Disaster Prevention Monitoring in a Vulnerable Environment

Mahabir Pun

Nepal Wireless Project

Nepal Research & Education Network

14 April 2008, Japan

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My Involvement

- Chairman, the Institute for Himalayan Conservation – Nepal since 2000
- Team Leader – Nepal Wireless Networking Project since 2002
- Vice Chairman – Nepal Research and Education Network since 2006

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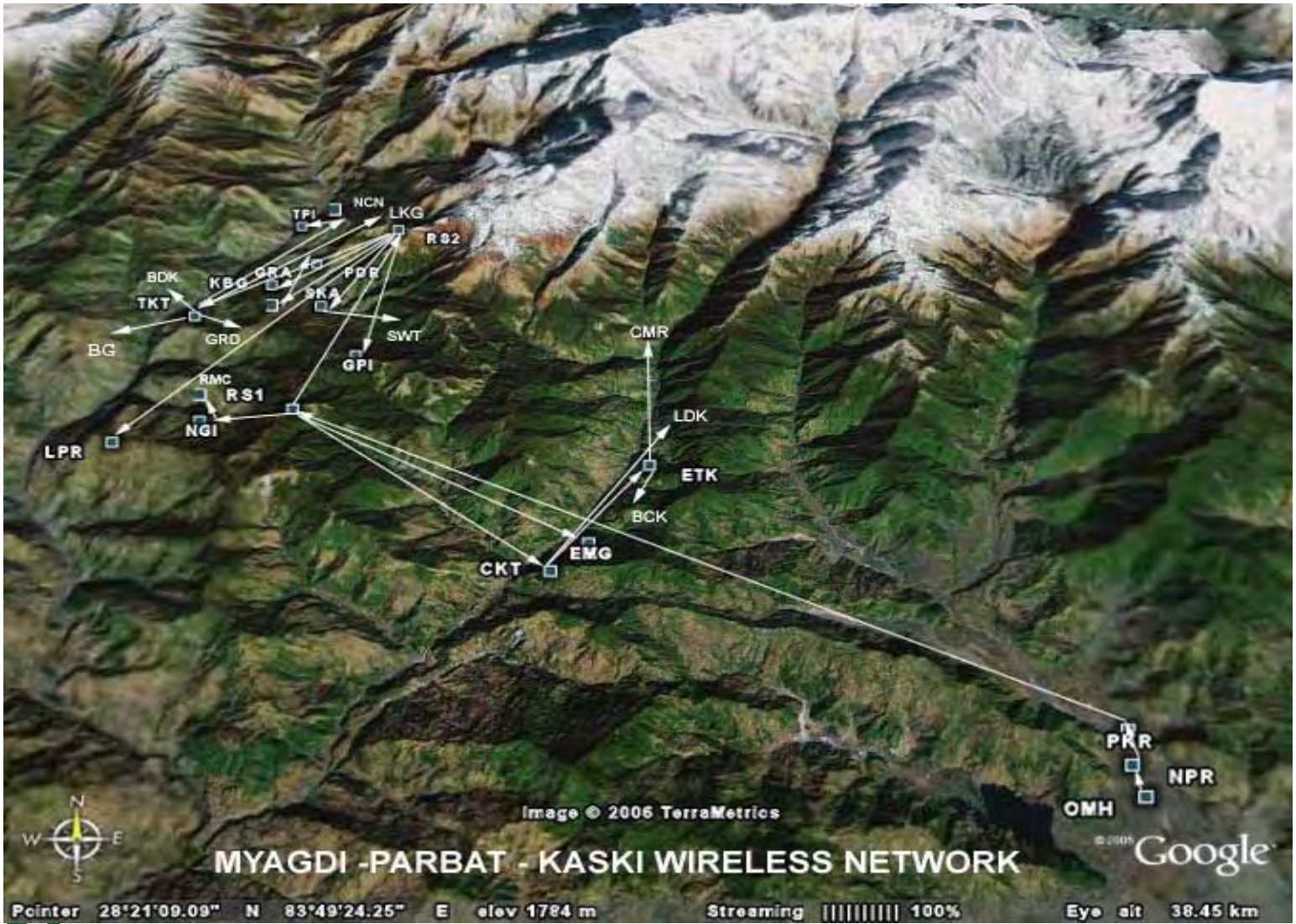
Dolkha Hospital
Charikot Relay
Bagmati
Aahal Danda Relay
Nagarkot Relay
Kathmandu
Kathmandu M. Hospital
Bhaktapur
Jawalakhel
Mahadev Danda
Guranse Relay
Manakamana Relay
Hetaunda DDC
Phaparbari
Bhirkot
Hattisunde
Chisapani
Chhatiwan
Rai Gaun
Image © 2007 TerraMetrics
© 2007 Europa Technologies
Narayani
Google
Pointer 27°33'38.23" N 85°29'20.53" E elev 4941 ft Streaming 100%
Eye alt 61.18 mi



