# Improving free topography data for more reliable flood modelling in data-scarce regions

Natural Hazards Research Australia

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## Reducing vertical errors in DEMs using an ensemble of specialised models

Flood assessments need accurate topography data but often rely on free global Digital Elevation Models (DEMs), despite well-known errors. Ensembles of prediction models (specialising by land cover) can reduce these errors.

### Can we predict vertical errors in DEMs?

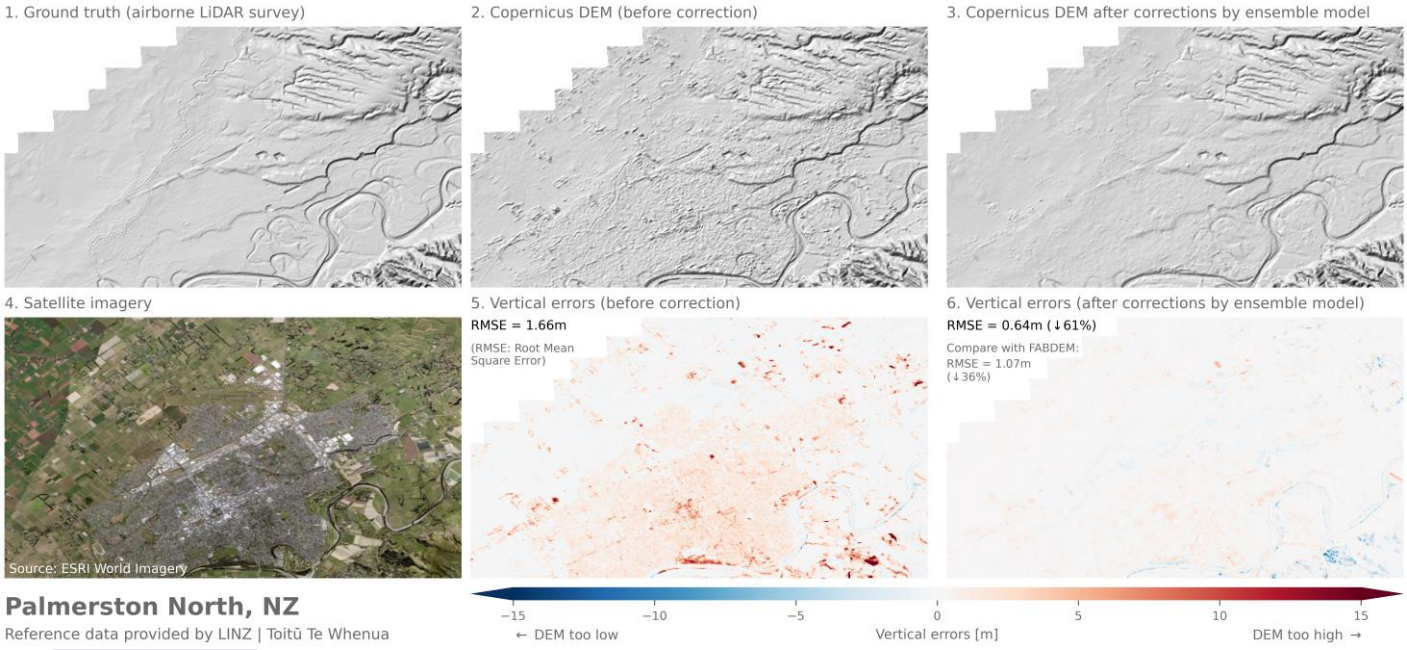
DEM errors occur where satellites can't "see" the ground surface (e.g. under vegetation or buildings). We used high-accuracy elevation data from 65 airborne laser surveys around the world (18.2 million data points) to assess these errors and to evaluate supplementary datasets that might help to **explain/predict** them. These included forest canopy maps, building footprints, night-time light intensity, topographical derivatives, Synthetic Aperture Radar (SAR), and multispectral imagery.

### Are separate prediction models useful?

A machine learning model trained to predict DEM errors using reference data from forest sites doesn't perform well if applied to a city. We developed a **transferability assessment** framework to identify which classifications are meaningful (e.g. land cover, landforms) and to explore training data sensitivities. This analysis informs the development of model ensembles, made up of specialist sub-models trained on subsets of the training data (e.g. separate models for forests and cities).

### How do we optimally combine them?

The maps below show the application of a preliminary **ensemble model** (six members, specialised by land cover) on a test site in New Zealand (unseen during model training). Vertical errors are reduced (RMSE down by 61%) without smoothing genuine topography features. We are now developing a more advanced version, using Vision Transformer (ViT) models and a meta-model trained to optimally combine the predictions made by each of the ensemble member models.




## Further information

For additional information scan the QR code or contact:

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