



中国科学院地理科学与资源研究所
Institute of Geographic Sciences and
Natural Resources Research, CAS

River morphology evolution driven by mass movements in tectonic active regions

— A negative feedback response of transient landscape

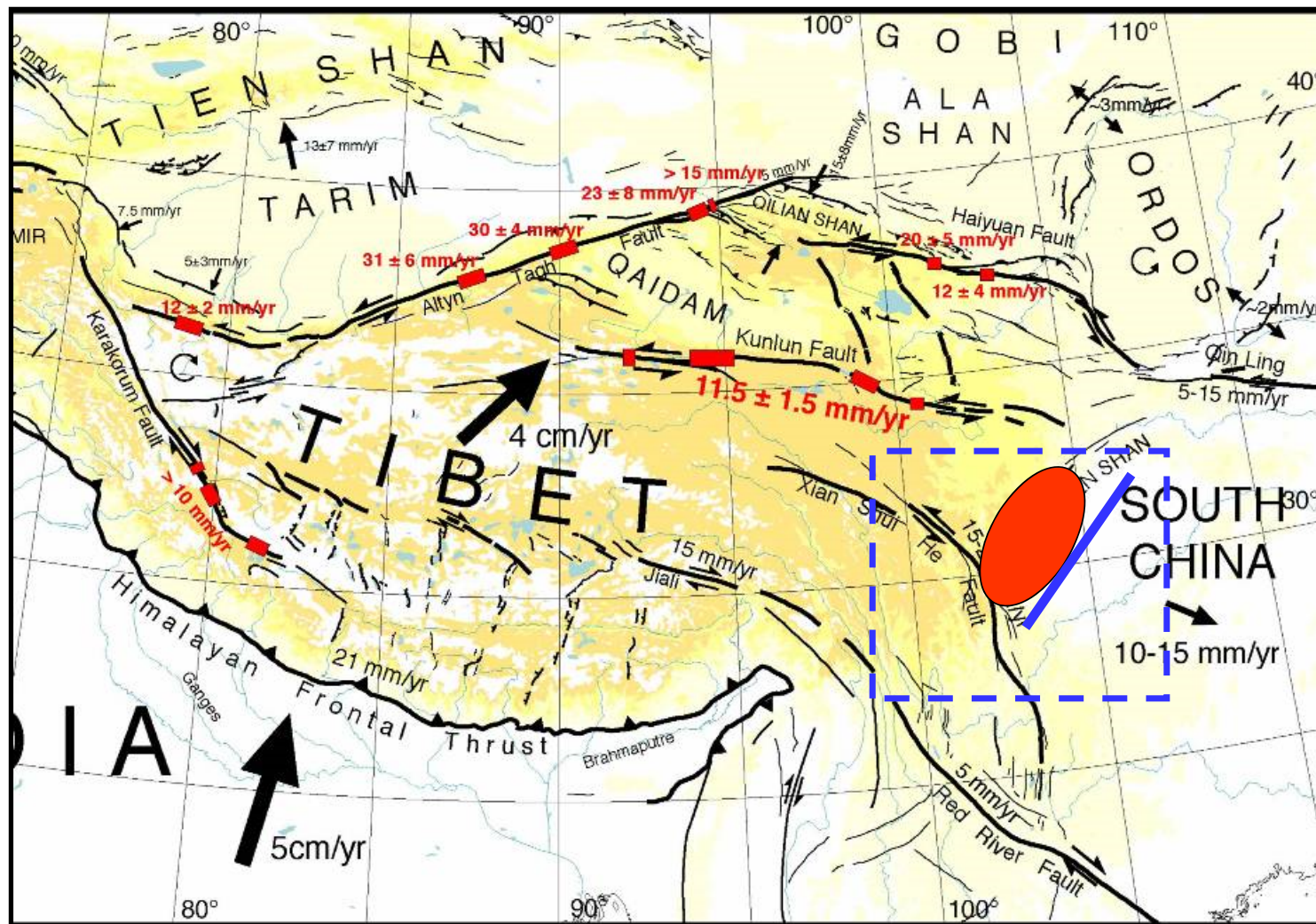
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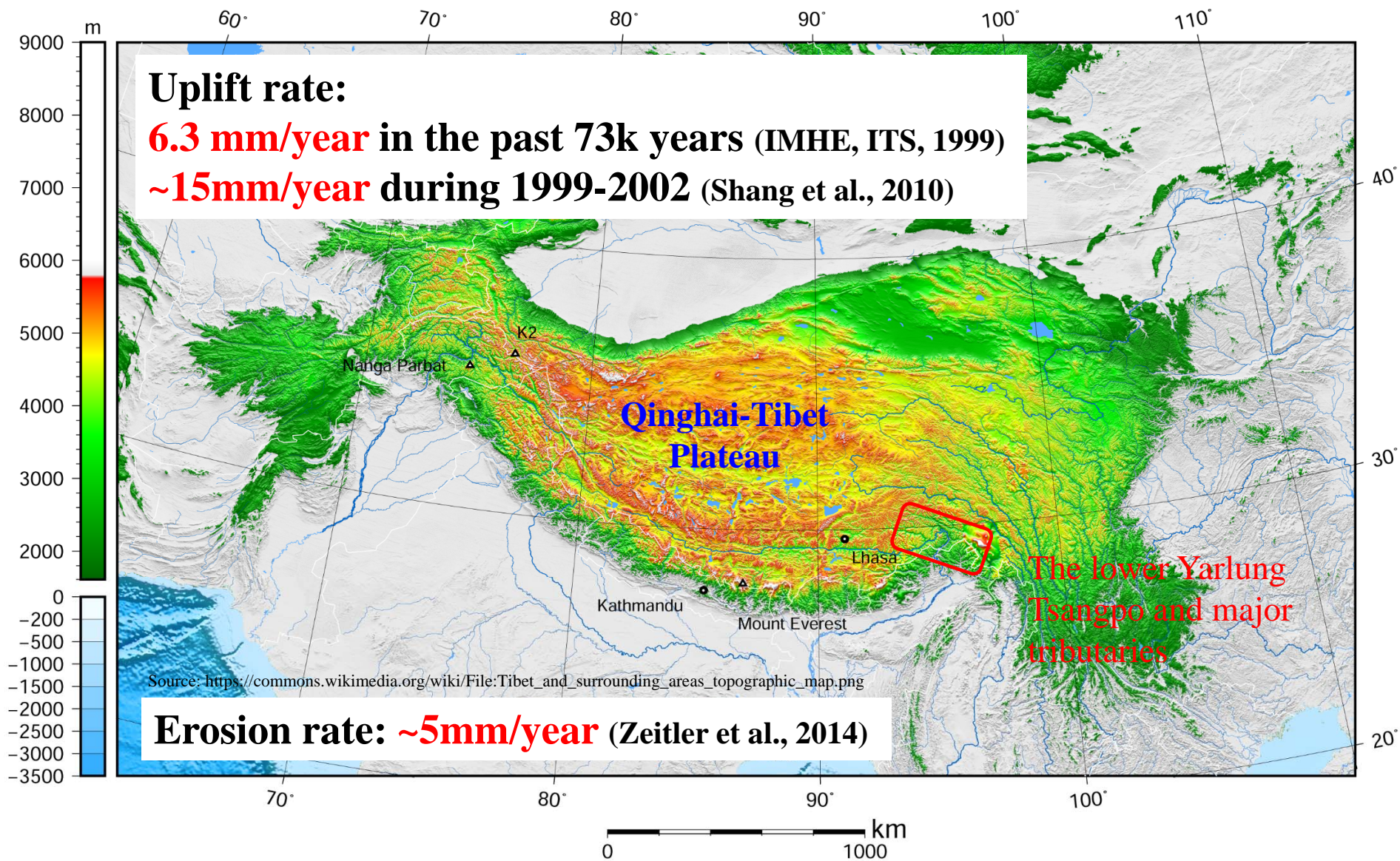
Outline

