

An example of a geographical cloud system that changes regularly with the season and the time of day is the low-level, layered stratus clouds that cover much of the world's oceans. Stratus clouds are more frequent during the summer months of the Eastern Pacific and the Eastern Atlantic and in the hours before sunrise.

Another example of a geographical cloud system that changes regularly with the season and the time of day is cumulonimbus. Cumulonimbus are large columnar clouds that can extend to high altitude. These clouds are concentrated where surface temperatures are high and there is a general upward movement of the air. An example is a zone known as the Intertropical Convergence Zone (ITCZ). In the ITCZ, the trade winds of the Northern Hemisphere converge with those of the Southern Hemisphere. Cumulonimbus

have high concentrations of droplets and ice crystals, which can grow to a large size. Cumulonimbus are often responsible for the frequent summer afternoon rainfall of South East Asia, North America, and Europe, and the December, January, and February rainfall of the Amazon basin.

Rain rate is another consideration in sensor selection. Figure 2 shows the world-wide average annual precipitation (rain and snow equivalent rain) characterized as wet (greater than 1500 mm/yr), temperate (between 250 mm/yr and 1500 mm/yr), and arid (less than 250 mm/yr). It is noted that over 90 percent of the world receives less than 1500 mm/yr rainfall. It is also noted that cloud cover variations due to geography, season, and time of day are reflected in the rainfall variations with geography, season, and time of day.

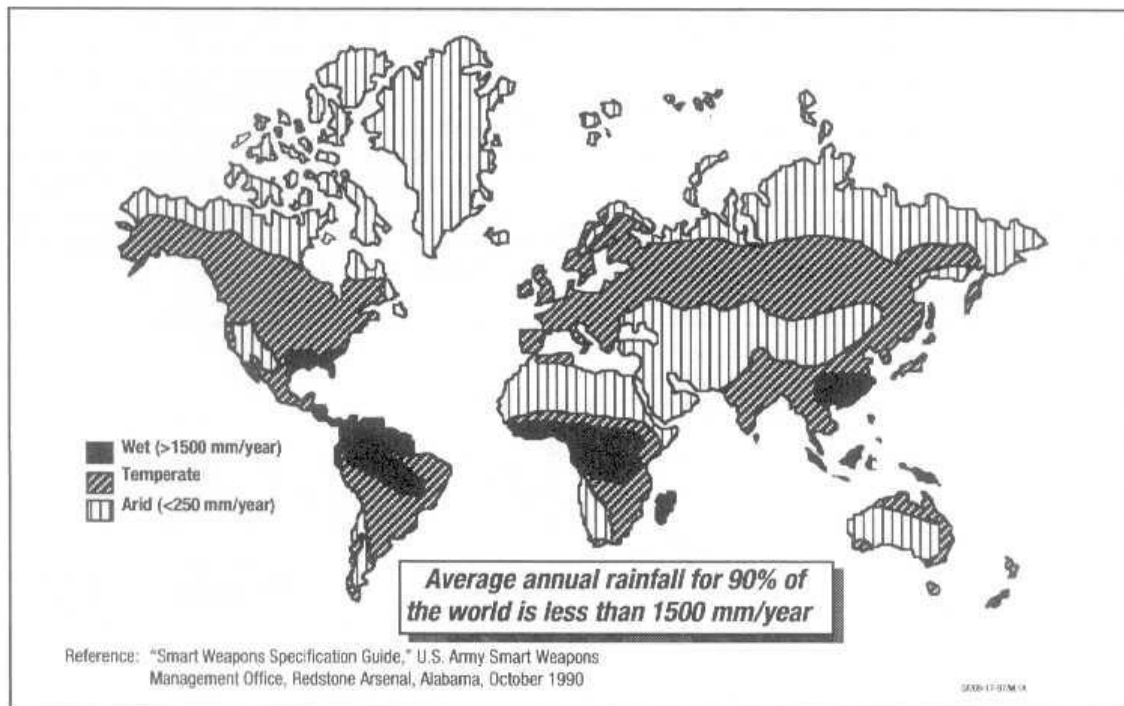


Figure 2. Rain Climatology

UTA sensor attenuation is greater for rainfall from high altitude clouds. There is a longer path length through the rain for high altitude clouds than for low altitude clouds. Figure 3 shows the probability of cloud height for the temperate, wet, and arid regions of the world's land mass. Note that clouds in arid regions tend to occur at higher altitudes while the clouds in the temperate and wet regions tend to occur at lower altitudes. Clouds tend to occur at a height of 1.0 to 5.0 km altitude.

Figure 3 also shows the probability of rain rate for a temperate region of the world that has a relatively high annual rainfall. The average probability of no rain is 80 percent for this region. The probability of rain rate less than 4 mm/hr is very high--96 percent. Also shown for comparison is an average probability of rain rate for the Middle East. The probability of no rain is very high--96 percent and the probability of rain rate less than 4 mm/hr is even higher--99 percent.