

THE INFLUENCE OF AN INDUSTRY STANDARD TUBULAR MAST ON MEASURED WIND SPEED

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IEA / IEC Standards

IEA / IEC standards state that an anemometer boom mounted to a mast should experience a wind speed perturbation no greater than 0.5%. The standards use computational fluid dynamics (CFD) modelling to justify a minimum boom length of 8.5 diameters for a tubular mast. However field measurements suggest that boom mounted instruments (in compliance with the standards) experience perturbations which exceed the 0.5% threshold.

Measurements of Anemometers Boom Mounted to a Tubular Mast

- An inherent difficulty in measuring flow distortion due to a mast is obtaining a reference measurement free of any effect.
- In practice we are forced to investigate using the ratio of two instruments, both under the influence of the mast.
- The ratio of boom mounted anemometers with an angular separation of 90° or 180° should contain a strong 'signal' of any effect induced by the mast.
- Figures 2-3 show the observed ratios for a boom length of 11 mast diameters (exceeding the standard by 2.5 diameters).
- The observed effect is far greater than suggest by the standard.
- Independent CFD analysis (commissioned by RES) predicted wind speed perturbations consistent with the standards i.e. much smaller than observed. Scaling the CFD results by a factor of six was found to reproduce the observed behaviour very closely (Figures 2-3).

Alternative Configuration



Figure 4. Alternative tower top configuration.

- RES has designed a new mast configuration which reduces the wind speed perturbation experienced by instruments.
- Extended tower top section and 'U-Boom' increases the separation between the instruments and the mast (Figure 4).
- The performance of the new configuration is illustrated in Figure 5. The observed wind speed perturbation due to the mast is significantly reduced (c.f. Figures 2 and 3).
- The new configuration would appear to achieve a wind speed perturbation less than the 0.5% threshold of the standard.

