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Data uncertainty: what is it, where does it come from, and why should we care?

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Data uncertainty arises because there is not a known, one-to-one correspondence between the observation and the quantity of interest.

Why should we care?

Because scientific conclusions drawn or decisions made as if that correspondence did exist may result in costs that are related to the magnitude of the error (the difference between the data and the true value of the QOI).

Probability

Why is probability a good way to measure data uncertainty?

- Probability is coherent (internally consistent).
  - important for propagating through processing flows
  - permits universal comparisons
- Probability is intuitive (interpretation as long-run relative frequency).
  - communication by analogy with games (and betting)
- Probability is mathematically precise (it's branch of mathematics).
  - the basis for hypothesis testing (scientific method)
  - the basis for decision theory

Questions? Contact Amy.Braverman@jpl.nasa.gov.

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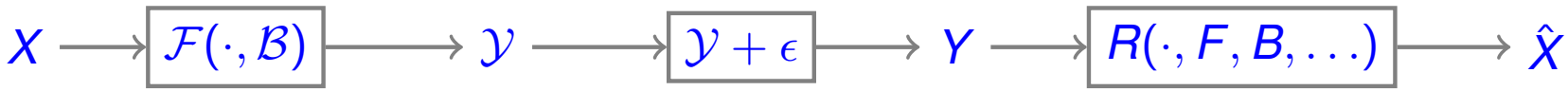
Panel Discussion

Observing system

True state	Forward function	Noiseless radiance	Instrument	Observation	Retrieval	State estimate



$\mathcal{F}$ = nature's true forward function; $\mathcal{B}$= other true quantities.

F = forward model used in retrieval; B= other retrieval quantities.

ϵ = instrument measurement error.

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