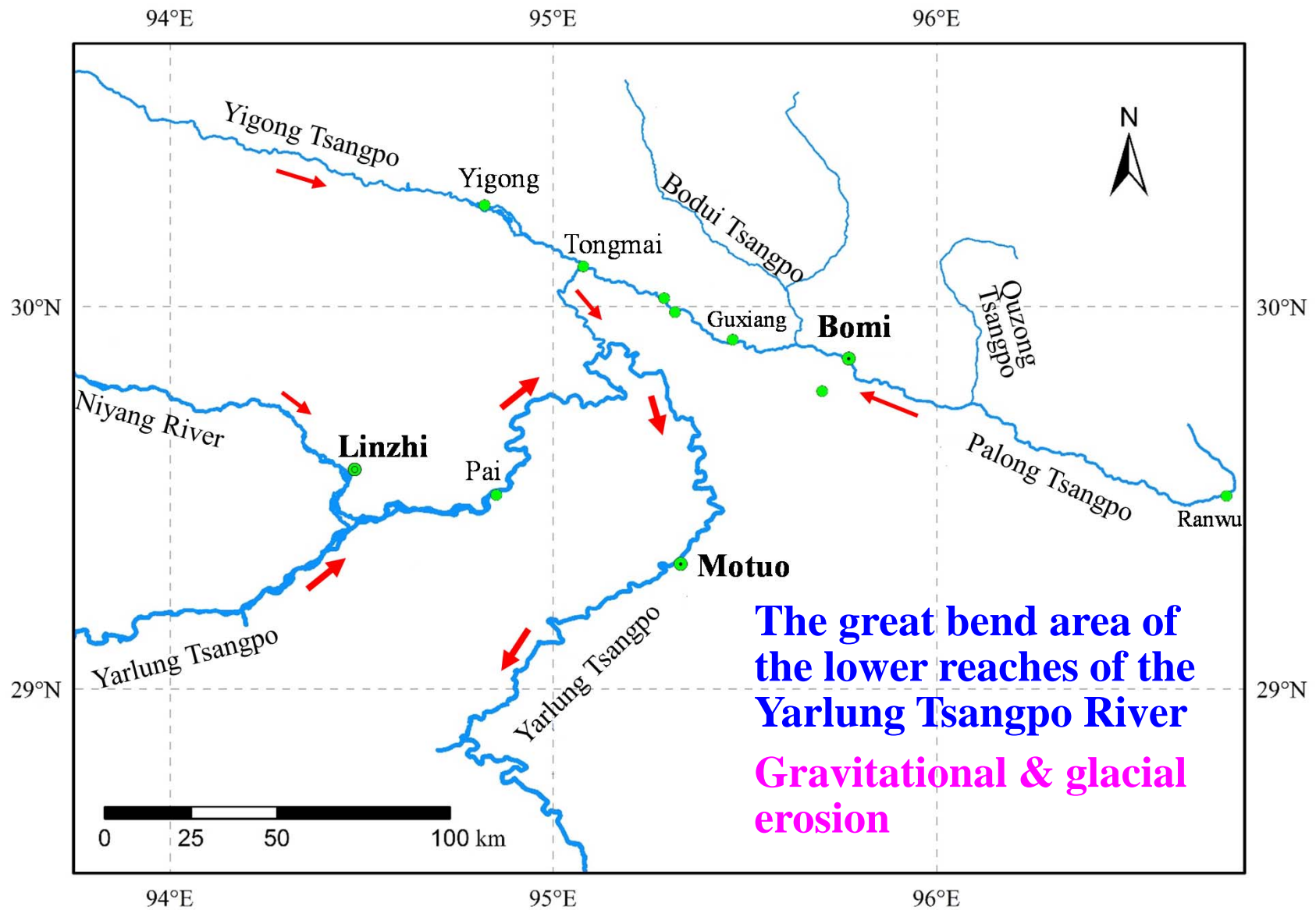
- **Active tectonic motion and macro relief in southeast Tibet**
- **Mass movements and fluvial processes**
(Cases of Yarlu Tsangpo Grand Canyon and Palong Tsangpo River)
- **Discussion: negative feedback of valley morphology to mass movements in tectonic active regions**

