$$\frac{M^2}{u^2} = \frac{\Gamma^2\left(1+\frac{1}{k}\right)}{\Gamma\left(1+\frac{2}{k}\right)}$$

- note: assumption: total distribution is Weibull distribution

   Step 4: Shelter effects

   Correction of Weibull A parameter depending on: - distance obstacle-site (x)

- height and length of obstacle (h, L)

- height at site (H)

- porosity of obstacle (P)

   $\rightarrow$ empirical relationships

   Step 4: Orography

   Correction for speed-up effects from local terain inhomogeneities

   Assumption: flow is modelled as potential flow

$\rightarrow$ velocity is gradient of a potential $\boldsymbol{u} = \nabla\chi$

$\rightarrow$ calculation of potential flow perturbations by terain

advantage: mathematically attractive description (polar representation)

$\rightarrow$ potential flow perturbation

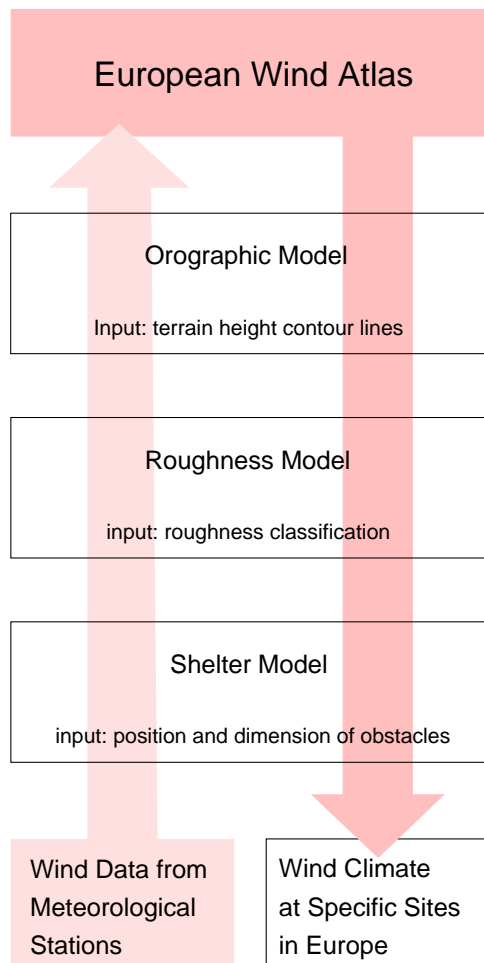$\rightarrow$ surface friction effects

   $A_{corr} = A(1 + \Delta S)$

$\Delta S = f(H.L)$ with half width L and height H

   for smooth hills (slope $<\approx 0.3$) only!

16.2 Resource Assessment in Complex Terrain - Mesoscale Modeling

European Wind Atlas

Orographic Model

Input: terrain height contour lines

Roughness Model

input: roughness classification

Shelter Model

input: position and dimension of obstacles

Wind Data from Meteorological Stations

Wind Climate at Specific Sites in Europe

Fig. 16.1. Structure of the Wind Atlas Analysis and Application Programme.