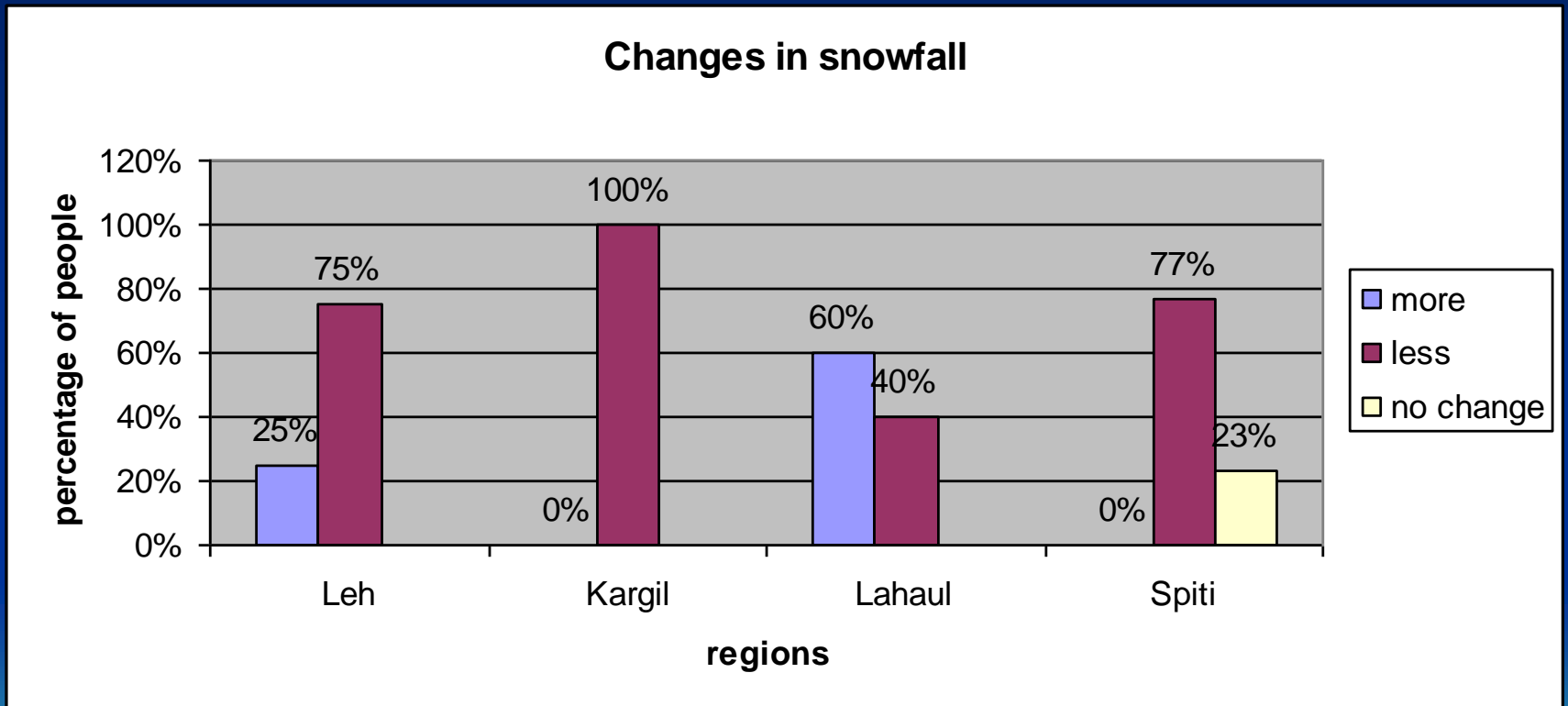
Changes in winter temperature



Changes in Rainfall



Changes in snowfall



Conclusions

- This study was a joint, preliminary effort of Local NGOs (LNP, LEDEG, LEHO, ECOSPHERE) with GERES to get a clear understanding rather than an in depth scientific study
- Decrease in precipitation has a greater impact than the increase in temperature
- A couple of villages have already been relocated and land in various villages left barren
- The mountain population are clearly being impacted





THANK YOU

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