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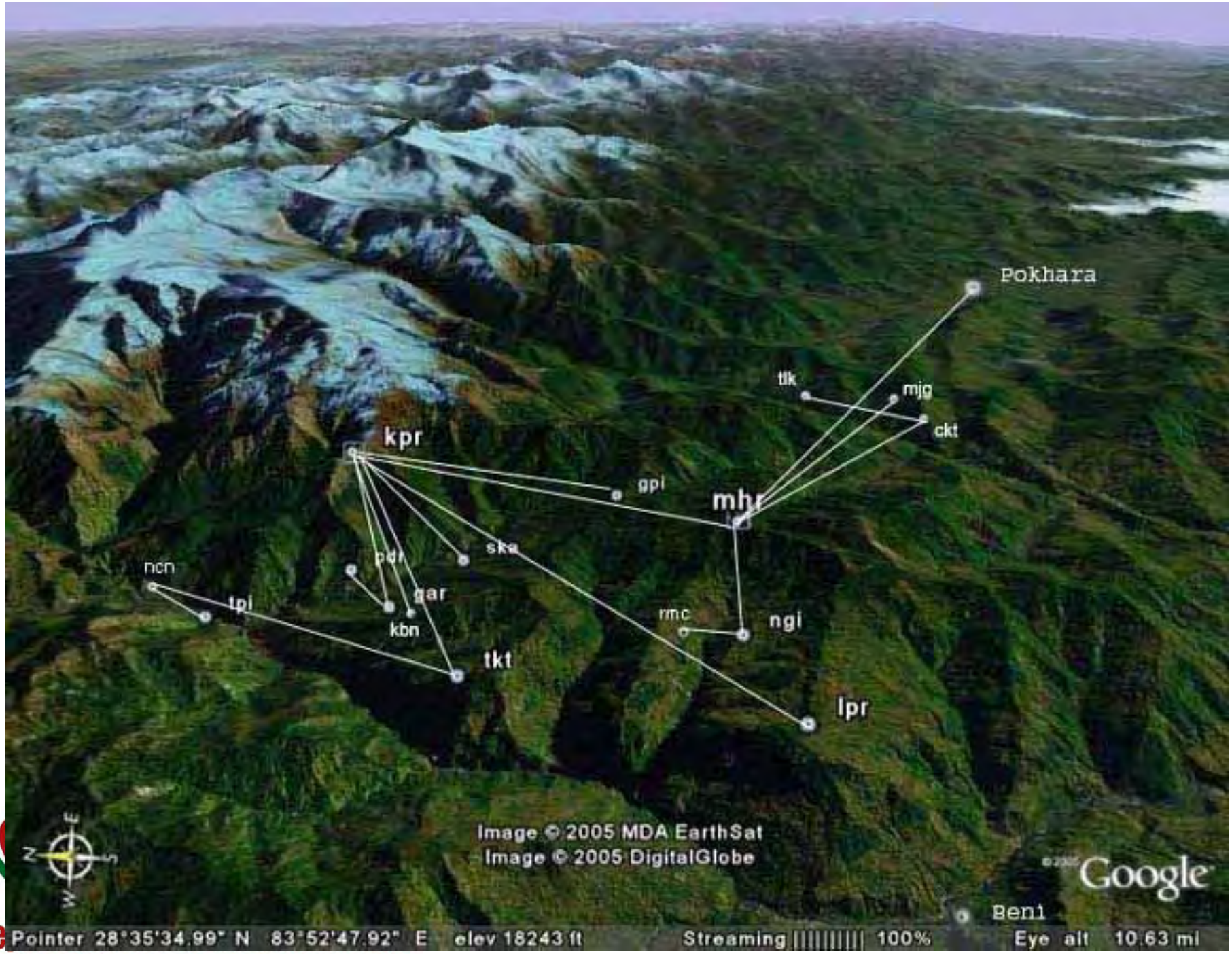
Pokhara
tlk
mjg
ckt
kpr
gpi
mhr
ska
pdr
ncn
gar
tpi
kbn
rmc
ngi
tkt
lpr
Image © 2005 MDA EarthSat
Image © 2005 DigitalGlobe
Google
Beni
Pointer 28°35'34.99" N 83°52'47.92" E elev 18243 ft
Streaming 100%
Eye alt 10.63 mi

