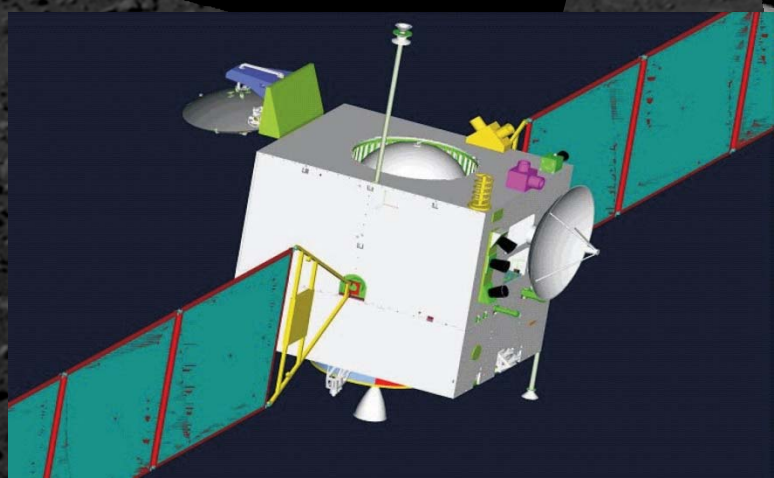
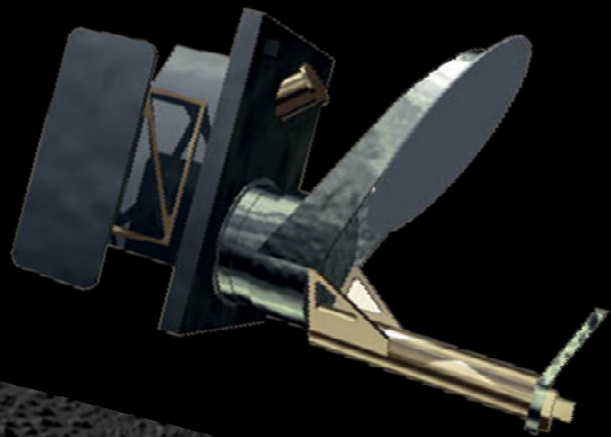


# Could a Microwave Radiometer find Lunar Volatiles?



Matt Siegler (JPL)  
Thanks to Sam Gulkis,  
Imran Mehdi, Mike Janssen



## Could a short wavelength Microwave radiometer find ice?

- Near surface dielectric constant (with cross polarization)
- Near surface thermal gradient
- Extreme sensitivity to chemical species in vapor
- Very low temperatures at high precision
- Development of arrays underway at JPL

### MIRO: Measured Flight Performance

Passband: 190 GHz, ~1.6 mm (millimeter wavelengths); 562 GHz, ~0.5 mm (sub-millimeter wavelengths)

Spectral resolution: < 100 kHz (sub-millimeter)

Spatial resolution: 75 m (millimeter); 25 m (sub-millimeter)

Field of view: < 22 arc minutes (millimeter); < 8 arc minutes (sub-millimeter)

Radiometric sensitivity: 1 K (continuum)

