

FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



*Presented at the FIG Regional Conference 2024,
14-16 November 2024 in Kathmandu, Nepal*

Enhancing Land Governance and Disaster Resilience in Bhutan through DrukNet

Chokila CHOKILA, Bhutan;
Phurba PHURBA, Bhutan;
Kinzang THINLEY, Bhutan;
Jamphel GYELTSHEN;
Gonçalo HENRIQUES, Portugal;
Pedro ALMEIDA, Portugal;
Rui FERNANDES, Portugal



ORGANISED BY



PLATINUM SPONSOR



FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Outline

- Introduction
- DrukNet
- DrukRef23
- Support to Land Modernization
- Velocities due to Tectonics
- Support to Disaster Resilience



ORGANISED BY



PLATINUM SPONSOR



FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Introduction

- NLCS (National Land Commission Secretariat) is the governmental agency responsible for the definition and maintenance of the national reference of Bhutan.
- Bhutan was one of the first countries in Asia to implement a new geocentric national reference frame based on modern space-geodetic techniques, namely GNSS (Global Navigation Satellite Systems), DrukRef03 (materialized by observing a network of passive control points).
- A consistent national reference frame is instrumental in land management and in supporting the mitigation of natural hazards.
- Bhutan is now in the transition process to implement DrukRef23, the new reference frame directly materialized by DrukNet, the national CORS (Continuously Operating Reference Stations) GNSS network.



ORGANISED BY



PLATINUM SPONSOR



FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



DrukNet

- DrukNet was established as a strategic initiative to provide a robust and reliable geodetic infrastructure across the country.
- Initially consisting of six stations installed between 2011 and 2012.