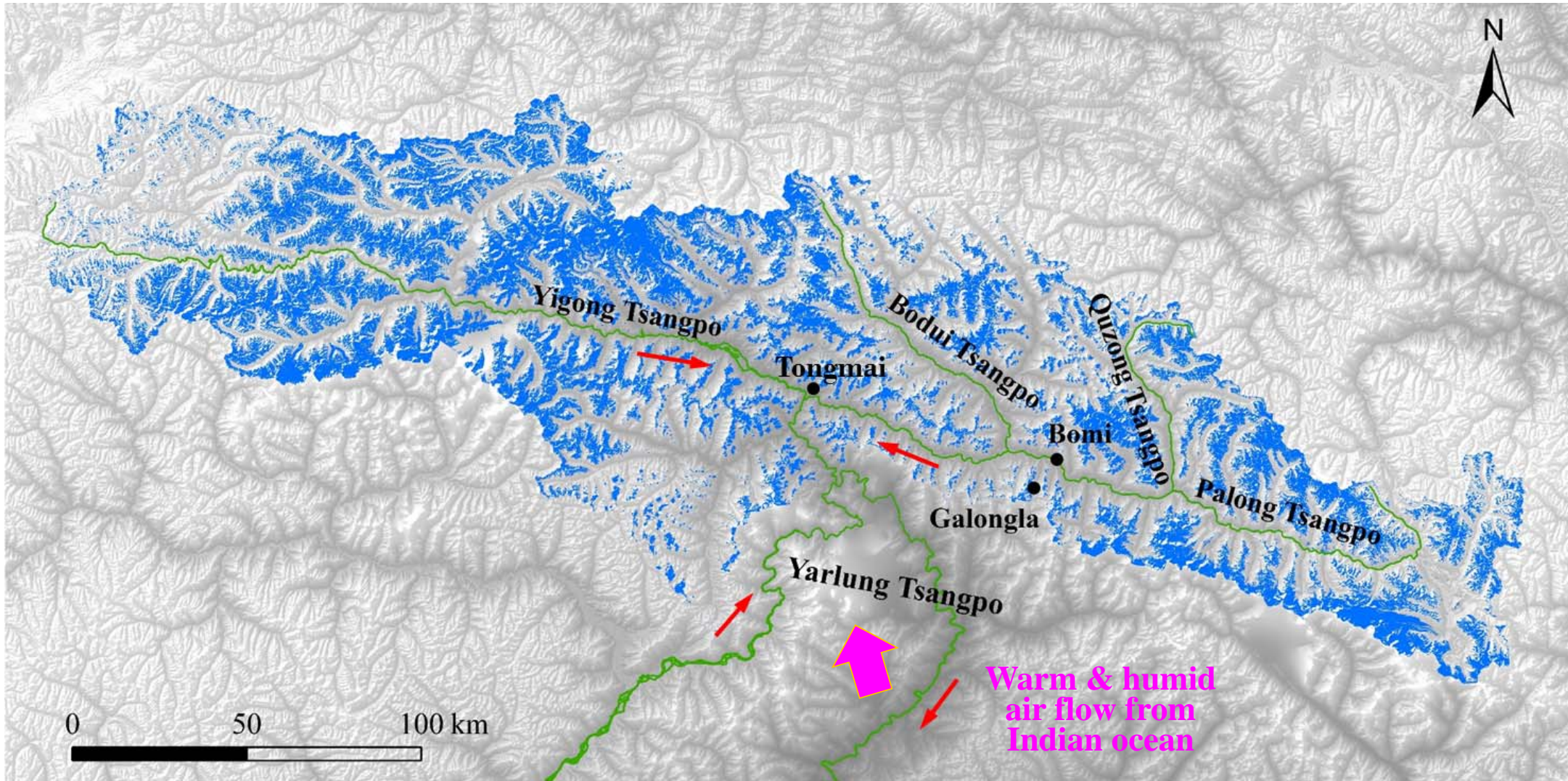


Ever-increasing uplift
of the Qinghai-Tibet
plateau

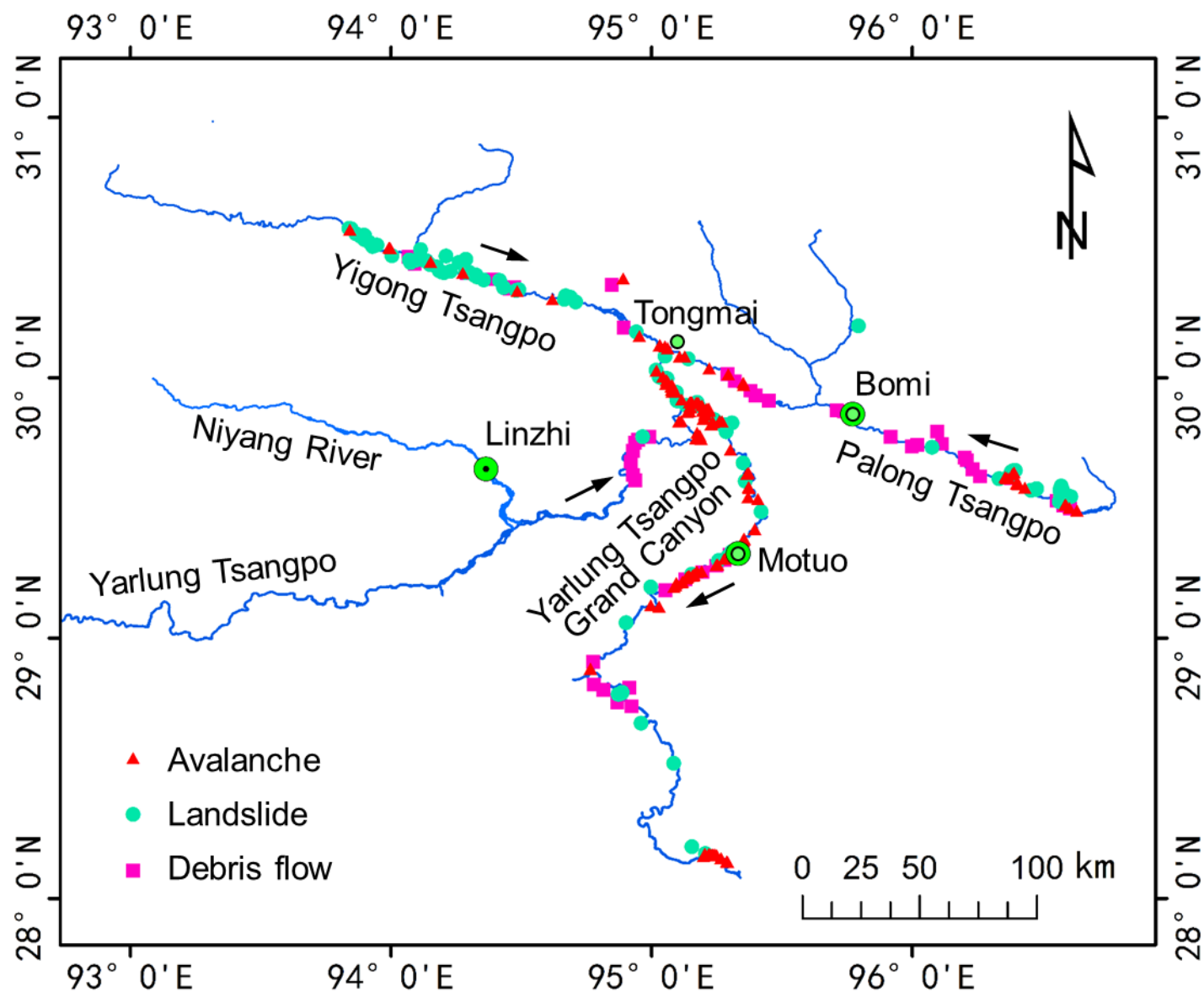
Continuous incision
of river channel







Glacier distribution in the Palong Tsangpo basin (Remote sensing data: ETM+)