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TOTAL

Relay Station 1 Receiver at 3,220m

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Impact of Climate Change in the Himalayas

- **Rate of increase of warming by 0.15 ° C to 0.6 ° C per decade**
- **Rate of glaciers shrinking is higher in recent decades**
- **The numbers of Glacial lakes are increasing**
- **Glacial lakes Outburst Floods (GLOFs)**

Nepal Context

- 8 out of 10 highest Mountains in the world
- Total Glaciers - 3252 covering 5223 sq. km in Nepal
- 2323 glacial lakes in Nepal

(Source: ICIMOD and UNEP)

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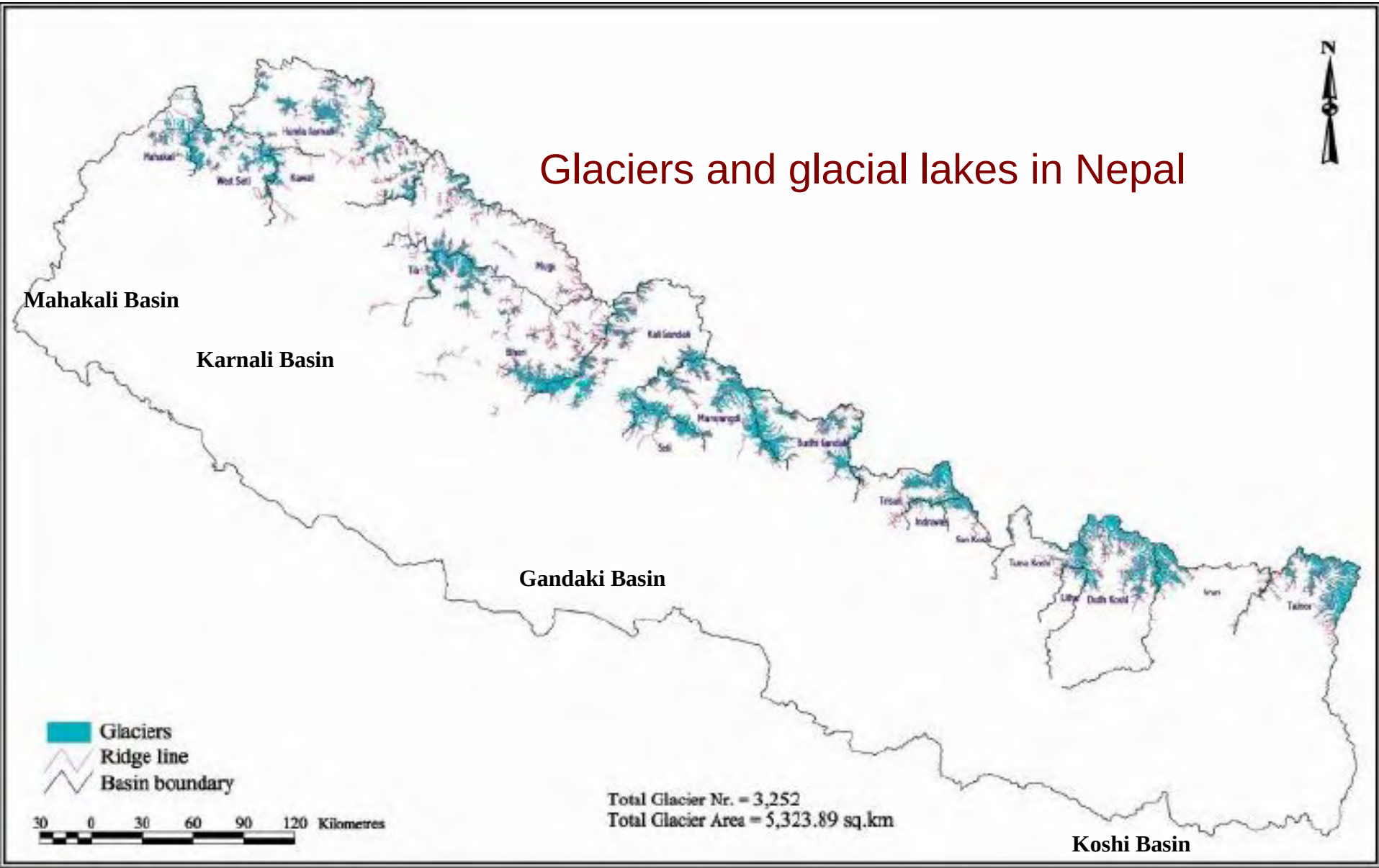
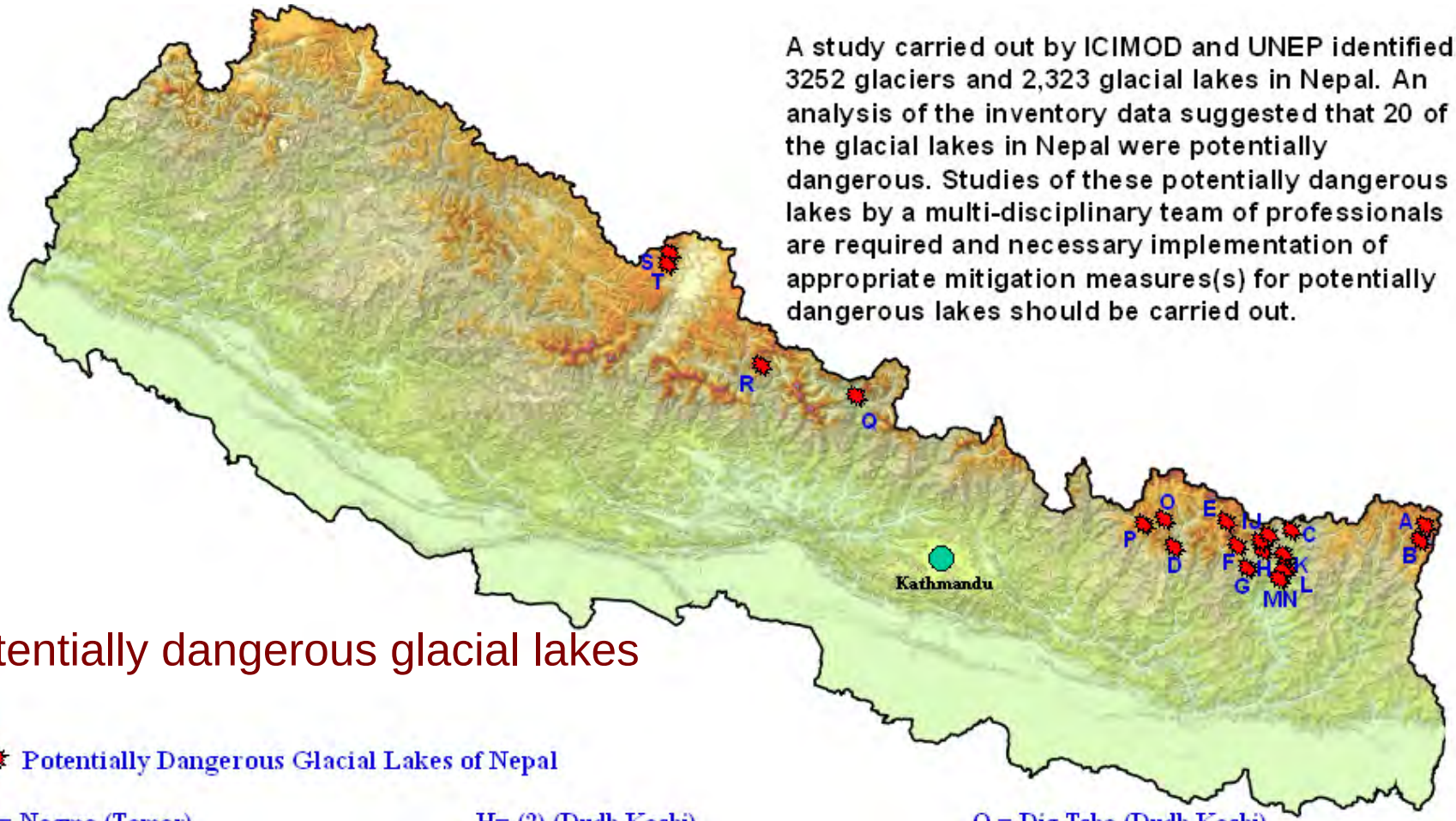