ORGANISED BY



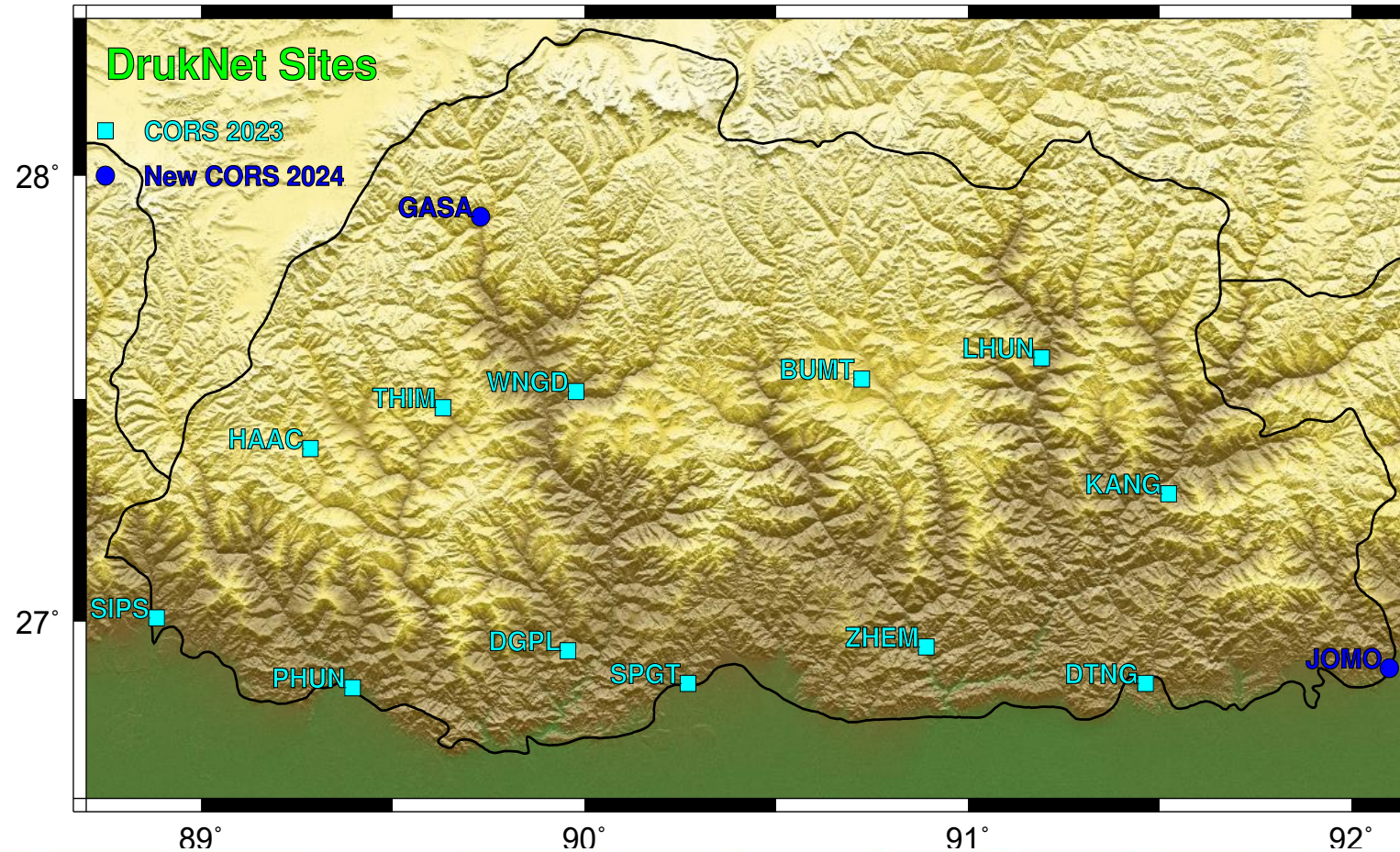
PLATINUM SPONSOR





DrukNet

- In recent years, there has been an effort to rehabilitate and densify the network: DrukNet is currently formed by 14 operational CORS stations distributed by the entire country.
- Plans to further densify the network in the coming years continue with the goal to complete the coverage of the inhabited territory of Bhutan with a network capable of providing RTK corrections.





DrukRef23

- This modern, static datum is aligned with the International Terrestrial Reference Frame (ITRF) 2020, ensuring consistency with global standards.
- DrukRef23 is anchored to the epoch 2023.5, providing a stable and accurate reference system that can accommodate the ongoing tectonic movements in Bhutan in the next years.
- DrukRef23 is continuously materialized by the DrukNet stations.





Support to Land Modernization

- DrukNet is a core instrument for georeferencing applications in Bhutan, in particular for cadastre.
- The use of DrukNet stations permits the efficient acquisition of data, both in real-time (most of the major areas with significant economic activity are already covered by the network) and for post-processing (when there is no internet coverage or in more remote areas where the distance to the nearest CORS is still too large $\geq 30\text{km}$).