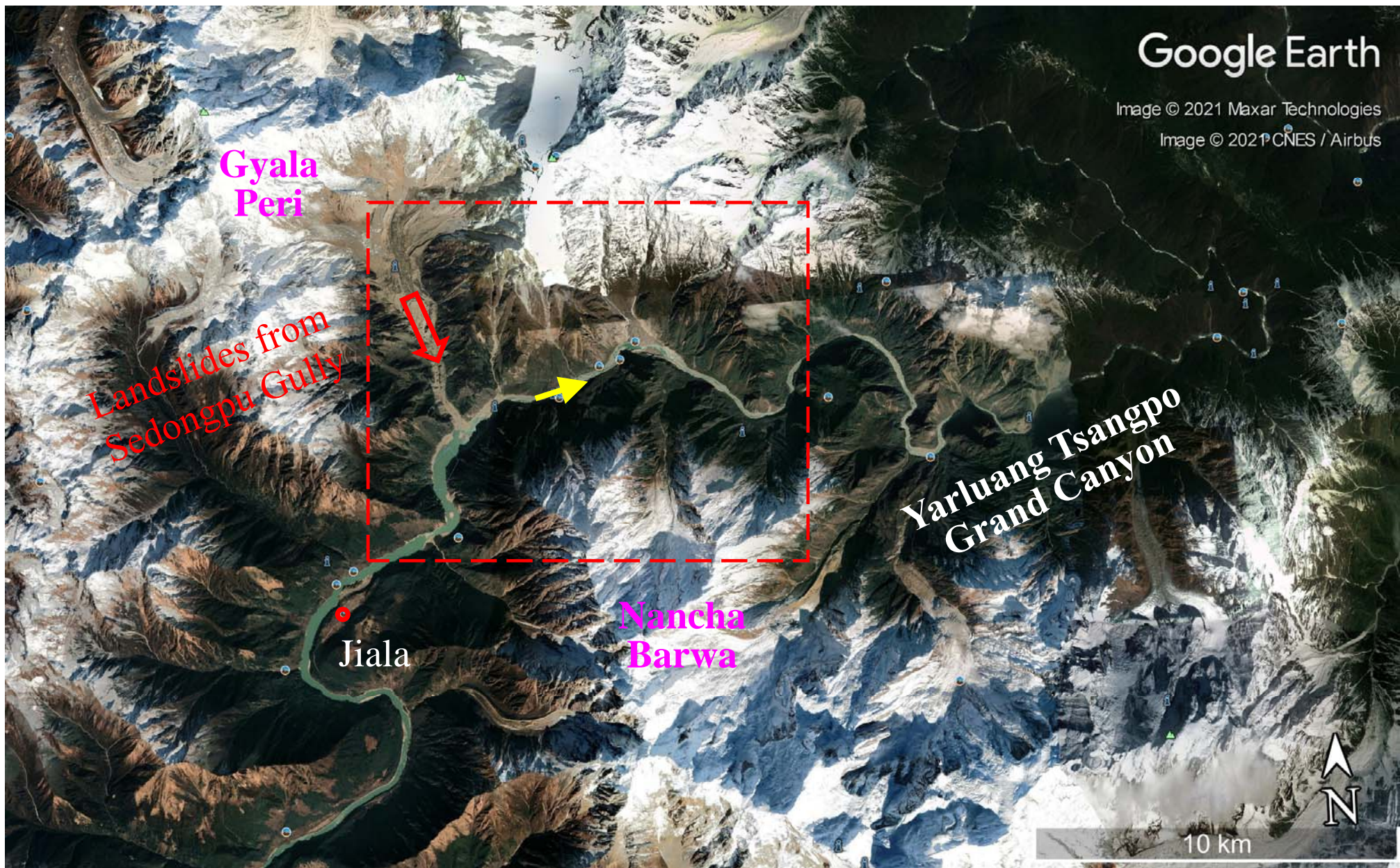


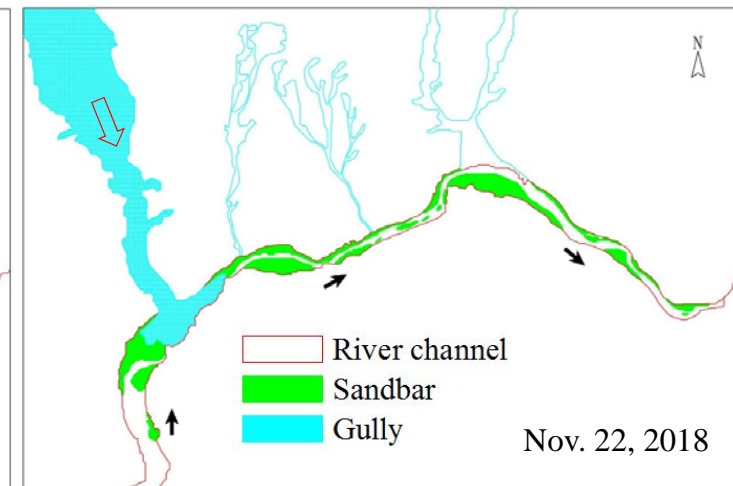
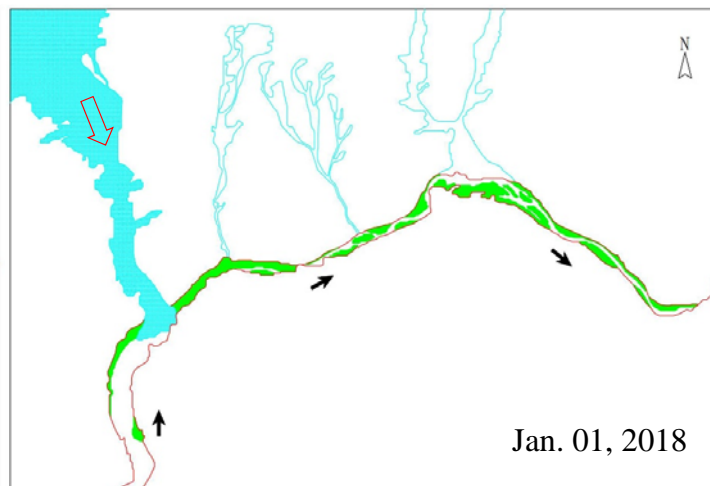
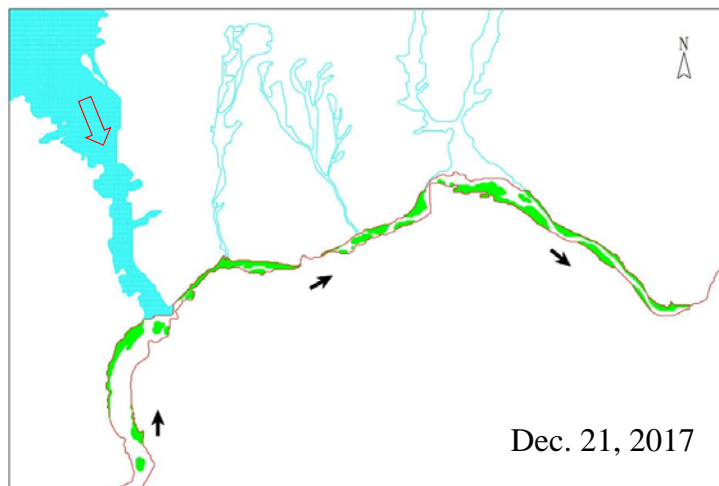
