Solution

# Data Measurement

Use the formula: σm2 = σp2 + σe2

Therefore the standard deviation of the measurement error is the square root of σm2 - σp2.

1. The measured standard deviation at the manufacturer was 3 mm. The actual standard deviation of the product found by the customer was 1 mm. Therefore, the standard deviation for the measurement system error is the square root of 8 or 2.82 cm. The measurement system at the manufacturer is ineffective for this product.
2. In this case, consider the National Weather Service to be the true value and the farmer’s weather station the measured value. The column on the right shows the error (sqrt of measured squared minus the true value squared). Based upon this, rainfall and % direct sunlight can be fully trusted, temperature and humidity are relatively close, wind speed is unreliable, and barometric pressure was absolutely awful.

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| --- | --- | --- | --- |
|  | Std Deviation National Weather Service | Std Deviation Farmer’s Weather Station | Std Deviation of Measurement Error |
| Temperature | 11 deg | 12 deg | 4.8 deg |
| Rainfall | 8 mm | 8 mm | 0 |
| Humidity | 9% | 11% | 6.3% |
| Barometric Pressure | 23 mm | 37 mm | 29 mm |
| Wind Speed | 3.4 K/hr | 4.4 K/hr | 2.8 K/hr |
| % Direct Sunlight | 17% | 17% | 0 |