

MAT 395/495

Scientific Data Analysis and Computing

Summer 2020

Topic 6

Uncertainties in Measurements

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Uncertainties

Reading

Data Reduction and Error Analysis for the Physical Sciences
by P.R. Bevington, D.K. Robinson, 3rd Ed.

Ch. 1 Uncertainties in Measurements: pg. 1—13

An Introduction to Error Analysis
by J.R. Taylor, 2nd Ed.

Ch. 1, 2, 4 Description of Error analysis, how to report and use uncertainties

Lehigh County, PA

Monday 12:00 PM

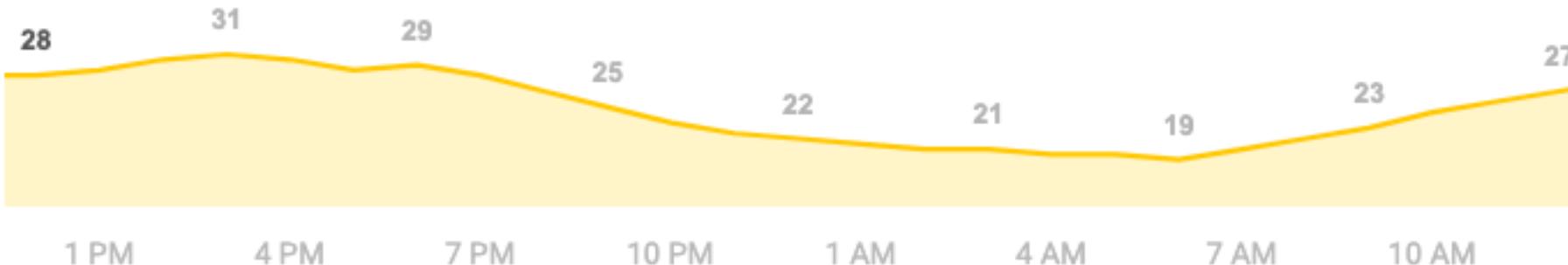
Partly cloudy



28 ^{°C | °F}

Precipitation: 15%
Humidity: 59%
Wind: 11 km/h

Temperature Precipitation Wind



1 PM

4 PM

7 PM

10 PM

1 AM

4 AM

7 AM

10 AM

Mon



31° 19°

Tue



31° 19°