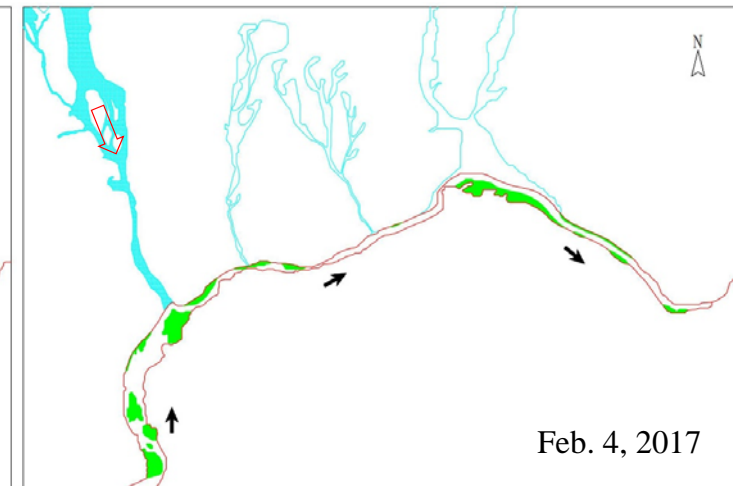
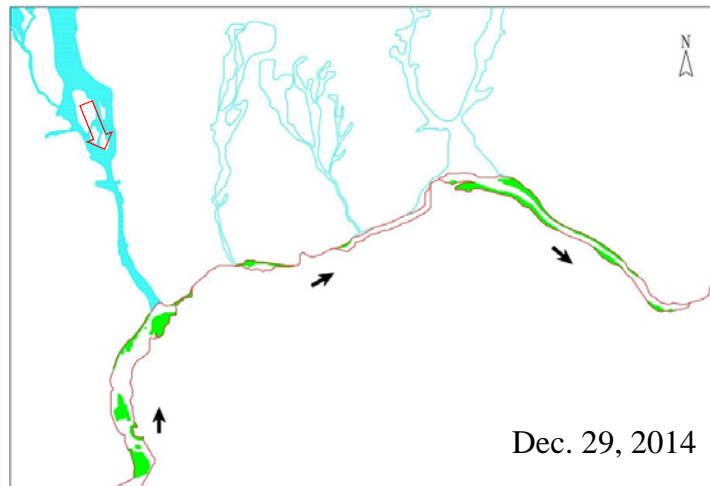
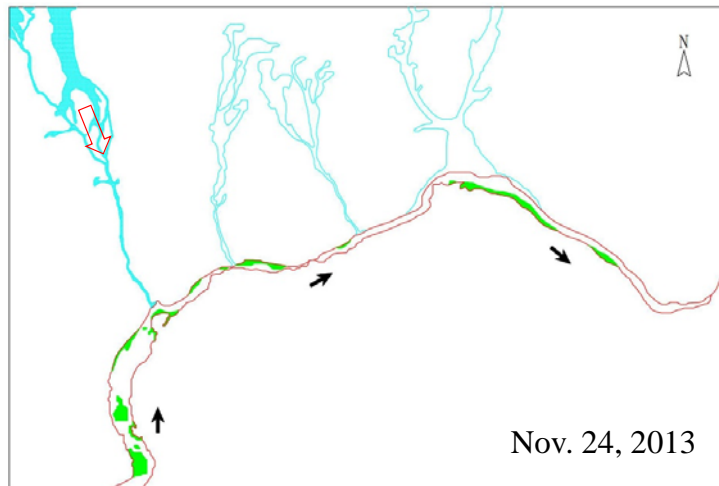
Deep incision