Glaciers and glacial lakes in Nepal
N
Mahakali Basin
Karnali Basin
Gandaki Basin
Koshi Basin
Glaciers
Ridge line
Basin boundary
30 0 30 60 90 120 Kilometres
Total Glacier Nr. = 3,252
Total Glacier Area = 5,323.89 sq.km

A study carried out by ICIMOD and UNEP identified 3252 glaciers and 2,323 glacial lakes in Nepal. An analysis of the inventory data suggested that 20 of the glacial lakes in Nepal were potentially dangerous. Studies of these potentially dangerous lakes by a multi-disciplinary team of professionals are required and necessary implementation of appropriate mitigation measures(s) for potentially dangerous lakes should be carried out.



Potentially dangerous glacial lakes

Potentially Dangerous Glacial Lakes of Nepal

A= Nagma (Tamor)
B= (?) (Tamor)
C= Lower Barun (Arun)
D= Lunding (Dudh Koshi)
E= Imja (Dudh Koshi)
F= Tam Pokhari (Dudh Koshi)
G= Dudh Pokhari (Dudh Koshi)
H= (?) (Dudh Koshi)
I= (?) (Dudh Koshi)
J= Hungu (Dudh Koshi)
K= East Hungu 1 (Dudh Koshi)
L= East Hungu 2 (Dudh Koshi)
M= (?) (Dudh Koshi)
N= West Chamjang (Dudh Koshi)
O = Dig Tsho (Dudh Koshi)
P= Tsho Rolpa (Tama Koshi)
Q= (?) (Budhi Gandaki)
R= Thulagi (Marsyangdi)
S= (?) (Kali Gandaki)
T= (?) (Kali Gandaki)

? No name

Source: Hiromichi FUKUI, Faculty of Policy Management, Global Security Research Center, Keio University

GLACIAL LAKE OUTBRUST FLOOD

- The highest risk from climate change is the increasing risk of Glacial Lake Outburst Flood
  - Impacts UPON mountain eco-system
  - Displaces downstream villages
  - Further south, huge damage to corps and other livelihoods
- There are many new glacial lakes being formed in the high Himalayas
  - *20 potential GLOF in Nepal*

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GLOF Risks in the Himalayas

- Extensive Study only done in Dudhkoshi Basin by *Samjwal et al* (ICIMOD)
  - Big Damage due to Dig Tso burst in 1985
  - Preventive work done in only in Tso Rolpa
  - Current Research work between NREN, ICIMOD, DNPW, Keio University, NARO and APAN-JP on Imja-Tse in Khumbu
  - This week there is expedition in Everest region already.