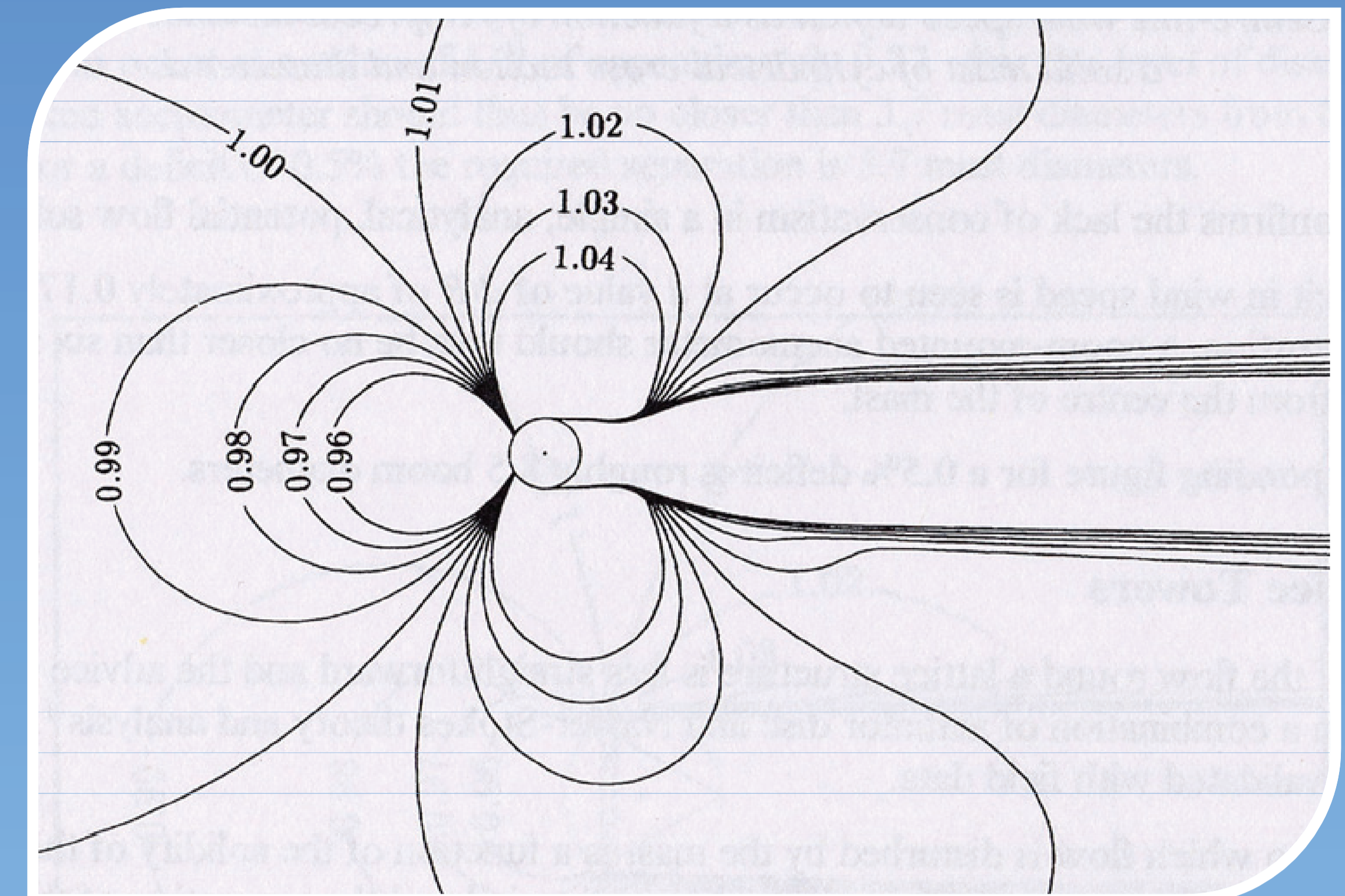


Figure 1. Expected velocity perturbation around a tubular mast from IEA / IEC standards

