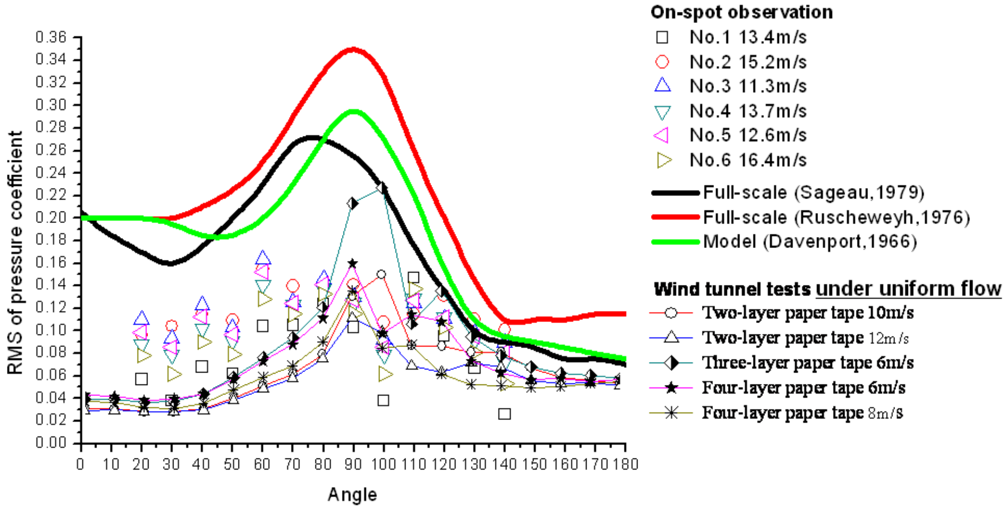

Fig. 18 Fluctuating wind pressure distributions obtained by full-scale measurements and wind tunnel model tests under uniform flow

Fig. 19 equally compares the fluctuating wind pressure distributions measured on Peng-cheng cooling tower with the results obtained by wind tunnel model tests under traditional ABL turbulent flow. It can be found that the model test results are approximately the upper envelopes of the full-scale measurement results, which also supports the practice of regarding wind effects obtained in ABL turbulent flow field as the upper limit value (also see Sec. 3).

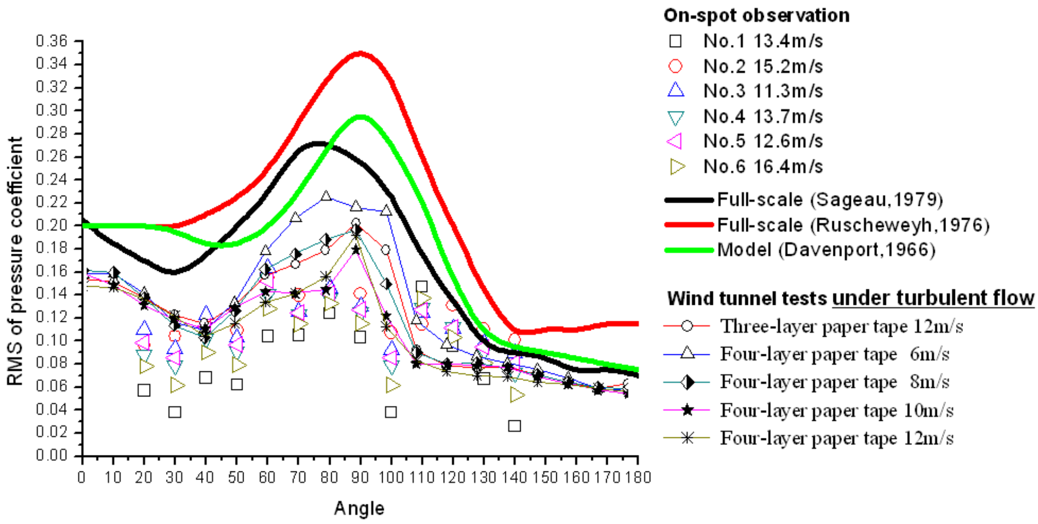

Fig. 19 Fluctuating wind pressure distributions obtained by full-scale measurements and wind tunnel model tests under turbulent flow

By using a mathematical conversion method (Zhao, Cheng *et al.* 2012), the model test results obtained under uniform and turbulent flows are averaged. A comparison made in Fig. 20 indicates that the averaged model test result is very close to the full-scale measurement results. Due to discretization errors, the averaged model test result might vary in a range, which is shown in Fig. 20. Coincidentally, most realistic fluctuating wind pressure coefficients fall into the variation range. These prove that the average value of the two wind tunnel model test results is the reasonable final result, and it can be applied to the full-scale condition.