**Fragmented
landforms**

**High annual
precipitation**

**Distribution of mass
movements (avalanche,
landslide, debris flow)**





River channel
 Sandbar
 Gully

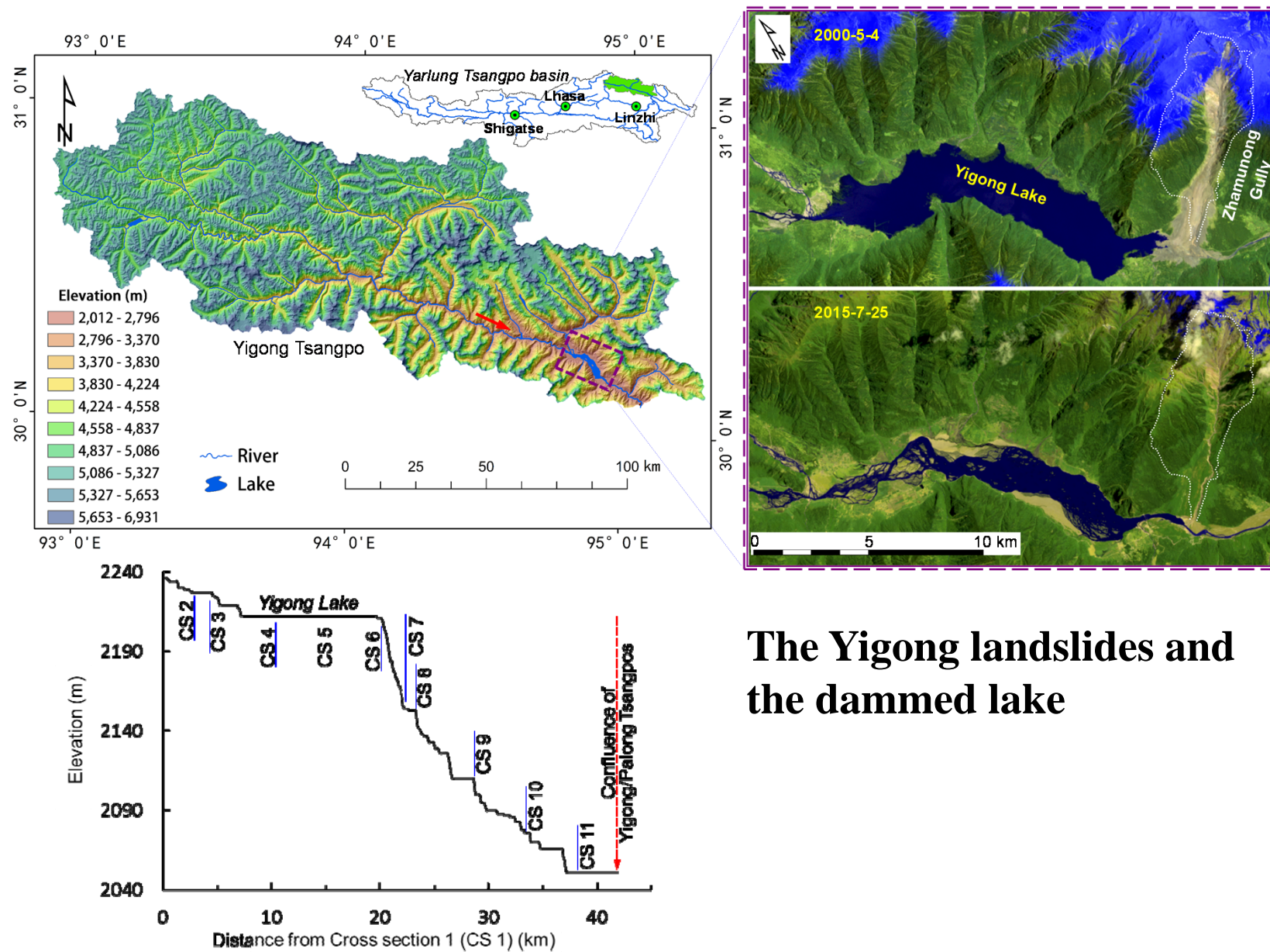
Channel bed siltation and planform variation of a stretch of river reach in the Yarlung Tsangpo Grand Canyon caused by landslides (debris flow) from Sedongpu Gully



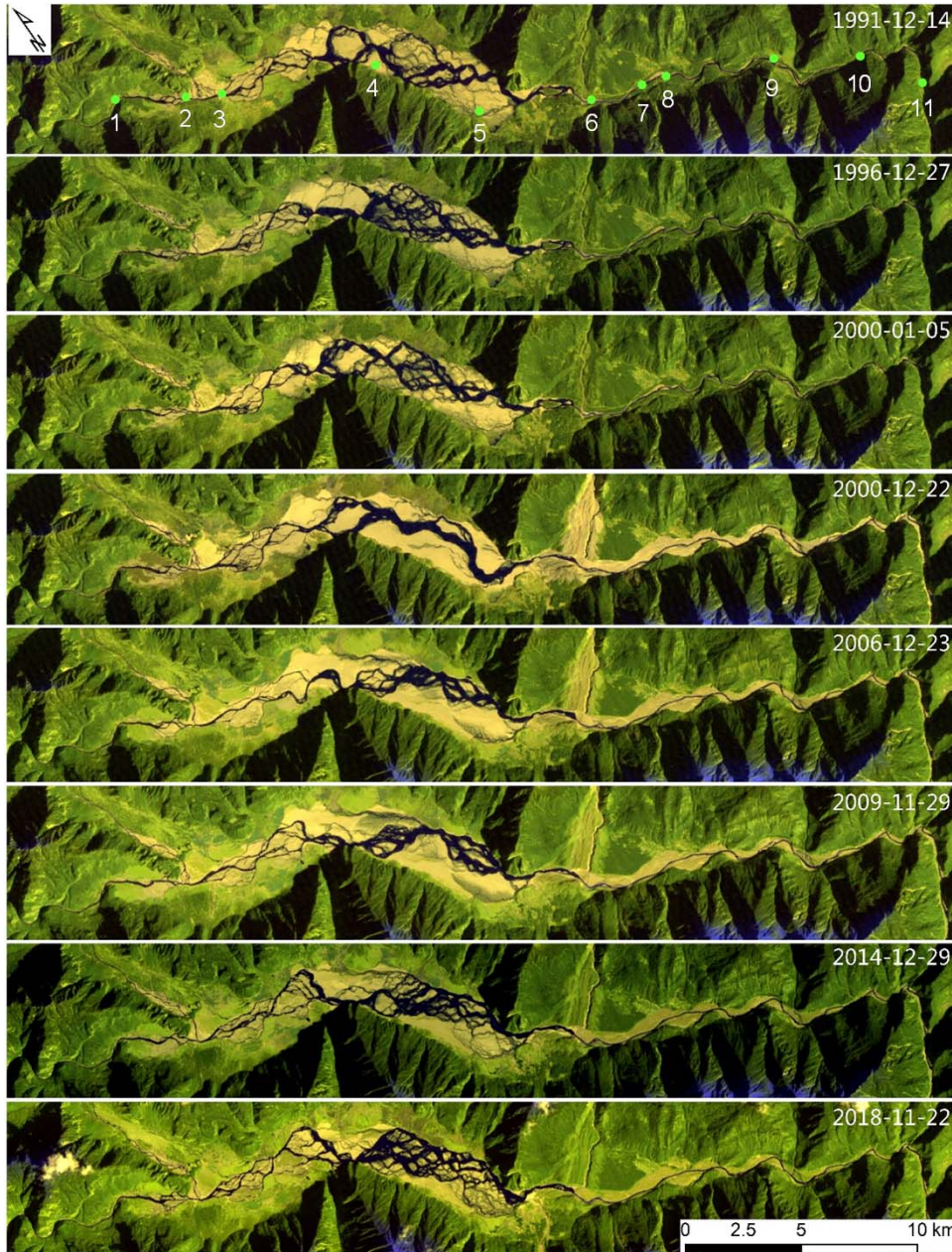
**Glacial erosion,
sediment transport,
and moraine deposit**