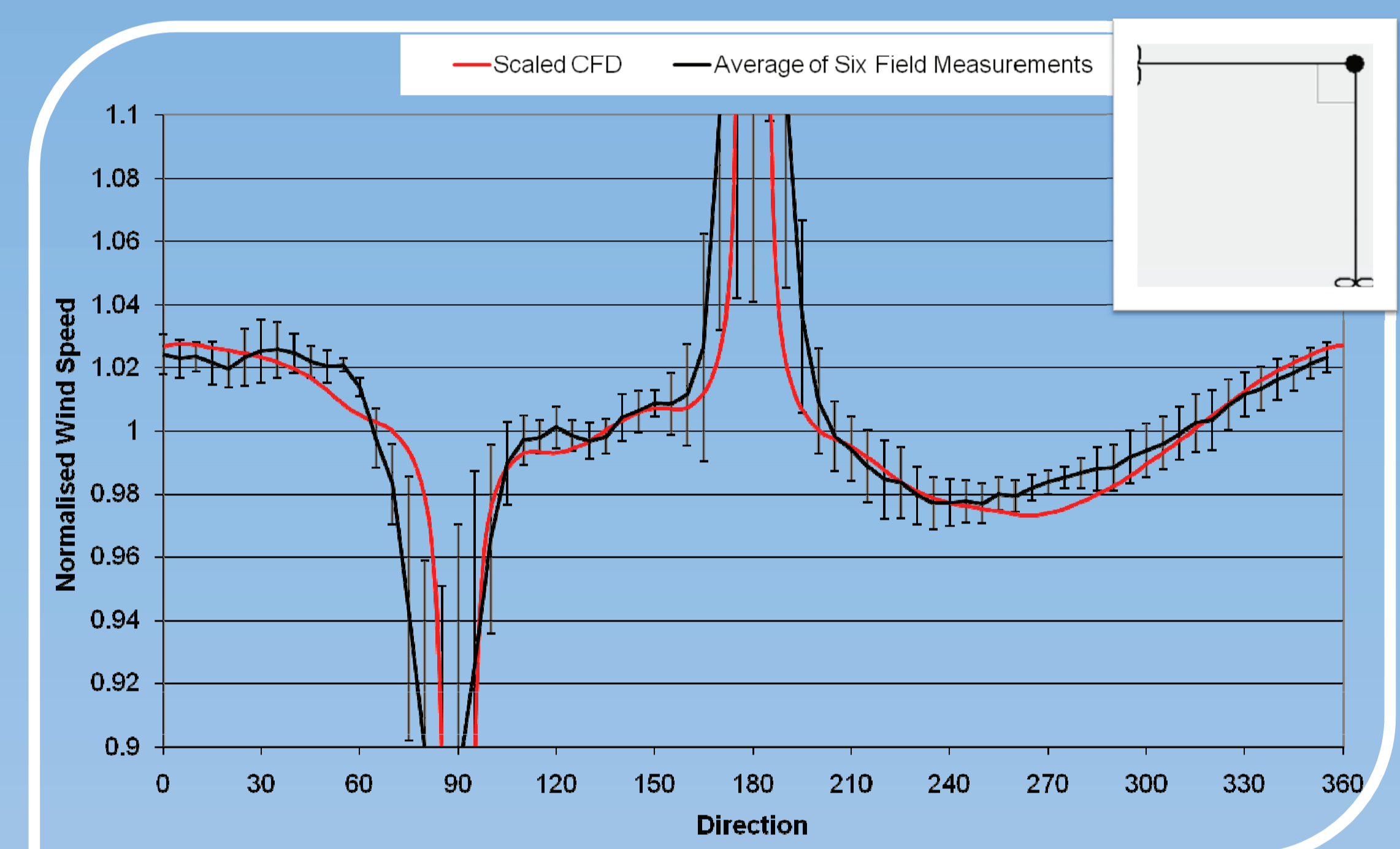


Figure 2. Comparison between (scaled) CFD and measured ratios of two anemometers with an angular separation of 90°.

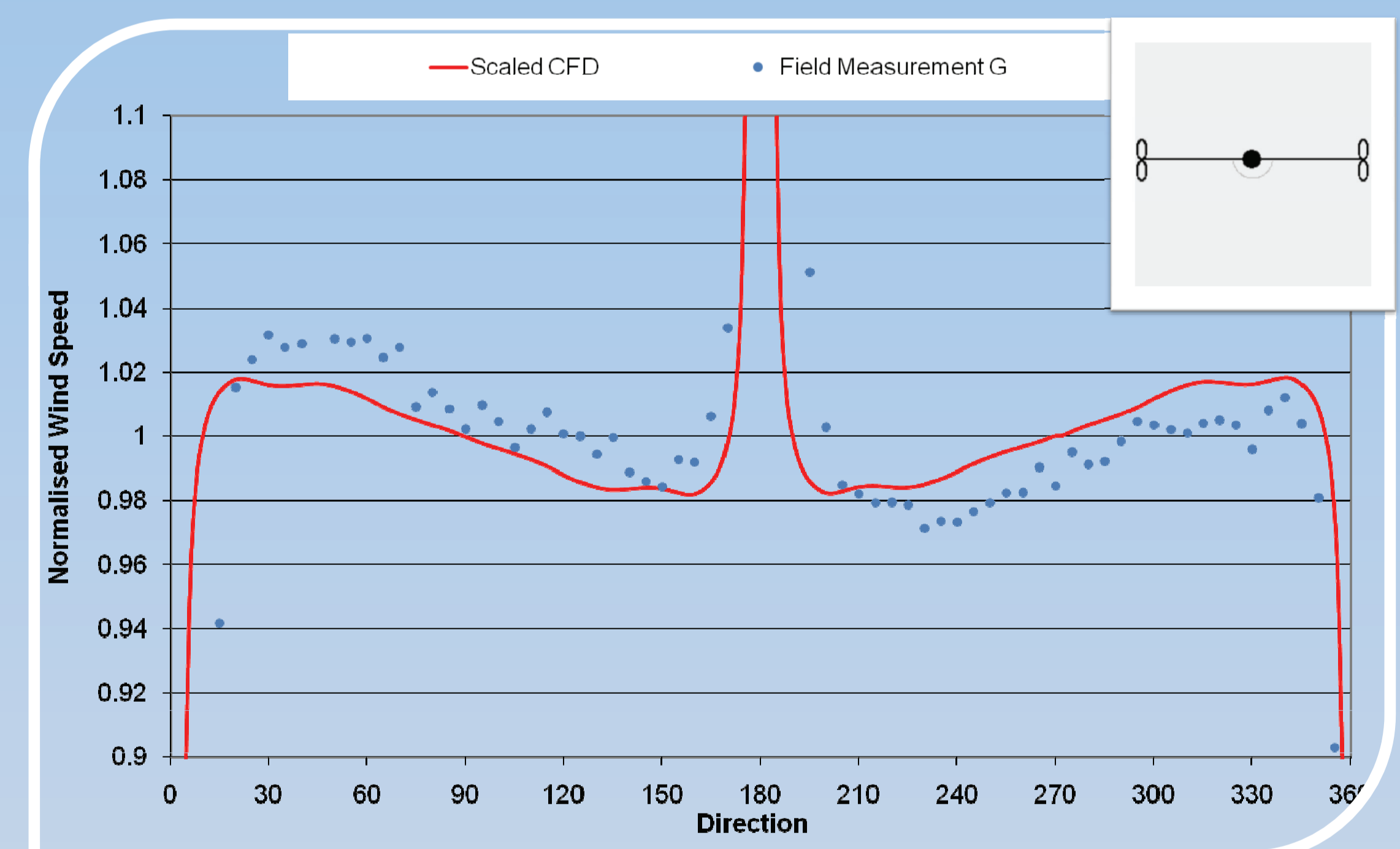


Figure 3. Comparison between (scaled) CFD and measured ratios of two anemometers with an angular separation of 180°.