Mass/power: 19.9 Kg / 43 W





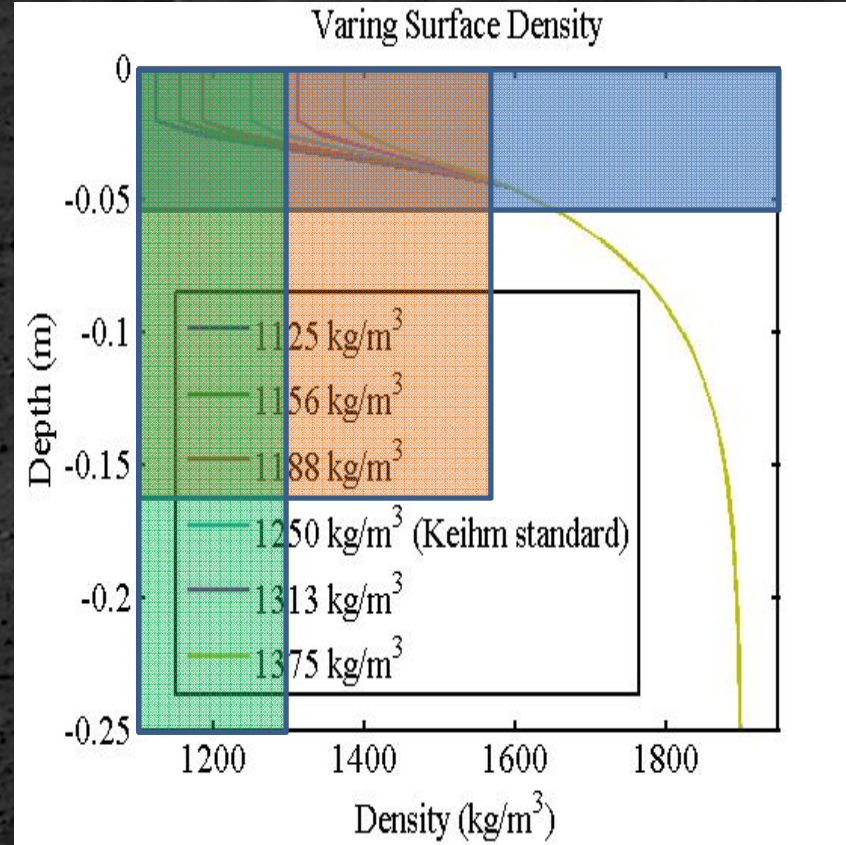
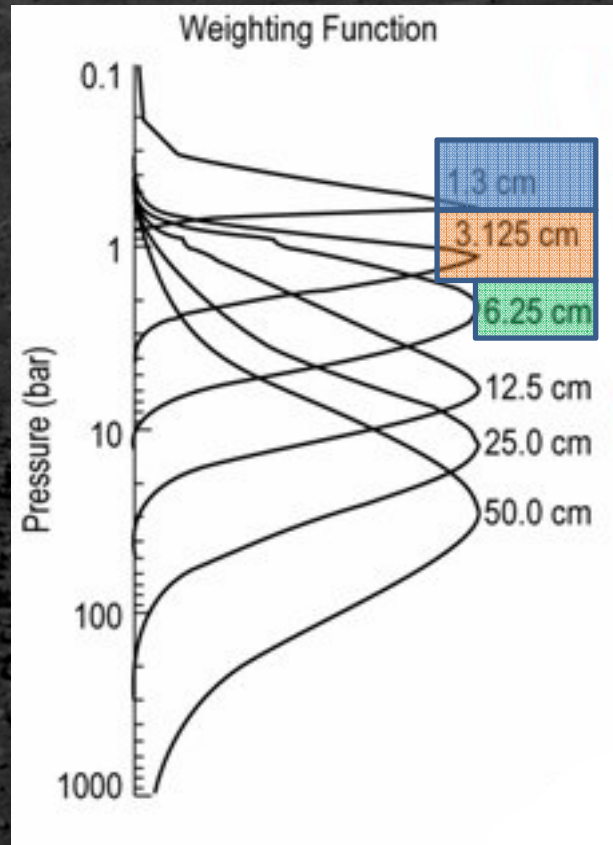
## Could a short wavelength Microwave radiometer find ice?

- Near surface dielectric constant (with cross polarization)
- Near surface thermal gradient
- Extreme sensitivity to chemical species in vapor
- Very low temperatures at high precision
- Development of arrays underway at JPL

### Species visible with MIRO spectrometer

Species	Frequency (MHz)	Transition
Water		
H <sub>2</sub> <sup>16</sup> O	556936.002	1(1,0)–1(0,1)
H <sub>2</sub> <sup>17</sup> O	552020.960	1(1,0)–1(0,1)
H <sub>2</sub> <sup>18</sup> O	547676.440	1(1,0)–1(0,1)
Carbon monoxide		
CO	576267.9305	J(5–4)
Ammonia		
NH <sub>3</sub>	572498.3784	J(1–0)
Methanol		
CH <sub>3</sub> OH	553146.296	8(1)–7(0) E
CH <sub>3</sub> OH	568566.054	3(–2)–2(–1) E
CH <sub>3</sub> OH	579151.005	12(–1)–11(–1) E

# What would the Juno MWR see?





# Could a long wavelength Microwave radiometer find ice?

**Dry regolith and icy regolith will show very different thermal profile with depth, which should appear in microwave data.**  
(in addition to dielectric changes, scattering, etc.)