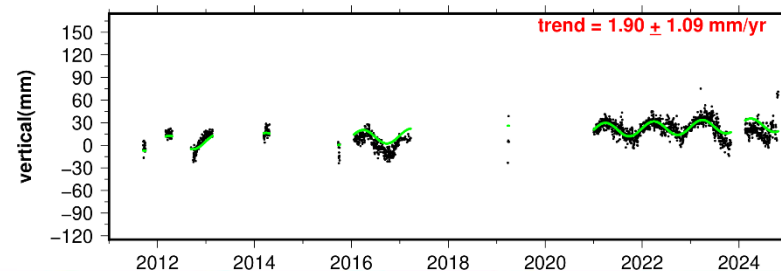
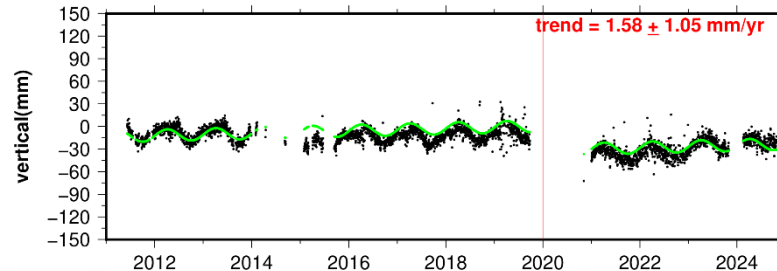
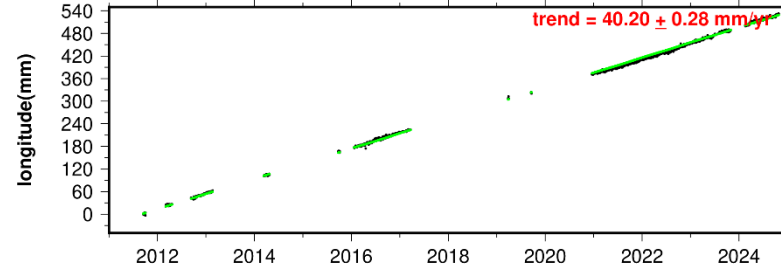
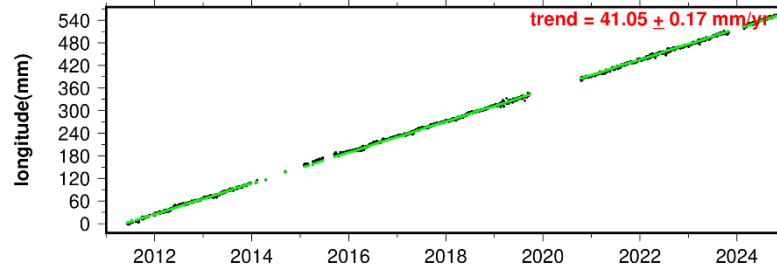
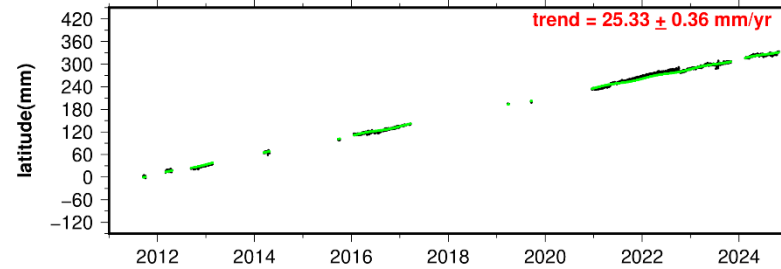
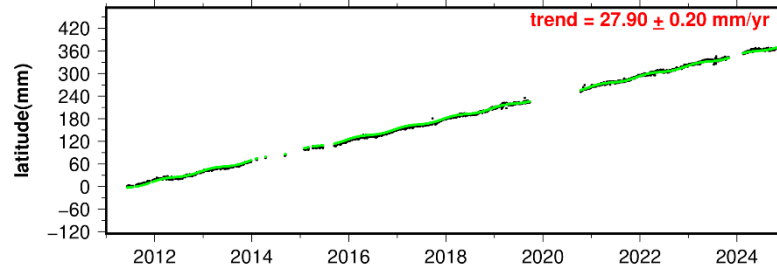


