

## **Submission to Senate Enquiry into Recent trends in and preparedness for extreme weather events.**

Regarding Terms of Reference (c) an assessment of the preparedness of key sectors for extreme weather events, including major infrastructure (electricity, water, transport, telecommunications), health, construction and property, and agriculture and forestry

### **Summary: The wind hazard for Darwin and adjacent coastal areas is substantially underestimated in the relevant Australian Standard leading to the risk from cyclones being substantially greater than allowed for under building legislation.**

The Building Code of Australia, which is invoked by building legislation throughout Australia specifies the exceedance probability (or return period) for wind events to which houses and other structures must be designed and constructed. For example the code specifies (Table B1.2b) that houses in cyclone regions must be built to withstand winds with an annual exceedance probability of 1 in 500 years.

The Australian Wind Action Standard (AS/NZS 1170.2) is invoked by the Building Code of Australia and defines the wind speeds required for compliance with that code. Darwin and other coastal areas of the Northern Territory are defined as being within wind Region C. For Region C, the standard defines the gust speed from cyclonic events with a 1 in 500 years probability as being 69 metres per second. By contrast the Pilbara coast of Western Australia is Region D with a 1 in 500 year gust speed defined as 88 metres per second.

In 2009 in the Journal of Applied Meteorology and Climatology, Cook and Nicholls argued that the wind hazard for Darwin as specified by the Australian Wind Action Standard was underestimated substantially. For a 1 in 500 year probability, the gust speed was more likely to be about 90 metres per second. The placement of Darwin within Region C effectively assumes that Darwin and nearby is never affected by Category 5 cyclones, for which the maximum gust speeds are greater than 78 metres per second. However, the Northern Territory has had three Category 5 cyclones in the past 15 years (Thelma, Ingrid and Monica). Of these Monica crossed the coast at full strength as one of the most intense cyclones to ever make landfall worldwide.

Cook and Nicholls concluded that houses built to the current Australian WindAction Standard are underdesigned for the wind hazard that has existed for the past century. Consequently the infrastructure and human life is at much greater risk that mandated under building legislation. According to their work, the wind hazard to which houses in Darwin are currently designed has an annual exceedance probability of about 1 in 170 years – much less than that required for a 1 in 500 year event.

In 2011, the work of Cook and Nicholls (JAMC 2009) was challenged in the scientific literature by Harper and colleagues. Cook and Nicholls then published a rebuttal that showed that the critique of Harper and colleagues was baseless. Harper et al. claimed that Cyclone Tracey, which destroyed Darwin in 1974 was possibly an outlier and an extremely rare event. However Harper et al. only considered wind data at Darwin from 1960 to 2005 and ignored the cyclones that destroyed Darwin in 1897 and 1937. By putting Cyclone Tracy into context as being one of three cyclones to have hit Darwin directly since the late 1800s Cook and Nicholls showed that the direct hits belong to a different population of wind events to those dominating the data analysed by Harper et al. When the cyclones of 1937 and 1897 are taken into account, it is clear that Darwin's wind hazard has been greatly underestimated. The reanalyses by Cook and Nicholls in 2011 concur with their previous finding that Darwin's wind hazard is substantially underestimated in the Wind Action Standard and that Darwin houses and people are at far greater risk than the legislated requirement within the Building Code of Australia.

## References

- Australian Building Codes Board. 2005. Building Code of Australia Volume 1 Class 2 to Class 9 buildings. Australian Building Codes Board, Canberra, ACT.
- AS/NZS 1170.2. Structural Design Actions: Part 2 Wind Actions.
- Cook, G. D. and M. Nicholls. 2012. Reply. *J. Appl. Meteor. Climatol.* 51: 172 - 81.
- Cook, G. D. and M. J. Nicholls. 2009. Estimation of tropical cyclone wind hazard for Darwin: comparison to two other locations and the Australian wind loading code. *J. Appl. Meteor. Climatol.* 48: 2331 – 40.
- Harper, B. A., J. D. Holmes, J. D. Kepert, L. M. Mason and P. J. Vickery. 2011. Comments on "Estimation of tropical cyclone wind hazard for Darwin: comparison with two other locations and the Australian Wind-Loading Code". *J. Appl. Meteor. Climatol.* 48: 161 - 171