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Objectives

- To demonstrate the real time monitoring of Imja glacial lake as a pilot study for potential Glacial Lake Outburst Flood hazard
- To provide early warning to save mountain communities, infrastructure and environment
- To build local area Wireless network (wifi) between the villages and connect with VSAT terminal to provide Internet connectivity and access for the local community

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Imja Glacier Retreat and Growing Lake

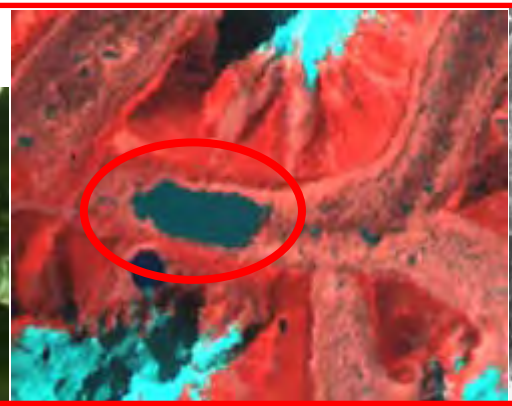
Source: Hiromichi FUKUI, Faculty of Policy Management,
Global Security Research Center, Keio University

•CORONA

15 DEC 1962

•SPACE SHUTTLE

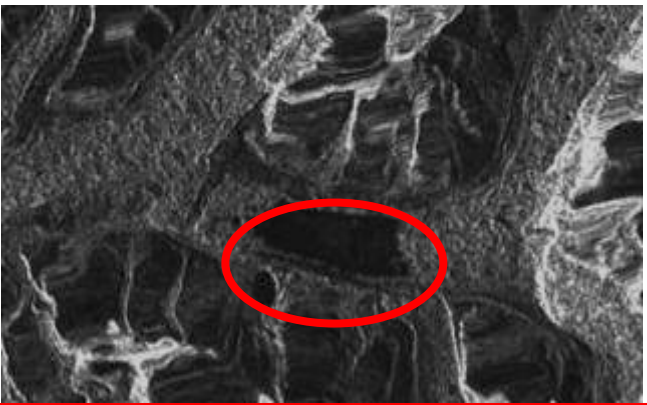
DEC 1983



•LANDSAT
TM 1992

•IRS ID PAN 19

MAR 2001



•ENVISAT, ASAR, 18 October 2007

•Quickbird Jan 2006

•IRS LISS3
2005

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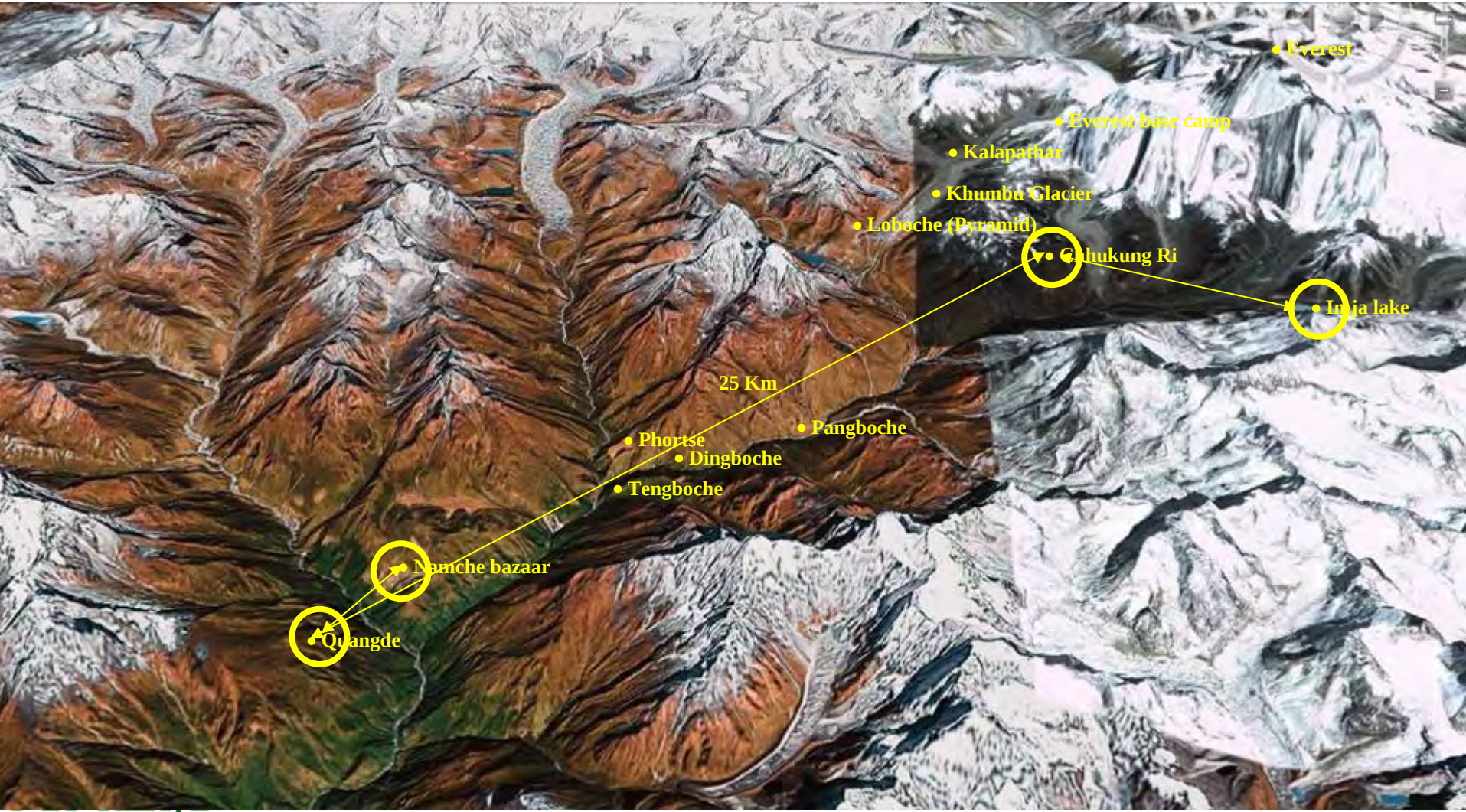
Networking of field sensor and transmission station in Mt. Everest region for the real time monitoring of Lake Imja Tsho



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Imja Lake at 5,110 m


Wireless Relay at Chhukung
with Prof. Hiramichi Fukui

Pictures of field server deployment

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Real Time Image of Imja Lake (2007/11/13, 12:54 PM)

Regular Monitoring, Early Warning and Mitigation Measures

- Simulation of GLOF
- Vulnerability and risk assessment
- (Near) Real time monitoring
- Networking of field sensor and transmission station
- Wireless Sensor Network

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Lessons Learned

- ICT technologies can help in monitoring and documenting changes.
  - Will also help in taking preventive measures.
- ICT can also increase the awareness in local communities about potential hazards
- A public private partnership between local communities, government, service providers and scientific researchers can only get the work done

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Technology Lessons Learned

- Wireless Network can be made to work in remotest areas
- Low power self sufficient devices embedded with appropriate sensors are needed to avoid big impact on fragile ecosystem
- Power storing technology still needs more work for remote and cold areas.

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Next Steps

- Enhanced observation, monitoring
- Promote exchange of data and information
- Enhance cooperative studies among other area
- Promote capacity building
- Considering systematic way for mitigation and adaptation

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Our Bigger Plan

- Deploy more wireless enabled field stations
  - Weather stations, sensor network, field servers
- Build a network from Khumbu region to Dhaulagiri /Annapurna region to monitor changes happening between the six 8000m+ and several 7000m+ mountains in the region.