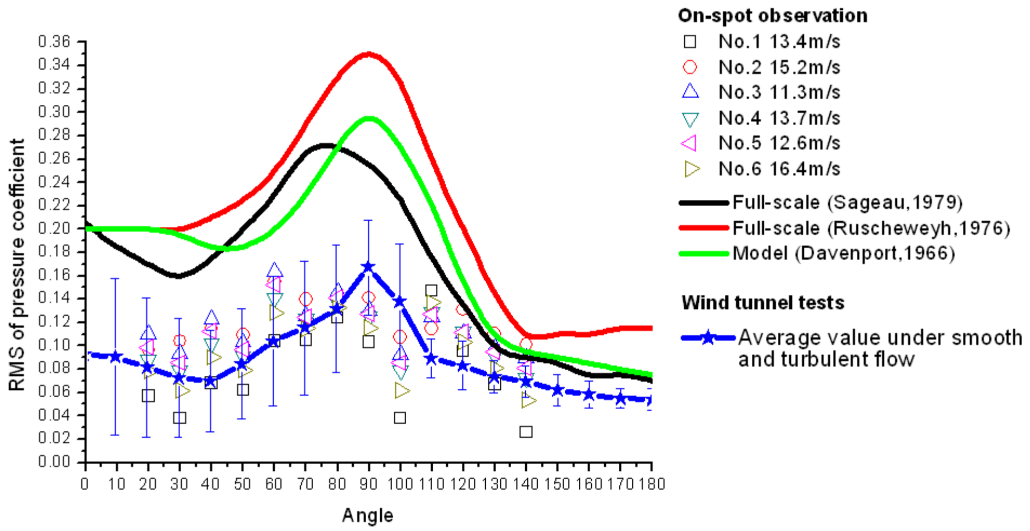

Fig. 20 Fluctuating wind pressure distributions obtained by full-scale measurements and the average value of the two wind tunnel model test results

5. CONCLUSIONS

(1) Theoretical knowledge and field measurement results both indicate that the turbulence intensity profile cannot be definitively described for each terrain type. This is because the turbulence intensity depends on the roughness length and the mean wind speed, which both vary in intervals.

(2) The turbulence intensity measured at Peng-cheng power station varies in a wider range than the theoretical value, and the lower envelope for measured turbulence intensity profiles is extremely low compared with the theoretical one. These suggest that there exist possibilities that theoretical ABL flow characteristics presented in Codes of Practice and publications might not be applicable to a specific engineering case. A reasonable explanation is that theoretical results are obtained by generalizing large quantities of measured data, and simplifications and conservatism are usually included in generalization.

(3) With measured wind environment information at hand, wind tunnel model tests can be adaptively formulated considering the realistic ABL flow characteristics. By comparing wind effects obtained from model tests and full-scale measurements, this paper proves that the adaptive model tests lead to more reliable results. Thus, it is suggested that if possible, field measurements for wind environments at specific engineering sites should be undertaken before wind tunnel model tests.

(4) The fluctuating wind pressure distributions obtained by wind tunnel model tests under traditional open terrain ABL turbulent flow are approximately the upper envelopes of the full-scale measurement results. This suggests the conservativeness of the

traditional model tests.

(5) The fluctuating wind pressure coefficients on Peng-cheng cooling tower are found to be much smaller than those measured on other cooling towers over the full half-circle. It is assumed that the differences have resulted from the discrepancy of the turbulence intensity of the oncoming flow. So, occasionally, wind effects obtained from one engineering case cannot be simply generalized to another without knowing the oncoming flow information.

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