Tutorial 3: Weather boundary conditions

Q1. List the weather parameters that influence a building's energy consumption and environmental conditions.

1. dry & wet bulb temperature (C);
2. wind speed and direction (m/s & ° from N);
3. global and diffuse solar radiation (W/m^2);
4. net longwave radiation (W/m^2); and
5. relative humidity (%)

For simulation, hourly (at least) time series are required.

Q2. Identify two major issues that must be addressed when selecting weather data for a particular site.

1. selection of representative extreme and typical conditions (to test operational robustness); and
2. adequate representation of overall severity (to test whole life performance).

Q3. Select three different energy systems and state for each the relative importance of the principal weather parameters.

1. In buildings, temperature dominates energy demand because it dictates heat losses/gains through conduction and air leakage. Solar radiation is next in importance, especially in designs embodying passive solar elements. Where air conditioning is employed relative humidity will be a major factor
2. With solar photovoltaics, the solar irradiance is the dominant factor. The temperature will have a second order effect because the lower the panel temperature the greater its efficiency.
3. With a CHP plant, the output is only indirectly influenced by the weather parameters through the load heat-to-power ratio, which influences plant operation.

Q4. Most weather stations are located at airports. What are the potential problems when recorded data are used to design a building including renewable energy technologies in the city centre?

The data will not adequately represent the heat island effect of cities or the local micro-climatic impacts of urban forms (solar shading, wind attenuation *etc*.).