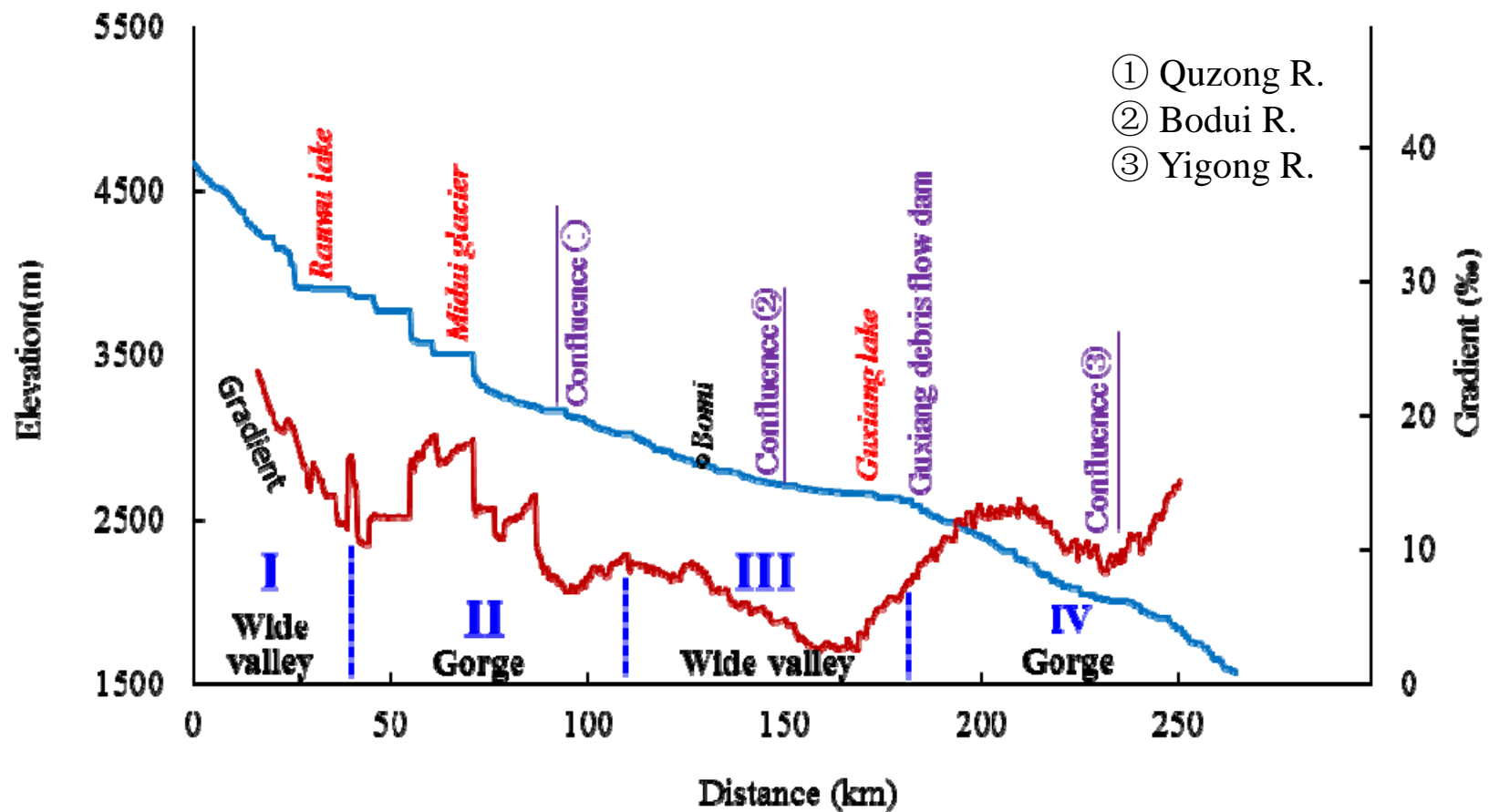
Streambed structures develop on glacial moraine



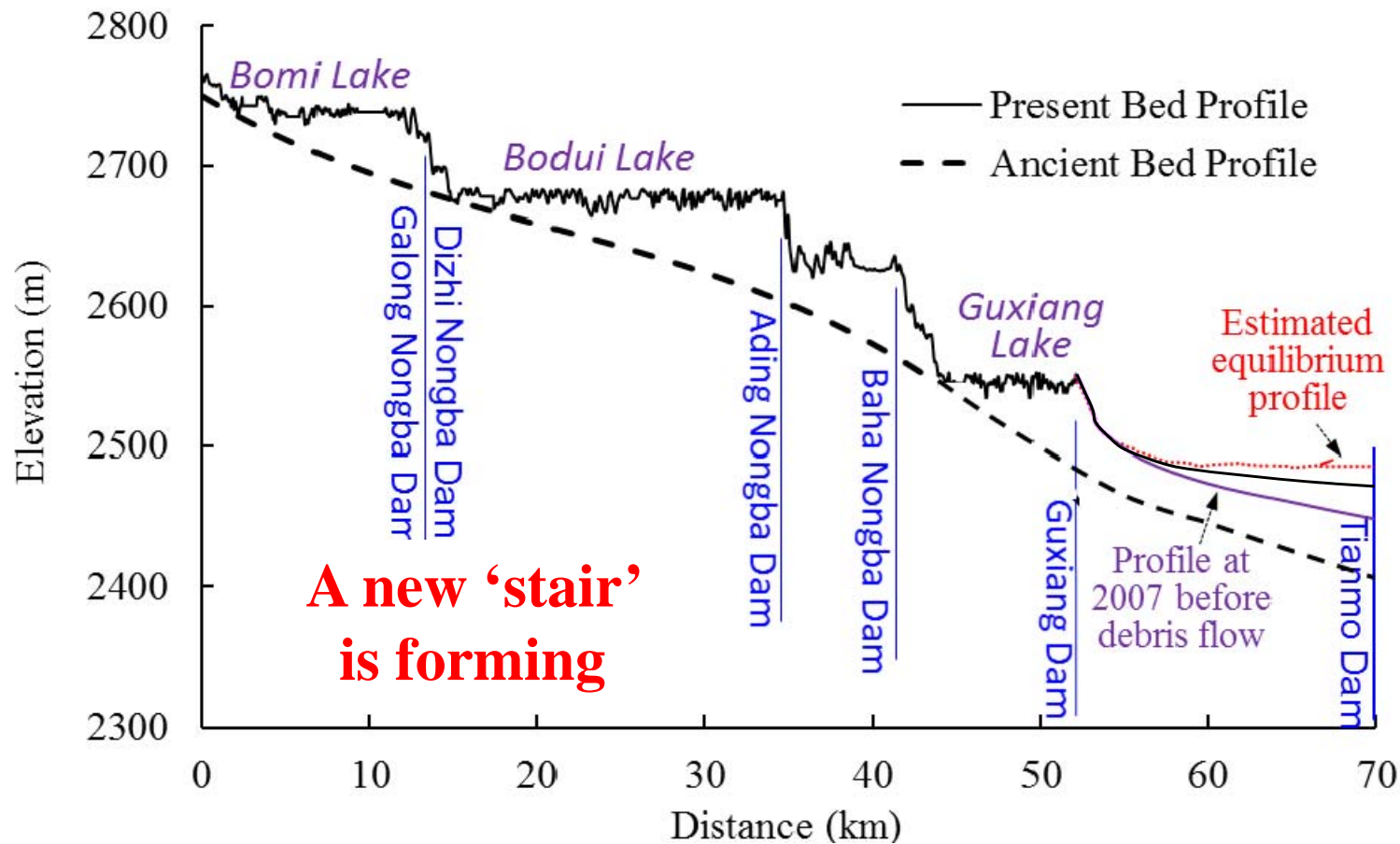
The Yigong landslides and the dammed lake