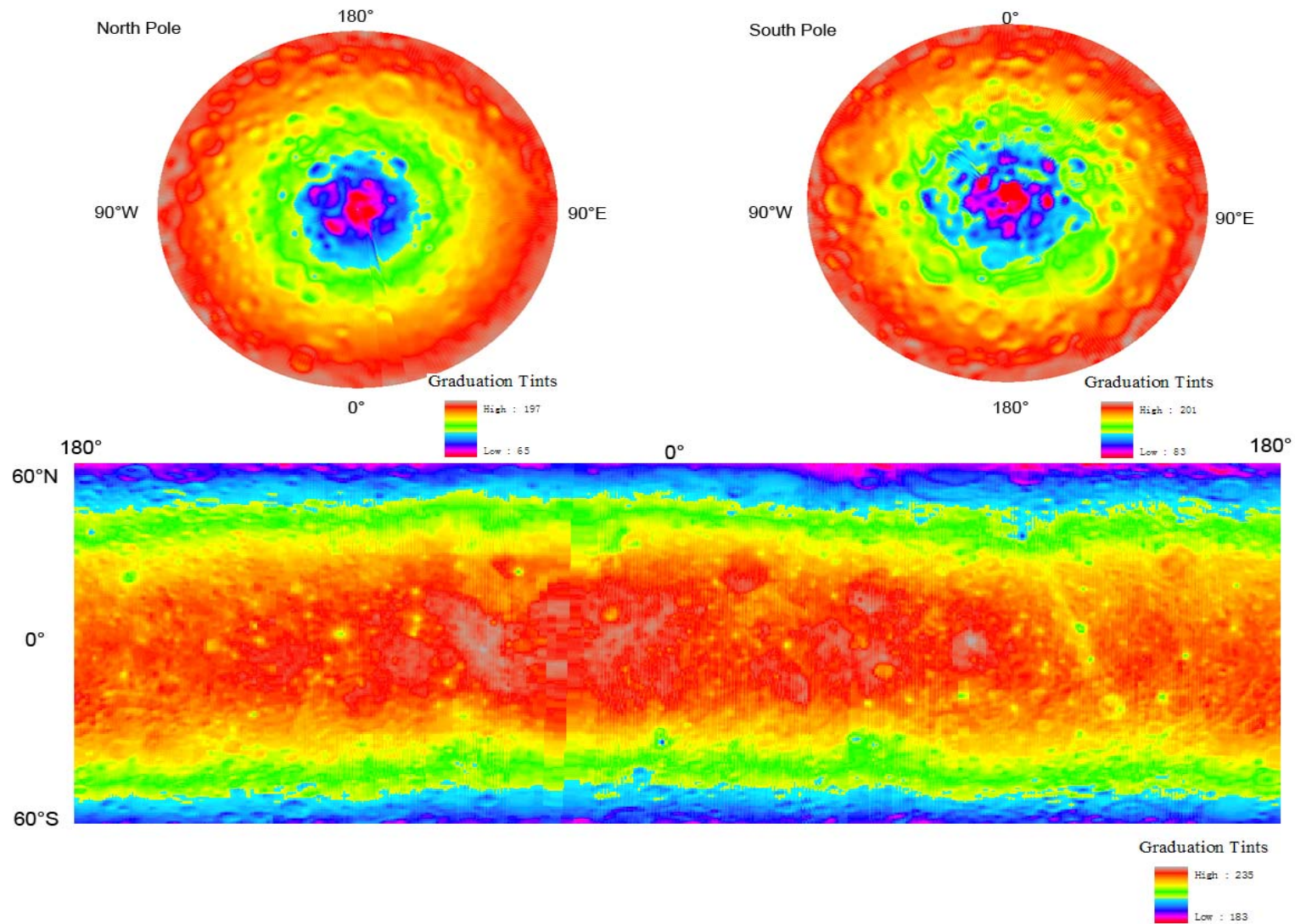
# Could a long wavelength Microwave radiometer find ice?

**Dry regolith and icy regolith will show very different thermal profile with depth, which should appear in microwave data.**  
(in addition to dielectric changes, scattering, etc.)