site THIM

site KANG

Velocities due to Tectonics

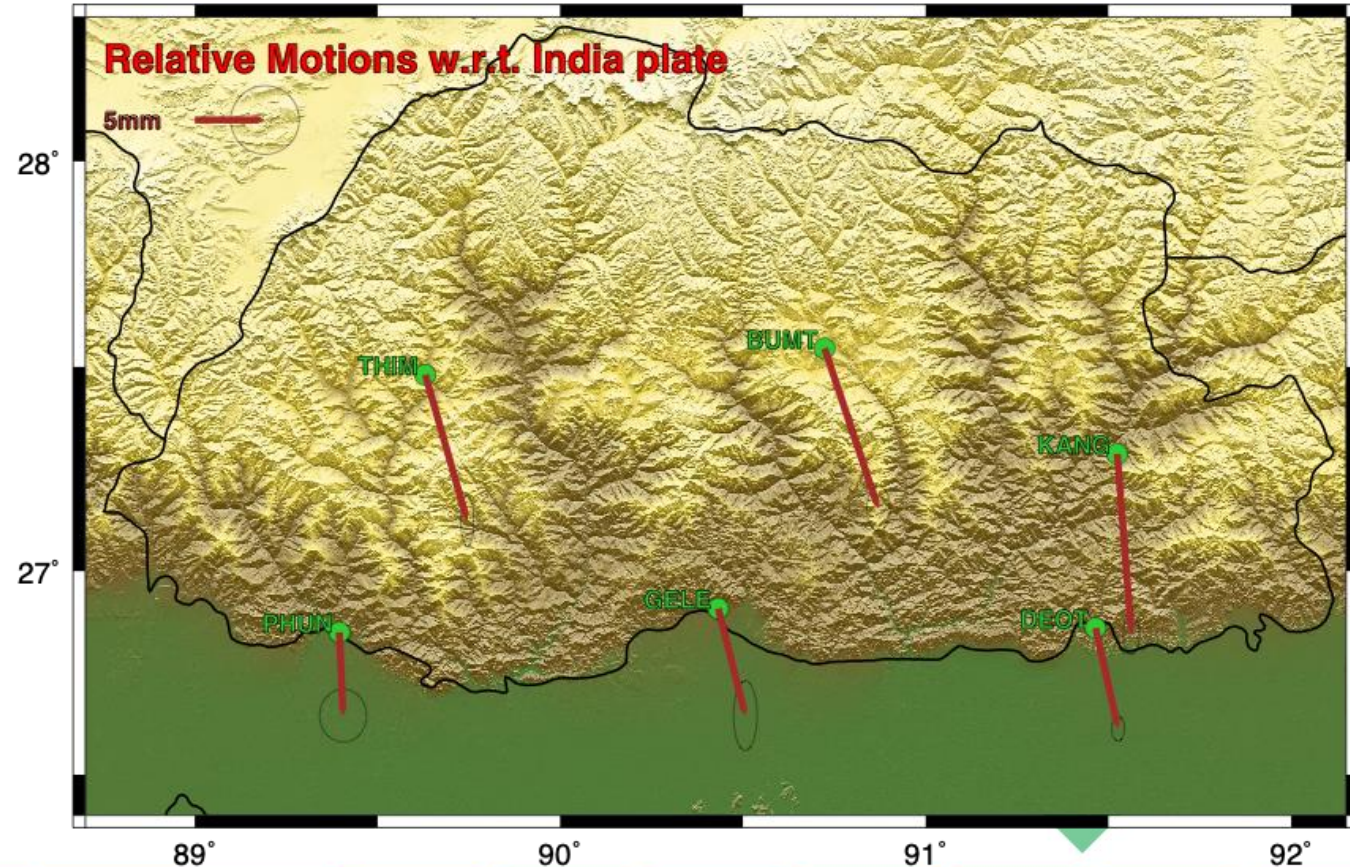
- Bhutan is situated in the Himalayas. This mountain range has been created as the result of the collision between Indian and Eurasian plates (around 45-65 Ma) and associated crustal shortening.
- The time series of the CORS stations show the displacements caused by the movement due to the plate tectonics





Support to Disaster Resilience

- The internal shortening of the baselines between the average parallel defined by THIM, BUMT and KANG, and the average parallel defined by PHUN, GELE and DEOT, is about 5mm/yr (more than 10cm in 20 years).
- DrukNet can support disaster management efforts by providing accurate and timely geospatial information during and after natural disasters. DrukNet can provide real-time data on ground deformations, helping authorities assess the extent of the damage and prioritize response efforts.



