Power curve

Engineering

Homework #5 Assumption: The mean power obtained over time is not the same as the one obtained in a steady wind operating at the same speed.

2 – Radial velocity refers to the constituent of the wind vector located on the " look" direction of the radar (May 9). It is represented mathematically as e. u, where ' e' represents the unit vector located along the measurement direction while the ' u' represents the wind vector. In order to close the retrieval problem, additional information can be drawn from numerical frameworks that incorporate the flow of physics or rather the assumption of homogeneity of the wind vector over the ' section area'.

3 – The idea of Eddy Viscosity refers to the stress in a fluid that arises from unsettled motions. It can be modeled in a similar manner to that of the pressure that develops from molecular viscosity. That means that there is eddy viscosity that acts as super viscosity and can provide turbulent stress when multiplied by the mean gradients. Eddy viscosity is valuable since it provides us with a way to estimate the new terms developed by inserting the Reynolds decomposition through closure of the turbulent flow equations.

4- Solar insolation leads to large eddies especially during the day. The convective turbulence also leads to the development of a mixed boundary layer. The energy shuts down, and the turbulence keeps spinning aloft as the sun goes down. However, the energy is also suppressed down towards the ground due to the stably stratified turbulence. Suppression of the vertical motions by the stable flow forces the stable boundary layer to be thinner.

5- The twist in typical wind turbine blades occurs due to the differences in relative velocity wind vector (May 212). There are larger components of wind that are associated with the relative motion that occurs between the blade and the air at large.

6- One of the issues discussed in class was the current bottleneck with transmission lines. The second was the dual challenges that occur when competing with local companies that are invested and maintained by the state.

7- Turbulent energy develops from the large scale motions and gradients in the governing equations. For instance, flow instabilities get transferred to the medium scale motions, which transfer to the smaller scale motions. The smaller scale gradients become large enough and force the viscosity to dissipate turbulent kinetic energy. At the inertial subrange, turbulent kinetic energy passes through this range of scales without much dissipation.

8 – $u_2 = (u_1 + u_4)/2$ Bernoulli's Eng. and conservation of mass, conservation of momentum, F= ma.

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11 – The variability of wind the resource is equal to the variability of wind power. On the other hand, the variability of fuel costs is also equal to the variability in the power production costs. Traditionally, the cost of natural gas has been highly variable.

12 – Capacity factor refers to the actual power produced to house sign power.

13 – The foundations and cables are more expensive for offshore based wind projects. Bigger turbines are easier while wind resources are better at offshore. Offshore wind projects are closer to the users of electricity.

14 – Coal and Nuclear are less acceptable while solar and winds are most acceptable.

15 – Wind resources are strong at the Middle of the country. Coasts have major users, thereby requiring large transmission lines.

16 – Wind energy and natural gas.

17 – Doubling wind increases the energy factor by 8 since the energy in wind is directly proportional to (rho*A*u3).

Works Cited

May, Brian. A survey of radial velocities in the zodiacal dust cloud. New York: Springer; Bristol : Canopus Publishing, 2008. Thesis.