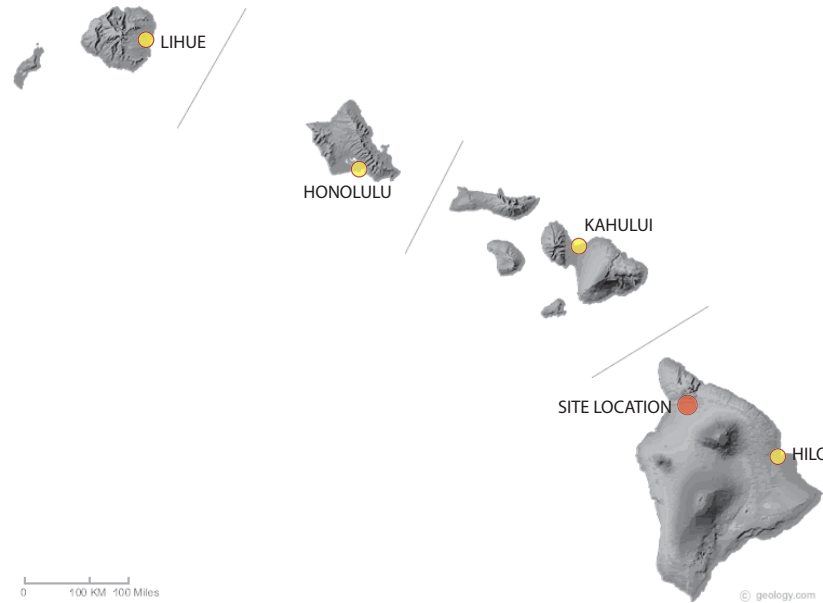


Available Weather Data

All building simulation programs use some means of representing the local climatic conditions relative to building models which usually consists of an hourly set of temperature, humidity, wind speed and direction, solar radiation and cloud cover data for a year, which is 8760 hours of weather data.

Examples of these typical data include TMY2 (NREL 1995: typical meteorological year) and WYEC (ASHRAE 1997). The weather data from EnergyPlus (used for this study) is a text-based format derived from the Typical Meteorological Year 2 (TMY) weather format. It was found to be available for the locations shown in Fig. 1 as of June 2008. The closest location to the site (marked in red) for which hourly weather data is available is Hilo.

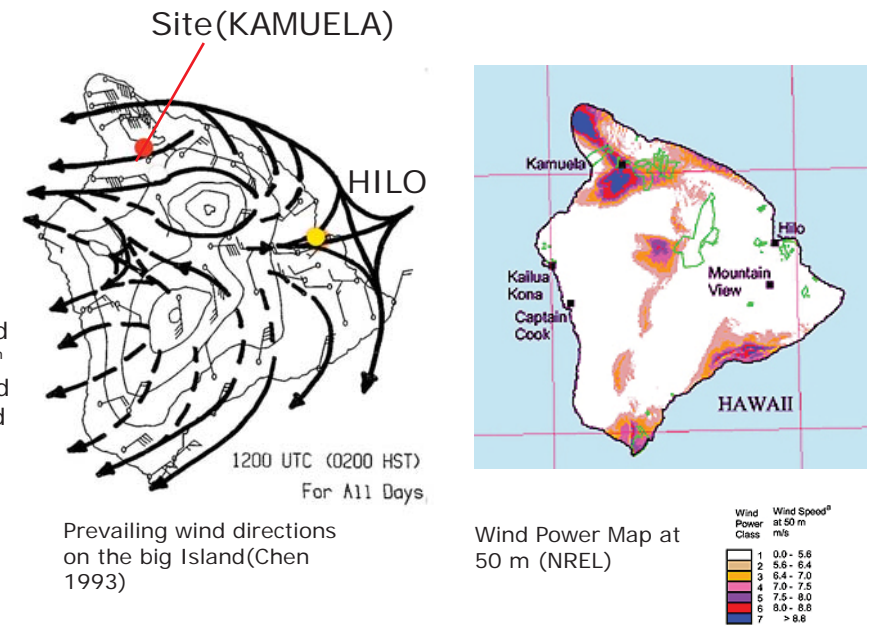


Inadequacy of available data

Although Hilo is located on the same island as the site (Kamuela, located on the Waimea Saddle), the wind flow patterns in terms of direction and speed are different than those observed on site.

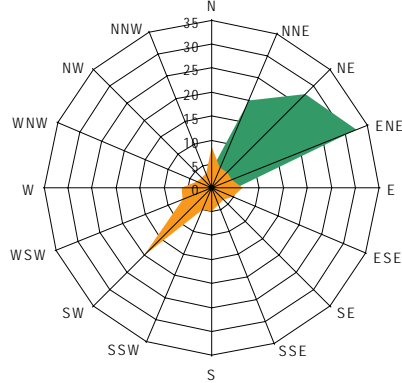
Wind at Hilo is often the net resultant of the prevailing trade winds and downhill katabatic winds, while Kamuela experiences high wind speeds consistently as the winds get channeled through the Waimea Saddle unobstructed (Chen 1993). Hilo thus experiences lower average wind speeds while Kamuela has higher average wind speed (>4m/s).

This fact requires a different data set than the available TMY2 weather data from Hilo, to represent the weather conditions at kamuela.