Wed



29° 15°

Thu



28° 16°

Fri



29° 16°

Sat



32° 19°

Sun



30° 18°

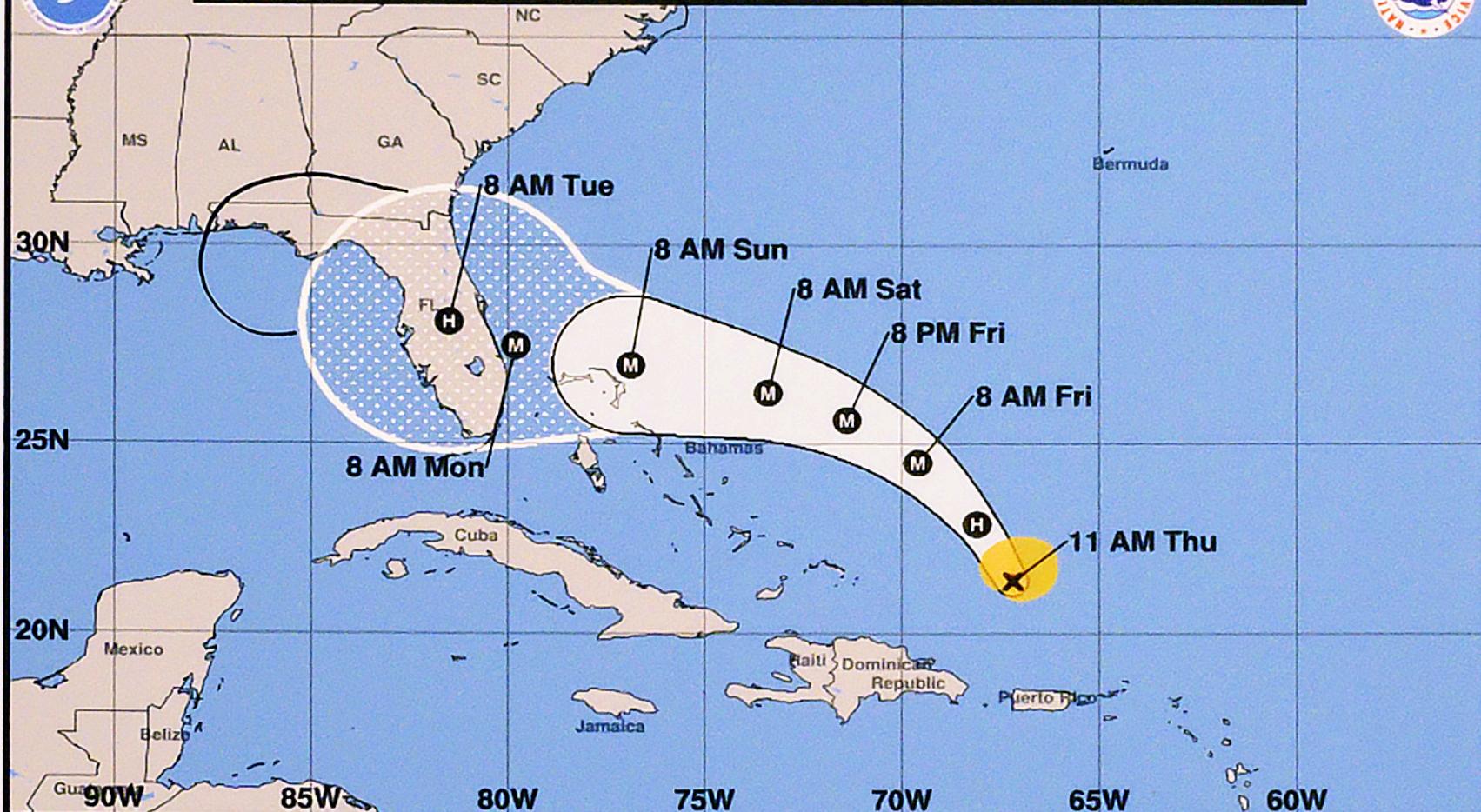
Mon



31° 18°



Note: The cone contains the probable path of the storm center but does not show the size of the storm. Hazardous conditions can occur outside of the cone.



Hurricane Dorian

Thursday August 29, 2019

11 AM AST Advisory 21

NWS National Hurricane Center

Current information: X

Center location 21.4 N 67.2 W
Maximum sustained wind 85 mph
Movement NW at 13 mph

Forecast positions:

● Tropical Cyclone ○ Post/Potential TC
Sustained winds: D < 39 mph
S 39-73 mph H 74-110 mph M > 110 mph

Potential track area:

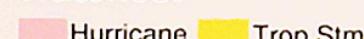


Day 1-3



Day 4-5

Watches:



Hurricane

Warnings:



Trop Stm

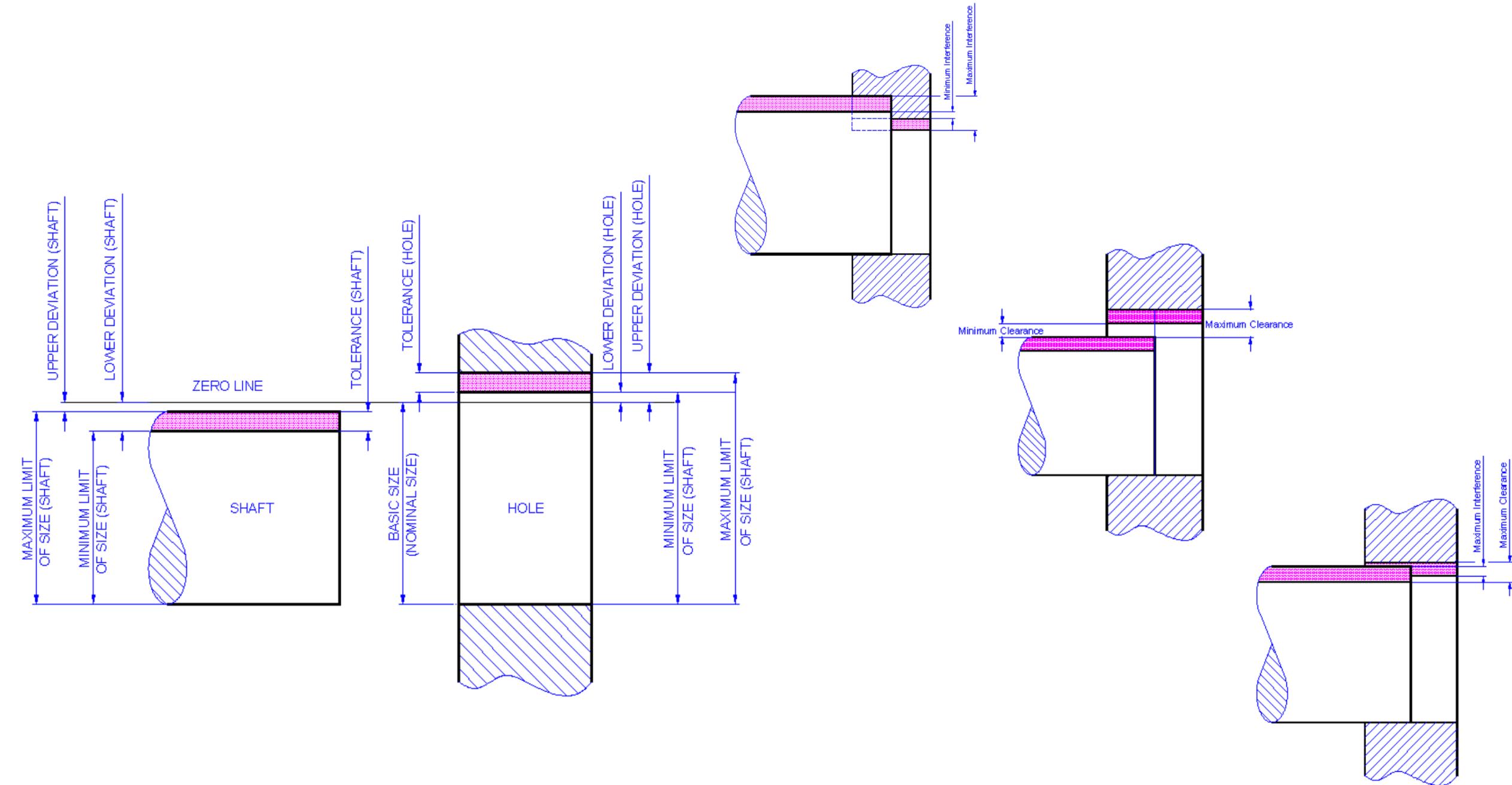
Current wind extent:



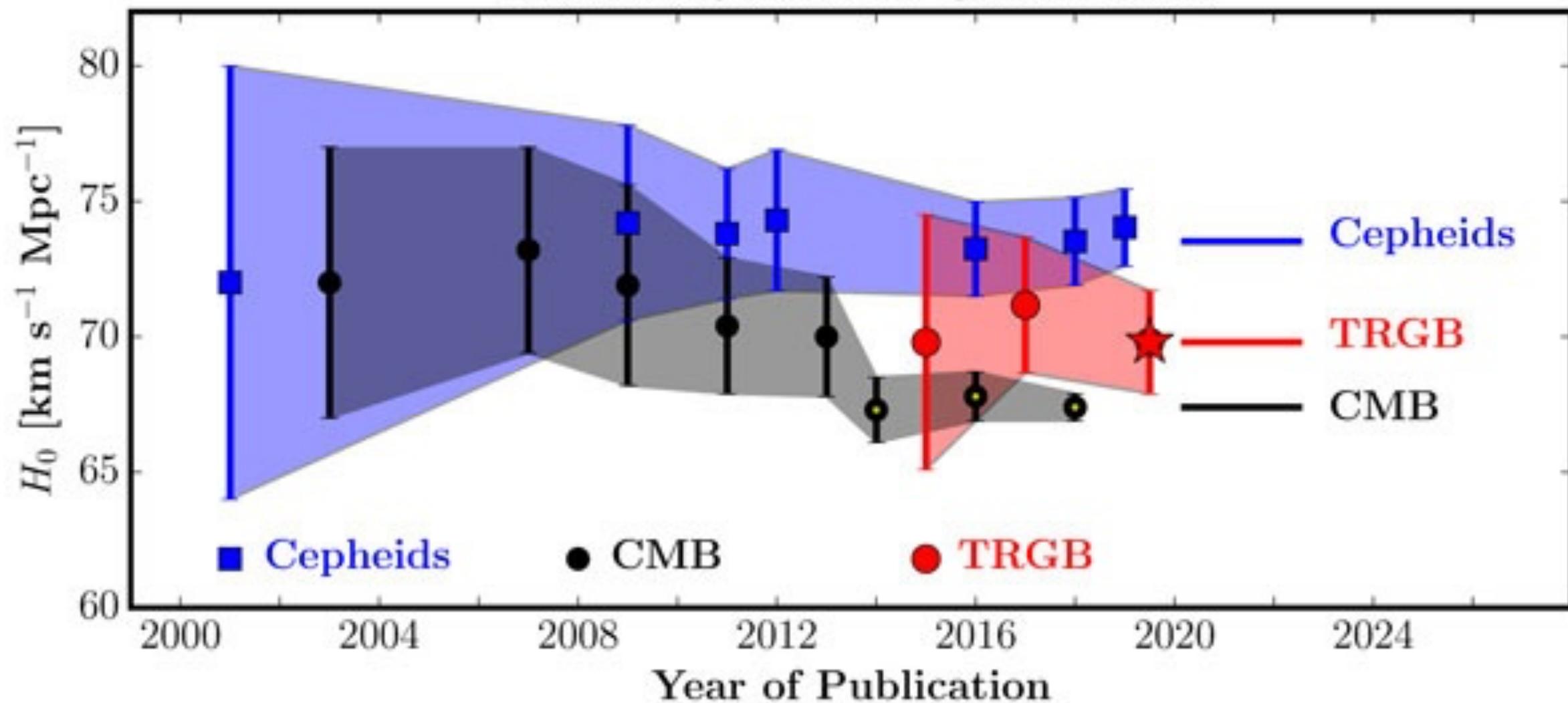
Hurricane

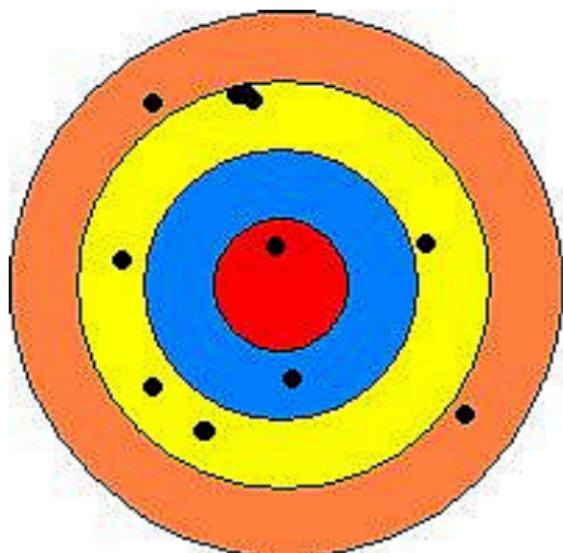


Trop Stm

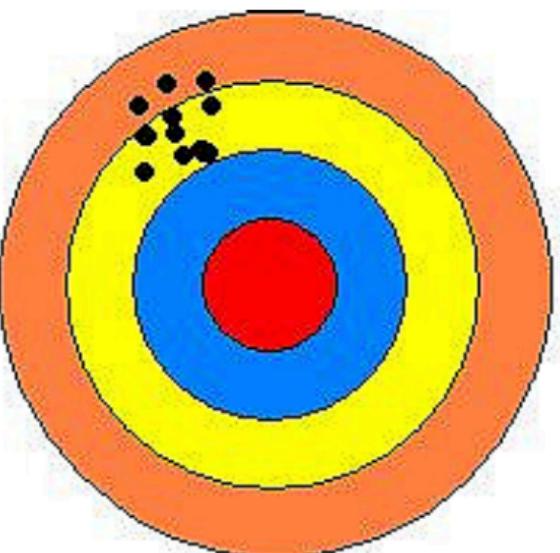


Hubble Constant Over Time

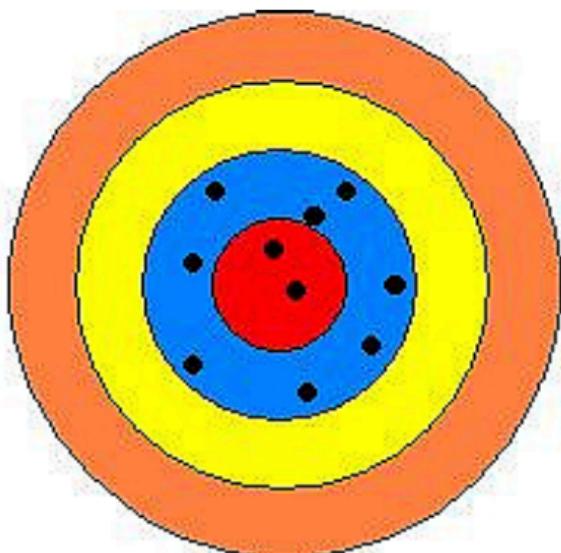




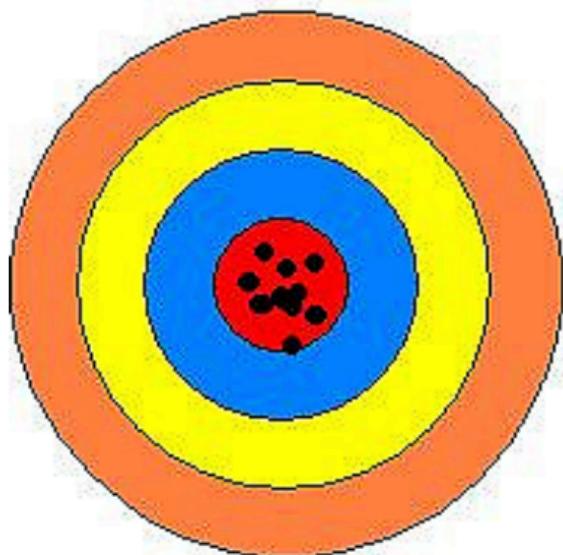
Not Precise, Not Accurate



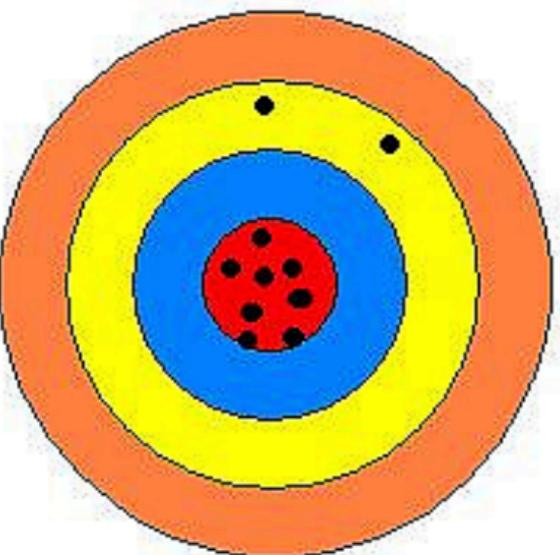
Precise, Not Accurate



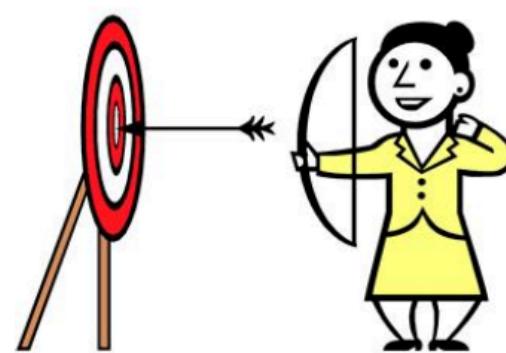
Accurate, Not Precise



Accurate, Precise



Errors





Fluke 8846A multimeter

Example Vdc (reading)=0.85V on 1V range

$$\Delta V = 0.85 \times (1.8 \times 10^{-5}) \\ + 1.0 \times (0.6 \times 10^{-5}) \cong 2.2 \times 10^{-5} = 22\mu V$$

8846A Accuracy

Accuracy is given as \pm (% measurement + % of range)

Range	24 Hour (23 \pm 1 °C)	90 Days (23 \pm 5 °C)	1 Year (23 \pm 5 °C)	Temperature Coefficient/ °C Outside 18 to 28 °C
100 mV	0.0025 + 0.003	0.0025 + 0.0035	0.0037 + 0.0035	0.0005 + 0.0005
1 V	0.0018 + 0.0006	0.0018 + 0.0007	0.0025 + 0.0007	0.0005 + 0.0001
10 V	0.0013 + 0.0004	0.0018 + 0.0005	0.0024 + 0.0005	0.0005 + 0.0001
100 V	0.0018 + 0.0006	0.0027 + 0.0006	0.0038 + 0.0006	0.0005 + 0.0001
1000 V	0.0018 + 0.0006	0.0031 + 0.001	0.0041 + 0.001	0.0005 + 0.0001