FIG

Kathmandu, Nepal 14–16 November

REGIONAL CONFERENCE 2024

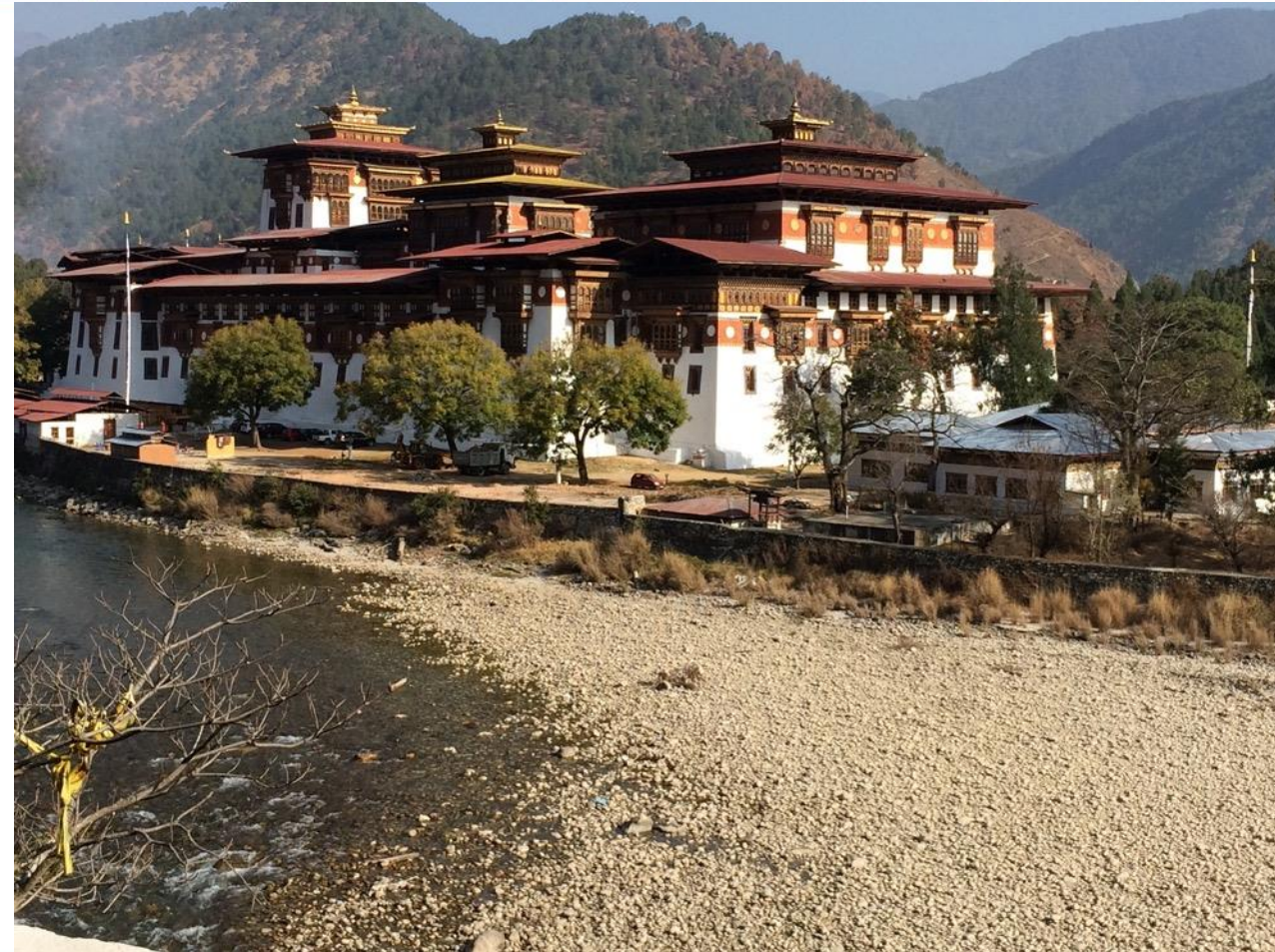
Climate Responsive Land Governance and Disaster Resilience: Safeguarding Land Rights



Kadrinchhey La

Obrigado

Thank You



phurba.605@gmail.com/phurba@nlcs.gov.bt

ORGANISED BY



PLATINUM SPONSOR

