A novel use of fractal analysis to constrain Titan's topography

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Based on the work by
Priyanka Sharma and Shane Byrne (2010)

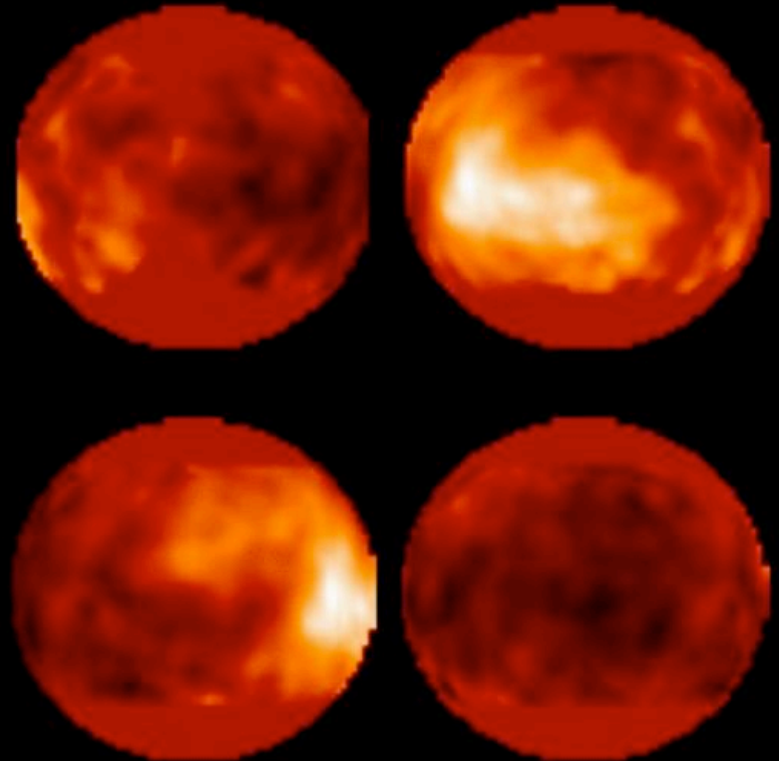*Benoit Mandelbrot*
(1924-2010)

Motivation

Surface of Titan   HST · WFPC2

- 2nd Largest moon
- Only moon with clouds
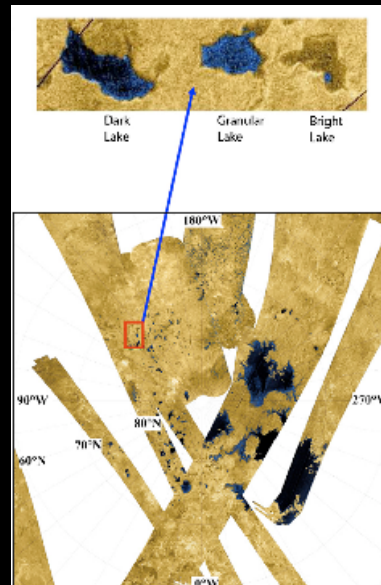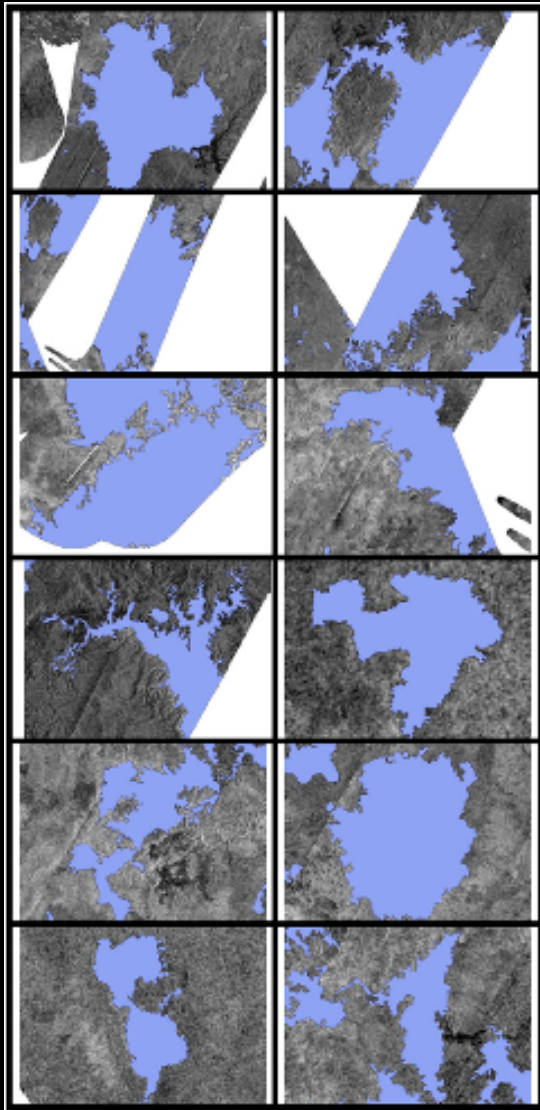- Possible liquid "seas"
  - Can have liquid methane-ethane on surface