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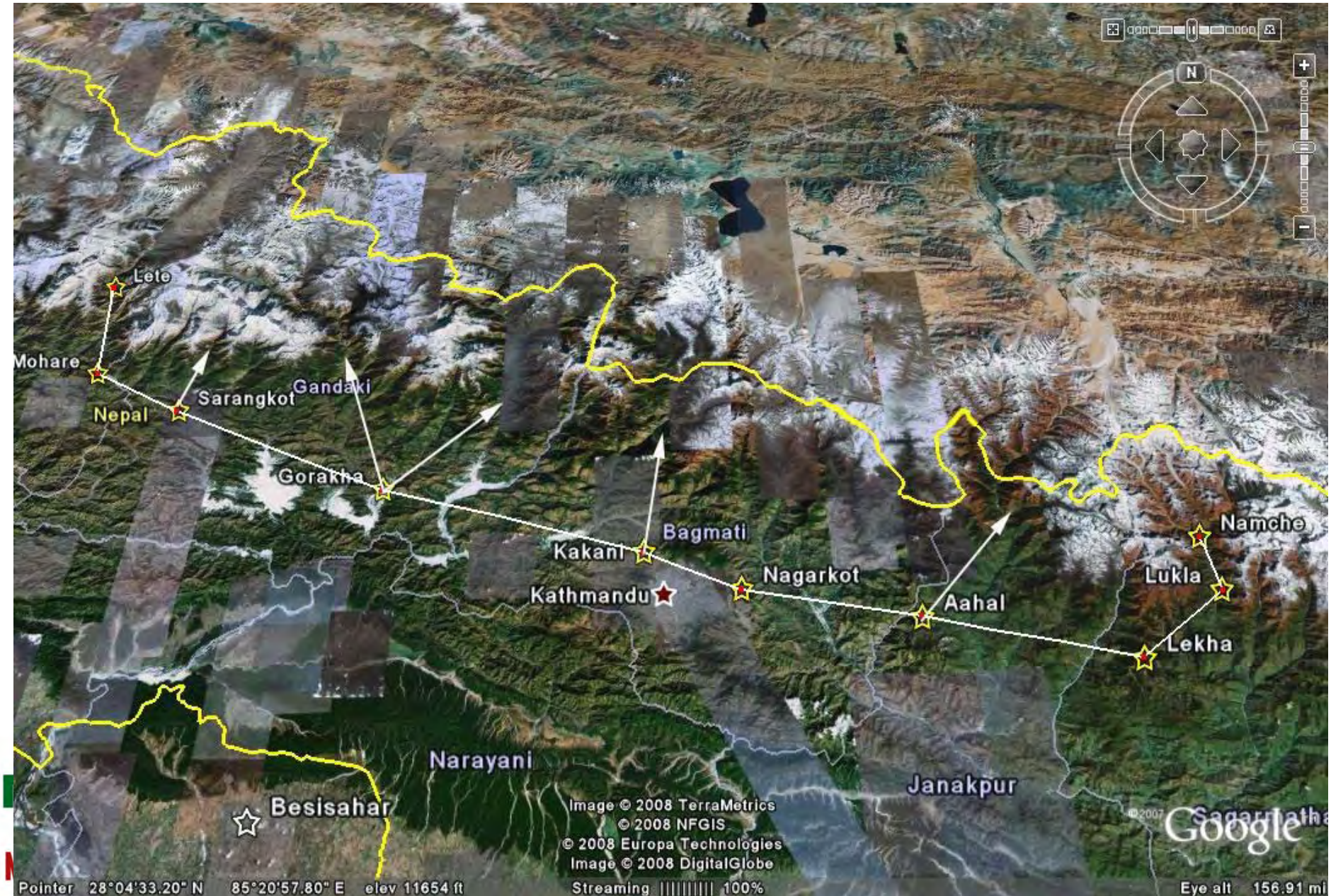
Mount Everest to Dhaulagiri ~ 370 KM



Invite all interested parties

- NREN, NWP and partners in Nepal welcome other participants who have stake in these activities.
- Imja FS website :
  - http://de04.gsec.keio.ac.jp:9080/glacier/sensordata.html
- Eco-Everest Expedition
  - www.ecoeverest.net.np

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PHILOSOPHICAL SOLUTION TO REDUCE THE CLIMATE CHANGE

WE MUST REDUCE HUMAN GREED IN ORDER TO REDUCE THE EMISSION OF CARBON DIOXIDE

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Thank you

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- Mahabir@himanchal.org

www.nepalwireless.net

www.nren.net.np

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