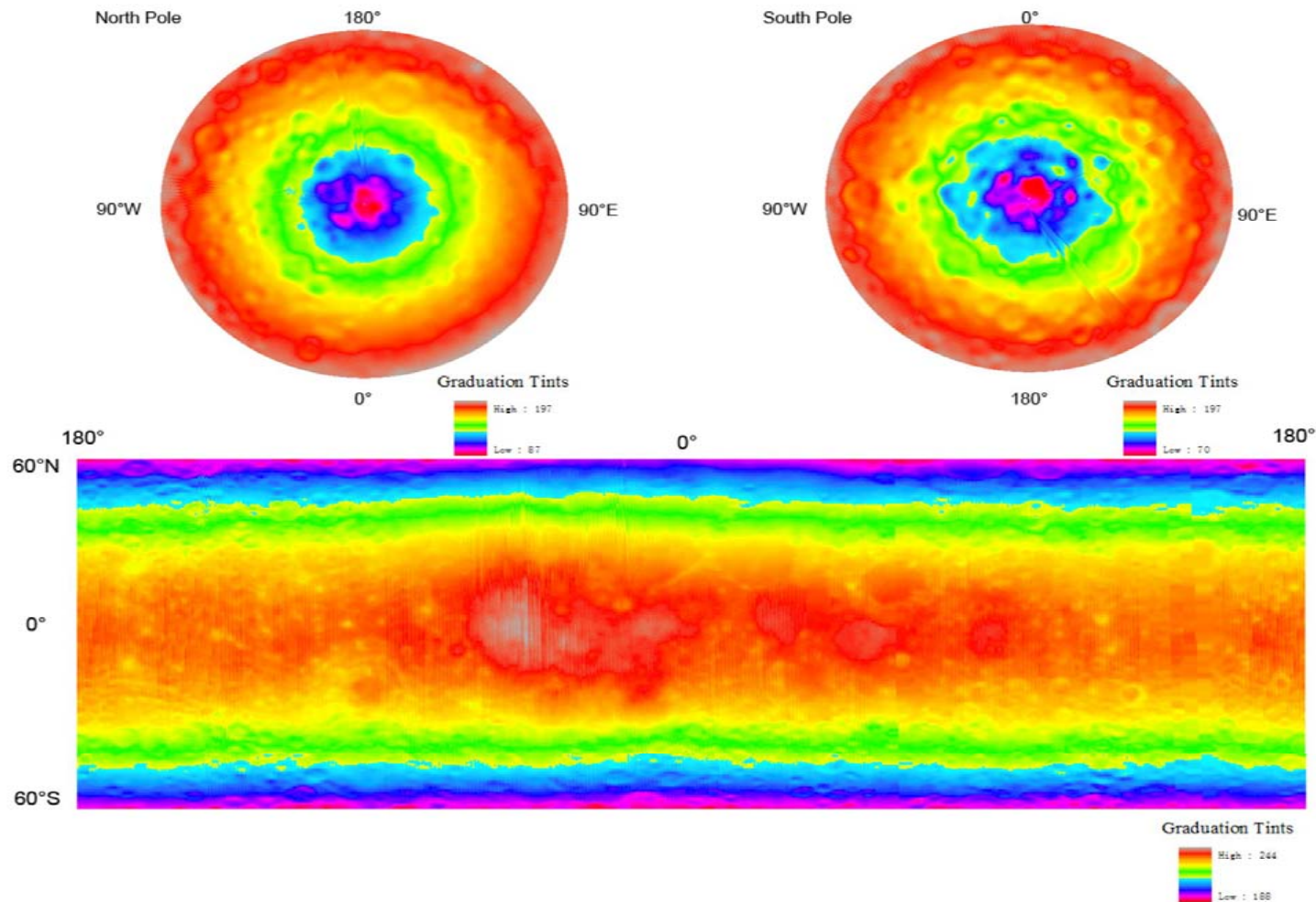


# Chang'e 1 and 2 had a 4 channel microwave radiometer ( 3.0, 7.8, 19.35, 37 GHz)



Nighttime Brightness Temperature Map of The Moon from China's First Lunar Probe Chang'E-1 (37GHz)

# Chang'e 1 and 2 had a 4 channel microwave radiometer ( 3.0, 7.8, 19.35, 37 GHz)



Daytime Brightness Temperature Map of The Moon from China's First Lunar Probe Chang'E-1 (3.0GHz)