⇒ How is Titan's surface evolution different from Earth's?
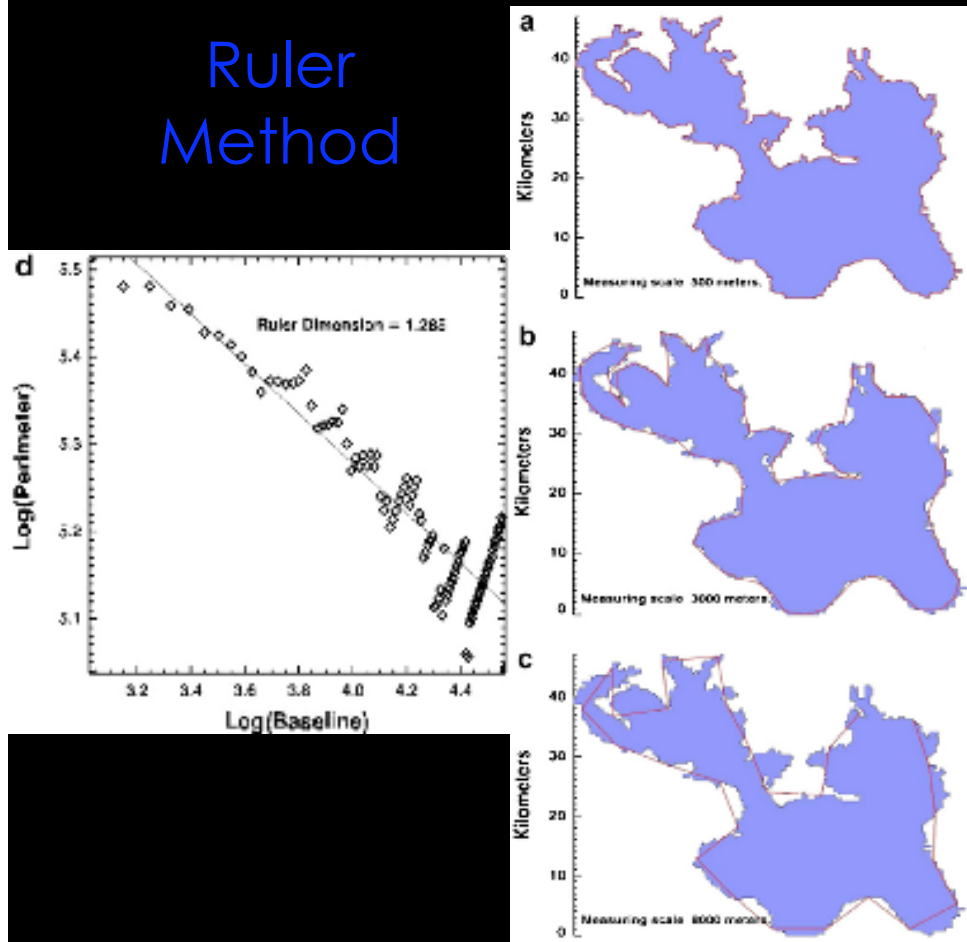
Mapping Radar-Dark Lakes