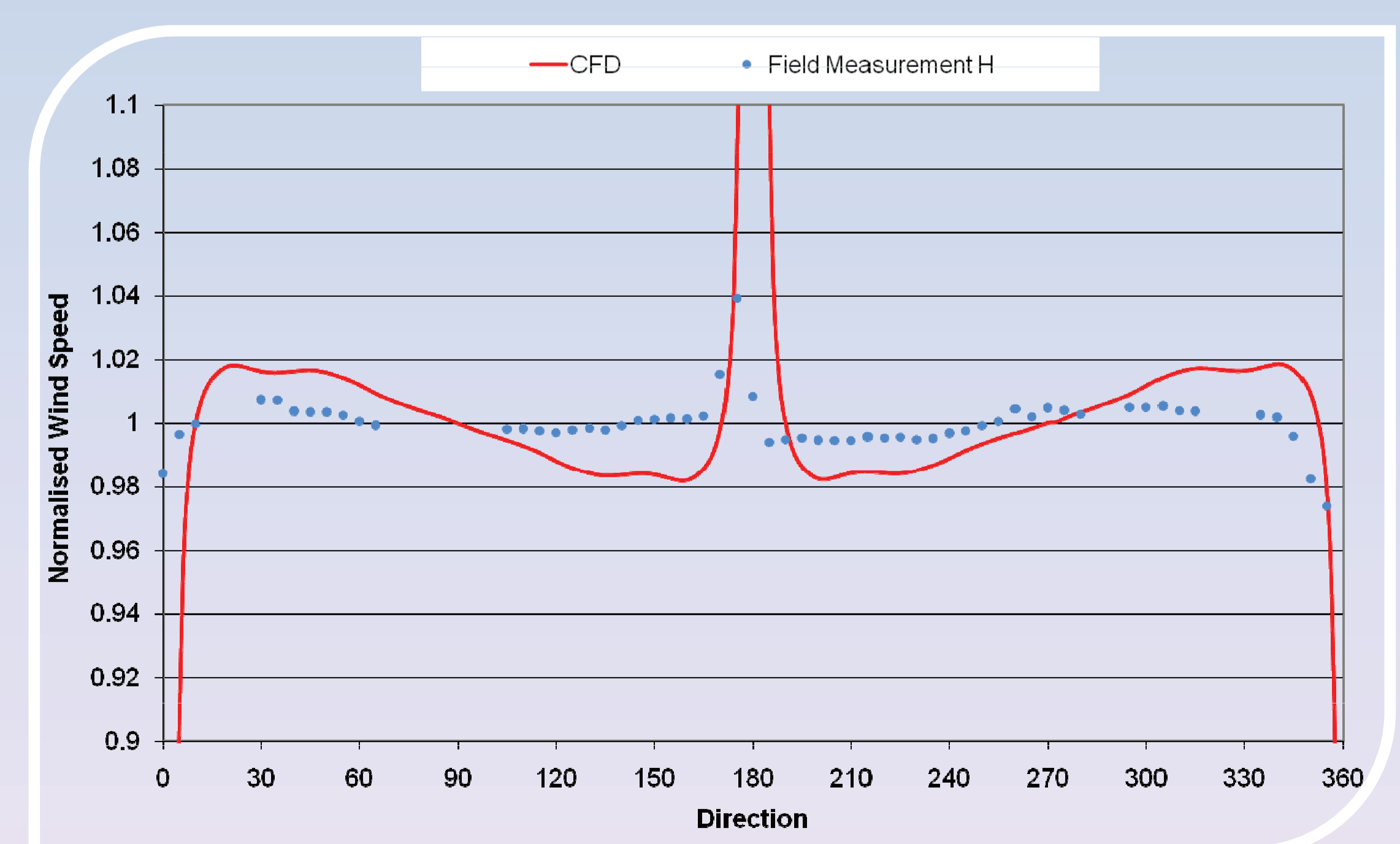


Figure 5. Measured ratio of two anemometers mounted using new tower top configuration. (Scaled) CFD ratio for boom mounted instruments is shown for comparison.