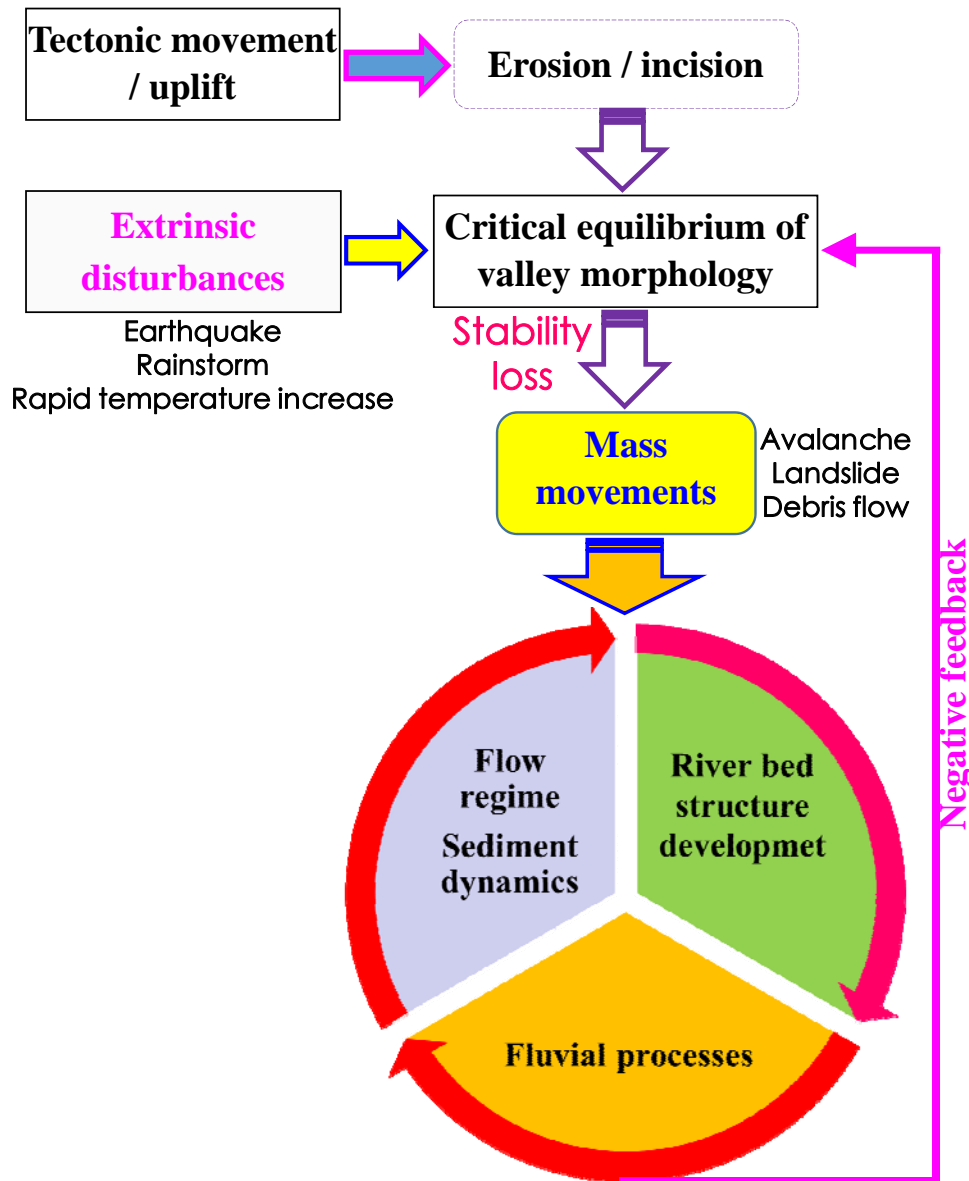
**Planform pattern of
the lower Yigong
Tsangpo in different
periods before and
after the landslide
in 2000**



The **stair-case like** longitudinal profile and channel gradient along the Palong Tsangpo



Longitudinal profile of a stretch of Palong R.: A new ‘step’ has been developing since debris flows in recent years transported huge amount of sediment into the River.



Mass movements & Negative feedback

- River morphology and slope from (quasi-) equilibrium to non-equilibrium state;
- Attendant rapid sediment incoming, valley bottom siltation and erosion benchmark rising;
- Negative feedback, driving the river morphology to a new round of development to equilibrium.

Concluding remarks

- Mass movement events in southeast Tibet:
 - key disturbing forces to fluvial processes
- Dynamic adjustment of valley/fluvial morphology
 - Negative feedback
- Longterm river (valley) morphology evolution
 - Alternating sections of gorges and wide valleys
 - Staircase-like longitudinal profile

Thank you for your interests!