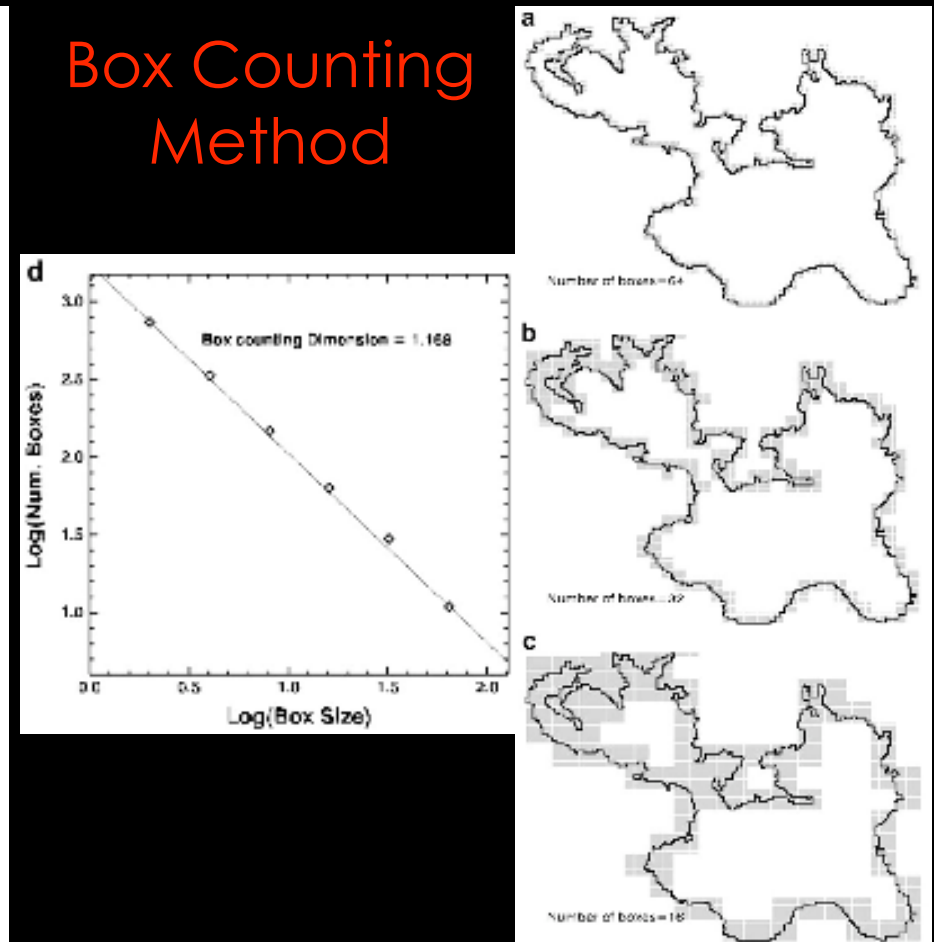One radar-dark "lake" shows evidence of liquid methane-ethane

⇒ 190 of the 290 radar-dark lakes around Titan's North Pole were mapped with Cassini

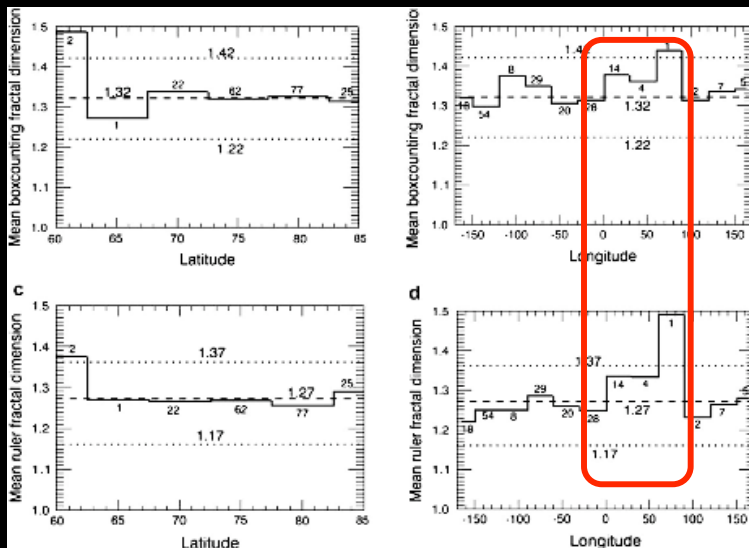# Measuring the Fractal Dimension

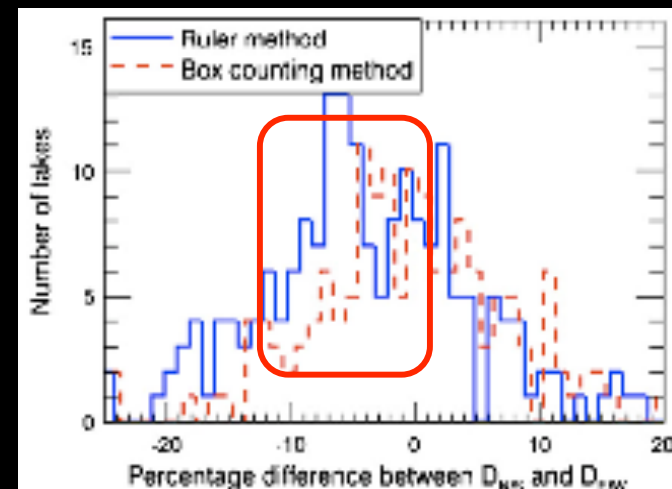## Ruler Method

Box Counting Method

Results:
Characterizing Titan's Topography

mean $D_{\text{ruler method}}$=1.27, mean $D_{\text{box-counting method}}$=1.32
⇒ rough terrain

1. Possible variation with longitude from 0 to 90 degrees.
   ⇒ Region where the largest lakes are located.

2. Anisotropy in the fractal dimensions measured E-W vs. N-S.
   ⇒Anisotropic surface modification processes

Fractal Dimension Analysis on Earth