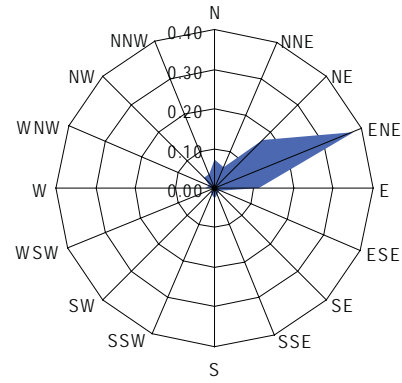


STEP 1: Prevailing Wind Direction

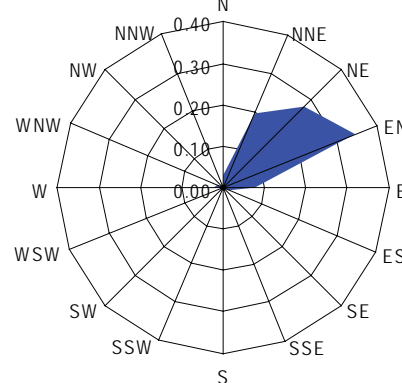
The direction of prevailing winds for Kamuela are very distinct from those recorded at Hilo. An hourly data set was thus generated by modifying an existing weather data set with similar characteristics



Annual Wind frequency Rose
 ■ Hilo: epw weather data
 ■ Kamuela: Kamuela airport jan-dec 1949



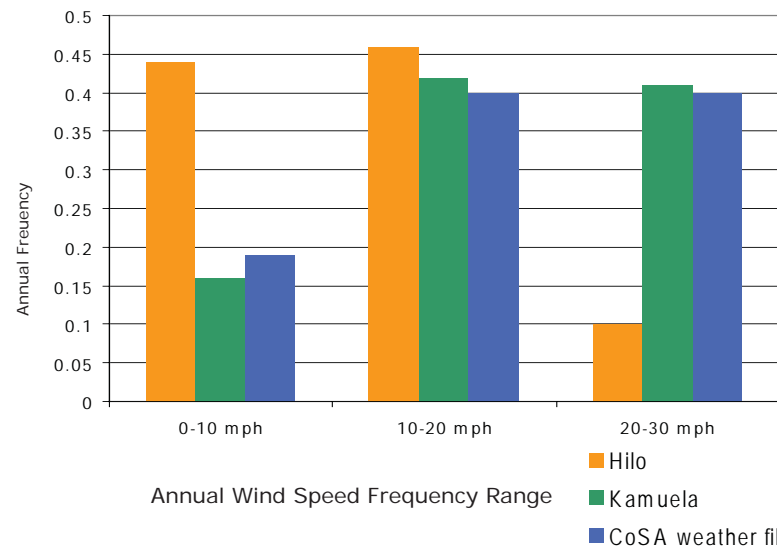
Annual Wind frequency Rose
 Hourly data from an available weather file with similar characteristics as Kamuela



Adjusted Annual Wind frequency Rose
 Hourly data manually adjusted to represent Kamuela in a hourly format (8760 data points on the CoSA weather file)

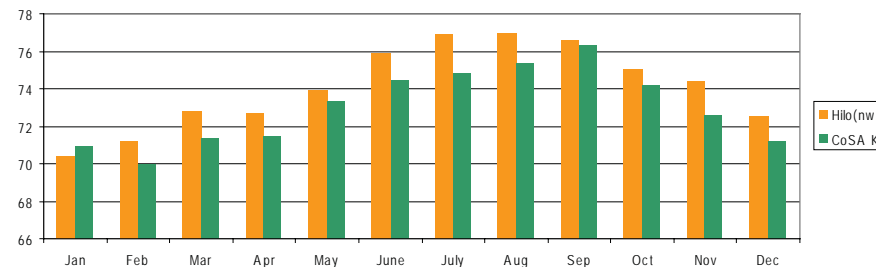
STEP 2: Wind Speed

Hilo is a low lying area which experiences lower average winds speed compared to Kamuela. The Hilo wind speed data was modified to create a wind profile similar to Kamuela (recorded Jan-Dec 1949). The trade winds blow unobstructed over the town of Kamuela located on the Waimea saddle, and descend into the leeward side. Hilo is under the influence of both, the trade winds and the downwards katabatic winds flowing in the opposite direction of the trade winds.



STEP 3: Temperature

The Annual recorded average dry bulb temperature for Hilo is 73.0 F while that for kamuela is 72.1 F (www.countrystudies.us). The temperatures of the two location are in close compliance throughout the year with kamuela remaining 1-2 degree F lower.



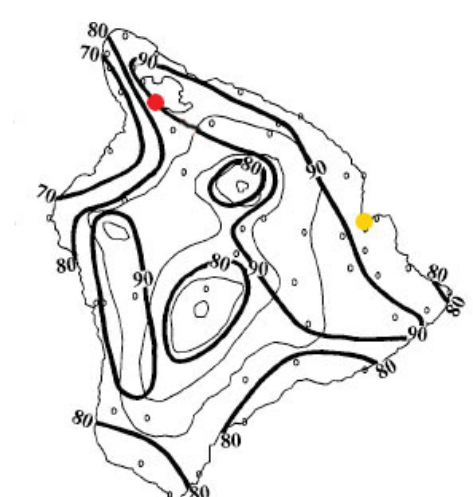
Monthly Average Temperature



The mean diurnal amplitude of surface temperature (Hilo(yellow) and kamuela(red) lie in the similar range)

STEP 4: Relative Humidity

Relative Humidity is dependent on the dry bulb temperature and the moisture content of the air. RH is a measure of the degree of saturation of the air at a particular temperature. The mean diurnal data and data recorded at 1800 HST show that the locations, Hilo and Kamuela are within the same humidity range. There may be variations during the day as moisture content is dependent on wind and topography (topography effects rainfall and thus effect moisture content) on the big island. Hilo is under the influence of trade winds and night time downslope dry winds, while kamuela experiences the trade winds at all times. During the day time at least the moisture content can be expected to be similar. The weather file generated by CoSA uses the same RH data as Hilo.



RH % at surface at 1800 HST