Improved TC forecasts with new CoMorph-A convection scheme

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1. Experiment settings

Model settings:

- GC4: global coupled model with the default GA8 convection scheme.
- GC4-CoM: global coupled model with CoMorph-A convection scheme.
- Model horizontal resolution: N320 (40km), Vertical levels: 70

Ensemble settings:

- Initial conditions: deterministic forecast (e0)+ 9 perturbed initial conditions(e1-e9)
- Model uncertainties: Stochastic Kinetic Energy Backscatter (SKEB), Stochastic Perturbation of physics Tendencies (SPT)
- No. of ensemble members: 10

Case studies: TC-Ruby and TC-Seroja

2. TC-Seroja: Intensity and track forecasts

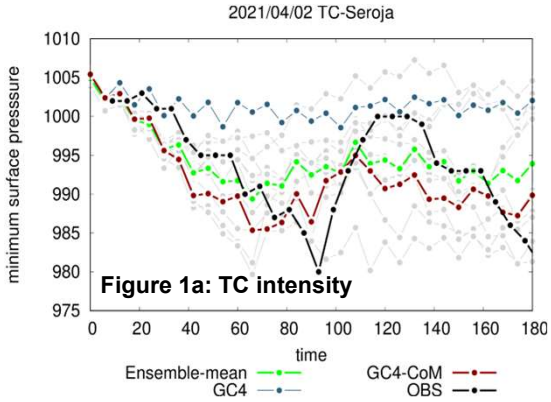

Fig 1a: Intensity forecasts for TC-Seroja in terms of minimum surface pressure with lead time, together with observations (black). Grey lines show the ensemble members for GC4-CoM. The ensemble mean (green) agrees well with the deterministic GC4-CoM forecast (red). In contrast, the GC4 deterministic forecast (using default convection) (blue) does not capture the intensification of the cyclone.

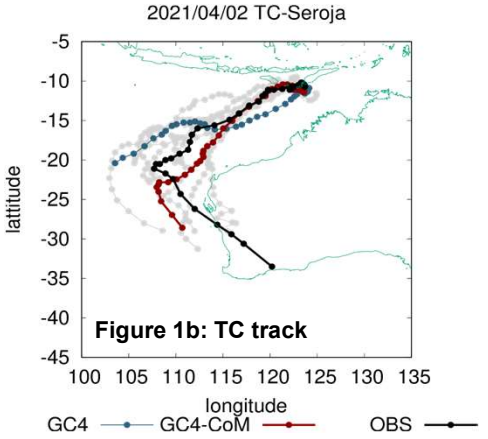

Fig 1b: TC-Seroja track. The GC4-CoM ensemble (grey lines) gives good coverage of the observed TC track (black). The tracks from the deterministic GC4-CoM forecast (red) and related ensemble (grey) are closer to observed compared to GC4 with the default convection scheme (blue), which does not capture the south-eastwards extra-tropical transition.

3. TC-Ruby: Intensity and track forecasts

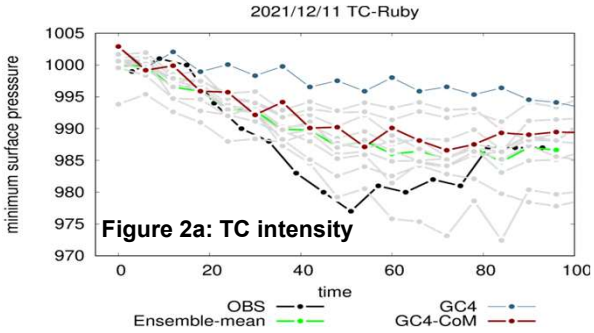

Fig. 2a: Similar to Fig. 1a, the intensity of the ensemble mean forecast (green) from the GC4-CoM agrees well with the related deterministic forecast (red) and is stronger and closer to observed (black) than that of GC4 with the default convection scheme (blue).

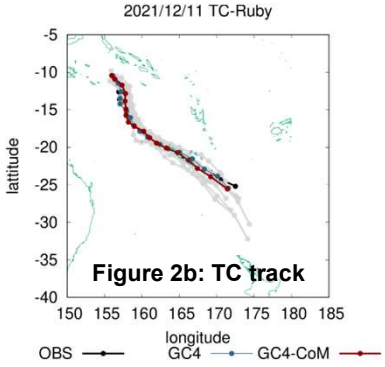

Fig. 2b: TC-Ruby track. Forecasts are similar for all configurations.

4. TC-Ruby: Ensemble spread and error for different configurations

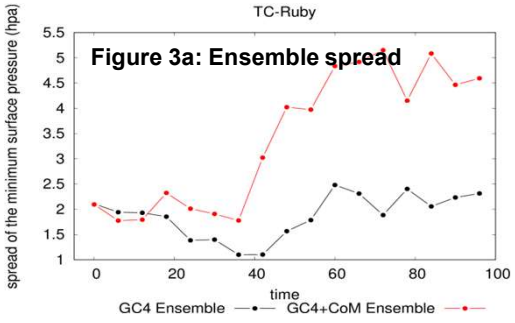

Fig. 3a: Ensemble spread with lead time for GC4 and GC4-CoM ensembles. The GC4-CoM ensemble (red) has about twice the ensemble spread as the ensemble using GC4 with default convection (black).

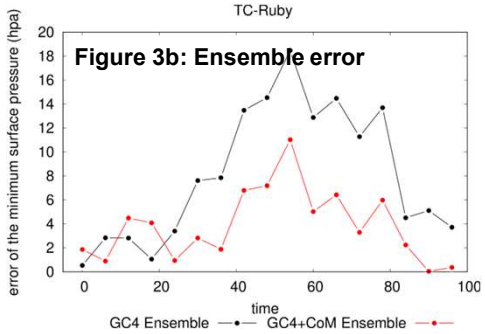

Fig. 3b: RMSE with lead time. The GC4 forecasts using CoMorph-A have a lower RMSE than GC4 with default convection. The greater spread in the GC4-CoM ensemble (Fig. 3a) has not compromised skill.