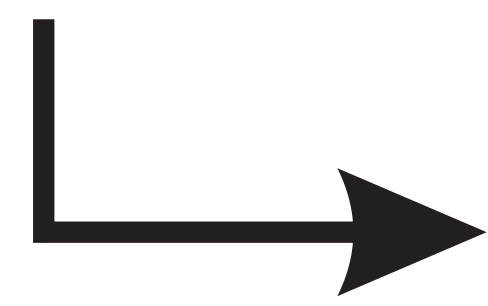


Question:

"How to represent wind climatology by a minimum amount of cases?"

wind climatology = wind rose or probability density density function (PDF)



Our solution: Polynomial expansion across PDF + Gauss quadrature (following Gautschi 1968)

Expressing the wind speed in the third power (U^3) carries our approach over to the wind farm energy. Thereby we reproduce about 98-102% of the Annual Energy Production (AEP, Table 1) compared to a full run using an engineering wake model.

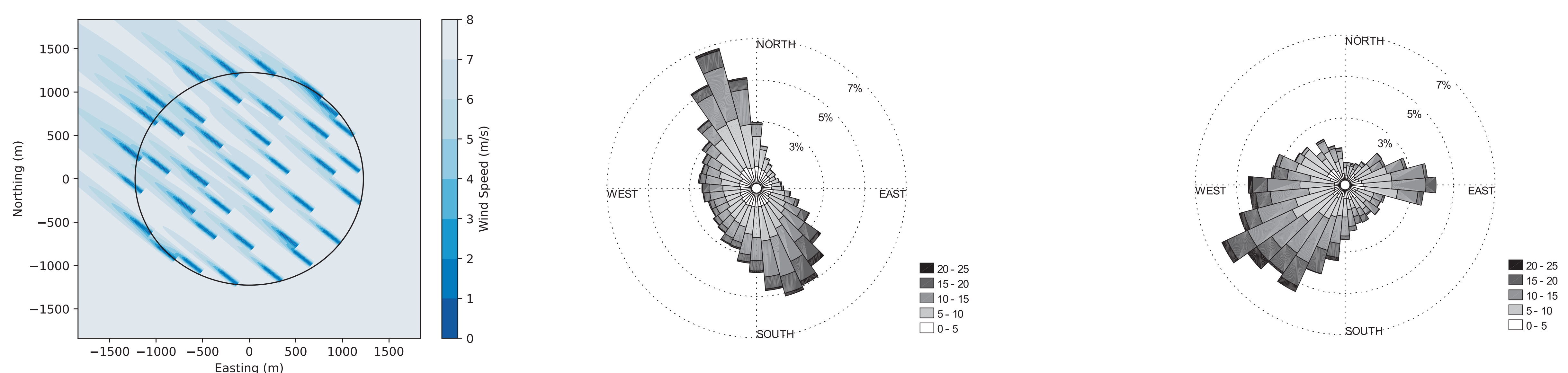


Figure 1. Left: Wind farm used for testing. Wake effects indicated. Middle and right: Wind rose from the west coast of southern Norway and from Nantucket, USA used for tests. Results are shown in Table 1.

Thousands of data points in a wind rose (Fig.1) is reduced to very few cases (e.g. 9 data points, red dots in Fig. 2) and the integrated PDF virtually stays the same.

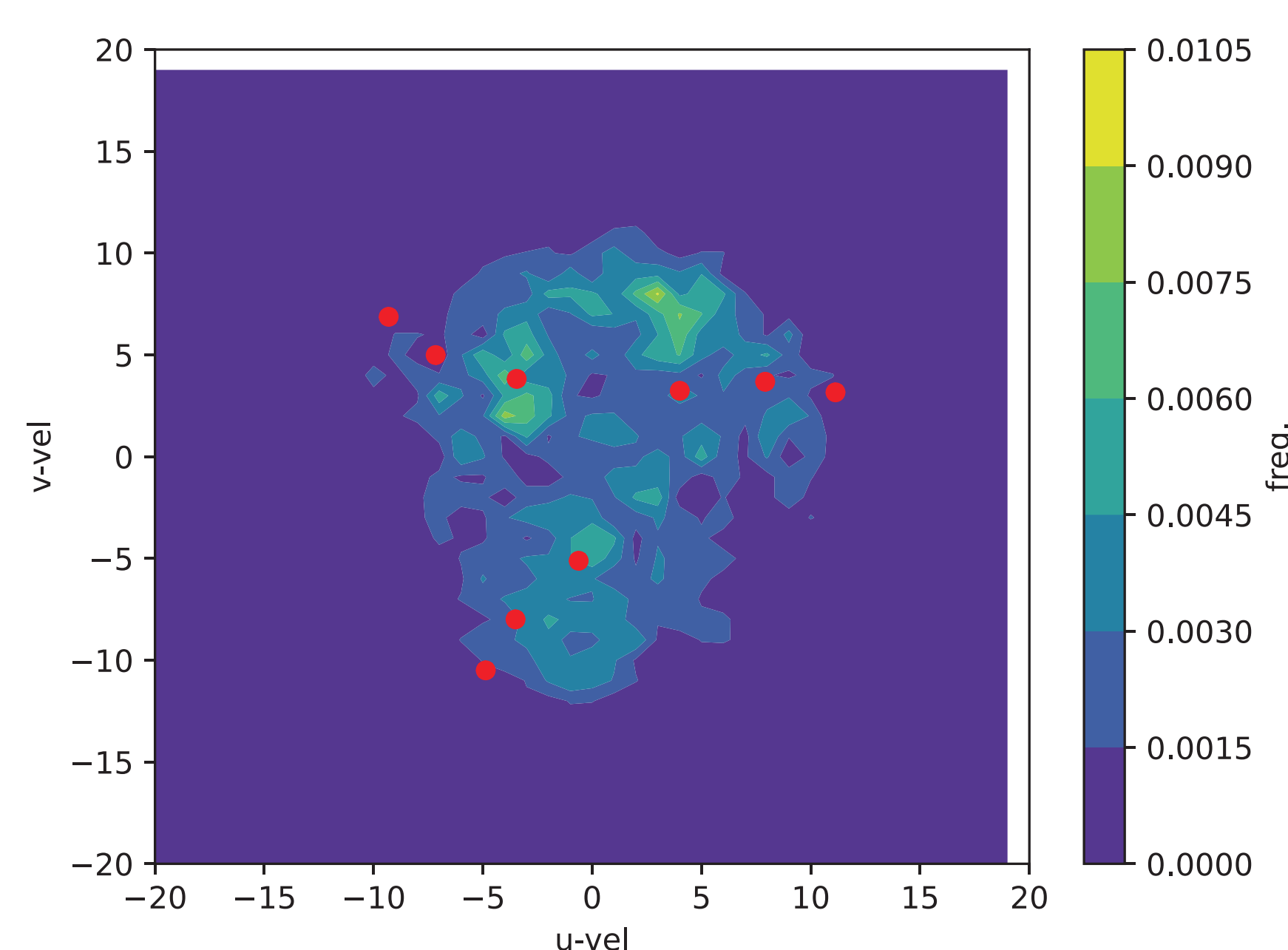


Figure 2. Nantucket PDF (contour plot) and the 3 x 3 nodes in the polynomial expansion giving 99% of the full time series AEP.

Table 1: Reproduction of full timeseries wind rose (U^3) and full time series AEP.

	west coast - Norway	Nantucket
AEP	98.6%	99.2%
U^3	101.4%	98.5%

Our method enables a smart choice of cases to simulate the wind climatology. Potentially, more sophisticated and computationally expensive tools can be used as very few realisations are needed.