EVALUATING TOPOGRAPHIC INFLUENCES ON THE NEAR-SURFACE WIND FIELD OF TROPICAL CYCLONE ITA (2014) USING WRF-ARW

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THIS STUDY UTILISES THE ADVANCED RESEARCH VERSION OF THE WEATHER RESEARCH AND FORECASTING (WRF-ARW) MODEL TO INVESTIGATE TOPOGRAPHIC INFLUENCES ON TRACK AND INTENSITY OF TROPICAL CYCLONE ITA (2014).
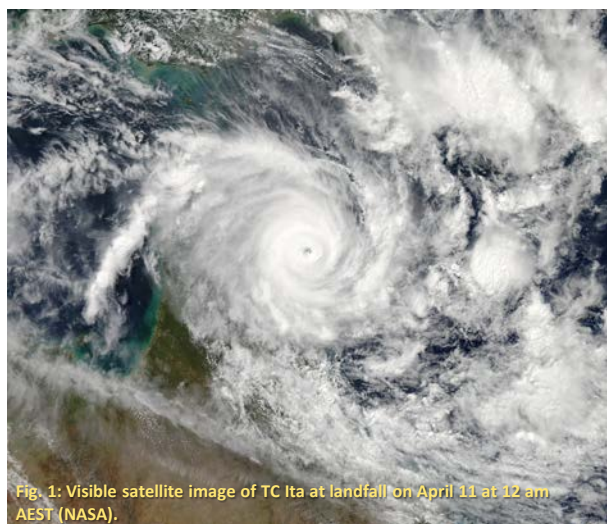

Fig. 1: Visible satellite image of TC Ita at landfall on April 11 at 12 am AEST (NASA).

Key Research Questions

▸ How do topographic features modify TC Ita track and near-surface wind field?

▸ Is WRF-ARW able to simulate the complex interaction between topography and the near-surface wind field?

▸ Does the removal of topography drastically influence the track and intensity of TC Ita?

WRF-ARW Model Setup

▸ Two domains – d01: 230x230 grid points, 10 km horizontal resolution, d02: 220x220 grid points, 3.3 km resolution.

▸ Initial and boundary conditions provided through 1° x 1° NCEP FNL reanalysis data.

▸ 1 km resolution of topography data.

Track Sensitivity to Topography

▸ The *top* track is in close agreement with the best track up to landfall.

▸ The *notop* track quickly begins to diverge after 24 hours and moves fast southward due to synoptic scale influences.

▸ The *notopCT* track shows very close replication of event characteristics up to landfall.

Intensity Sensitivity to Topography

▸ The 10 m winds to the north (south) of the inner core of TC Ita accelerate faster (decelerate slower) with *notopCT* (*top*) near Cooktown (Fig. 3).

▸ The *notop* wind field is generally stronger than the *top* wind field, as hills and mountains act as blocking ridges.
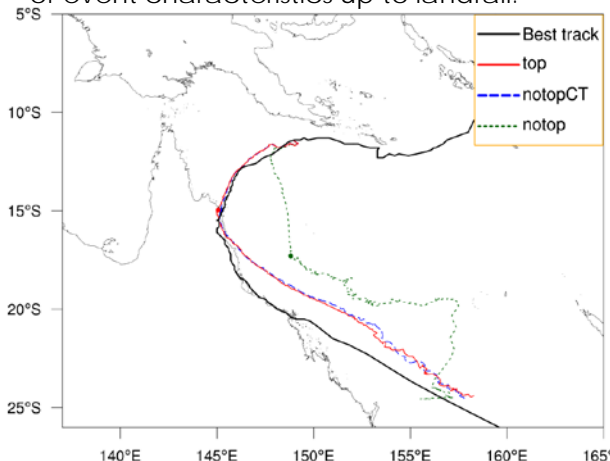

Fig 2: Modelled tracks and observed track (black) of TC Ita. *top* track: WRF-ARW default physics (red), *notop* track: Topography turned off for the entire domain (green), *notopCT* track: Topography set to zero ranging from 16S to 14S, 144E to 146E (blue). Coloured points show the time of best track's landfall.
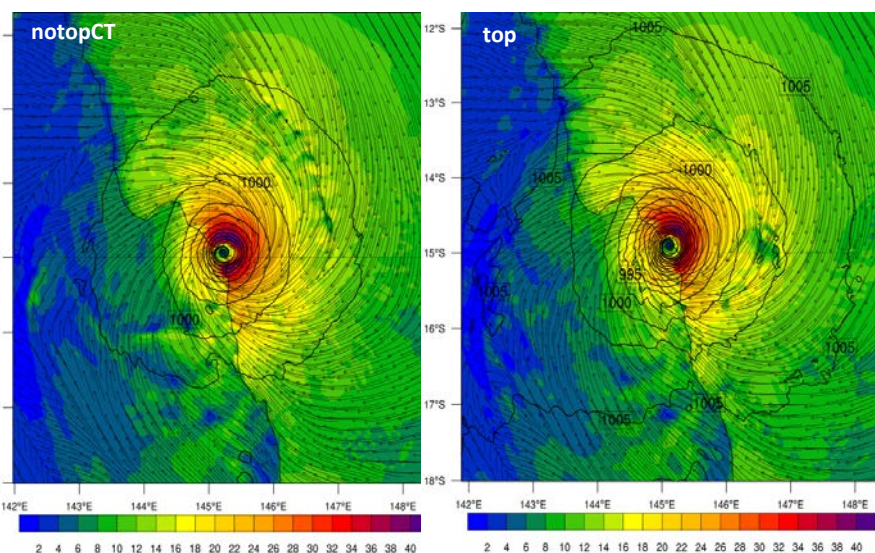

Fig. 3: The images above illustrate wind speed and pressure fields for the 3.3 km WRF-ARW resolution of TC Ita at landfall. Coloured contours indicate the 10 m wind speed magnitude in m/s, isobars are displayed with solid black lines, and wind direction with arrows.

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