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A few notes on InSAR

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Outline

- What is it good for (on Earth)
- Why its hard to for planetary

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SAR vs InSAR

- SAR = synthetic aperture radar: uses the motion of the spacecraft to simulate having a bigger antenna than you really have. Great images!
- InSAR = Interferometric SAR: combine multile SAR passes to create interferograms

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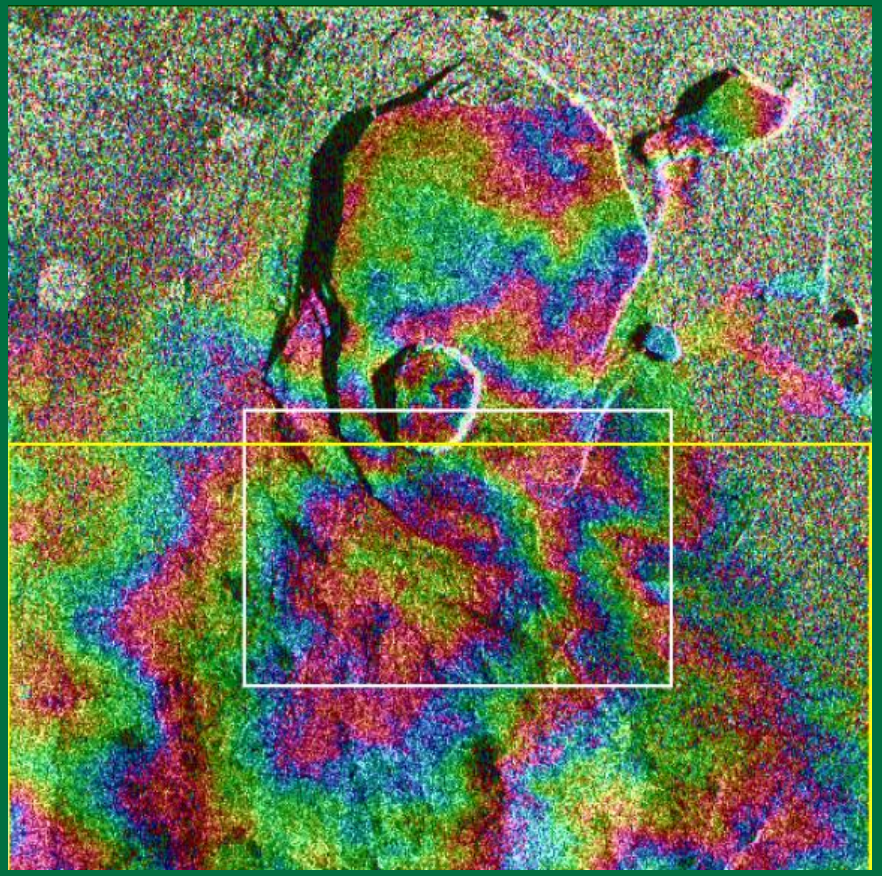

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Interferograms

- Color bands are each one wavelength of ground deformation – cm level geodesy over wide areas!
- Very useful for measuring ground deformation after an earthquake, as magma moves subsurface, etc.
- Hard to use when deformation is many wavelengths

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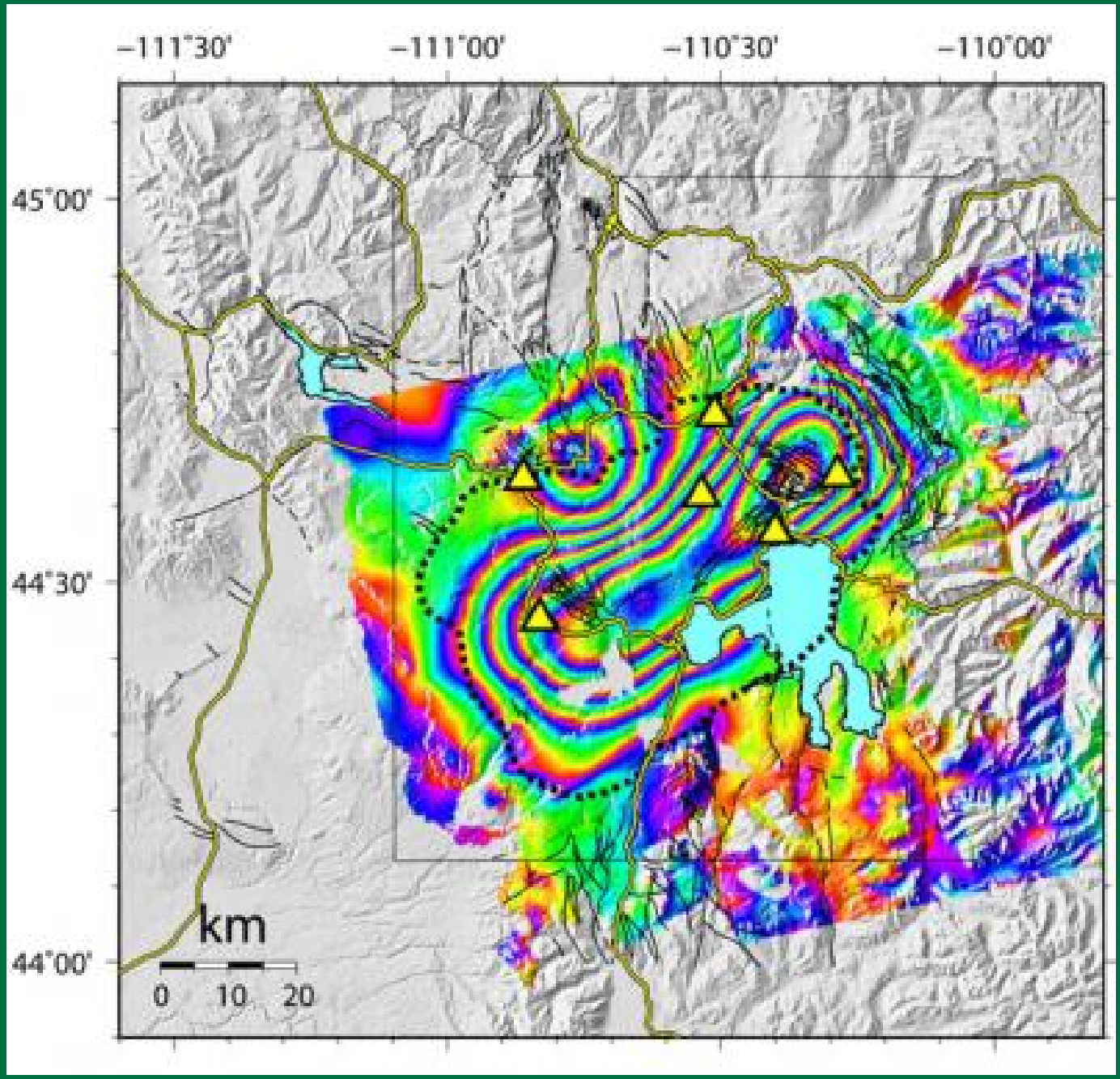

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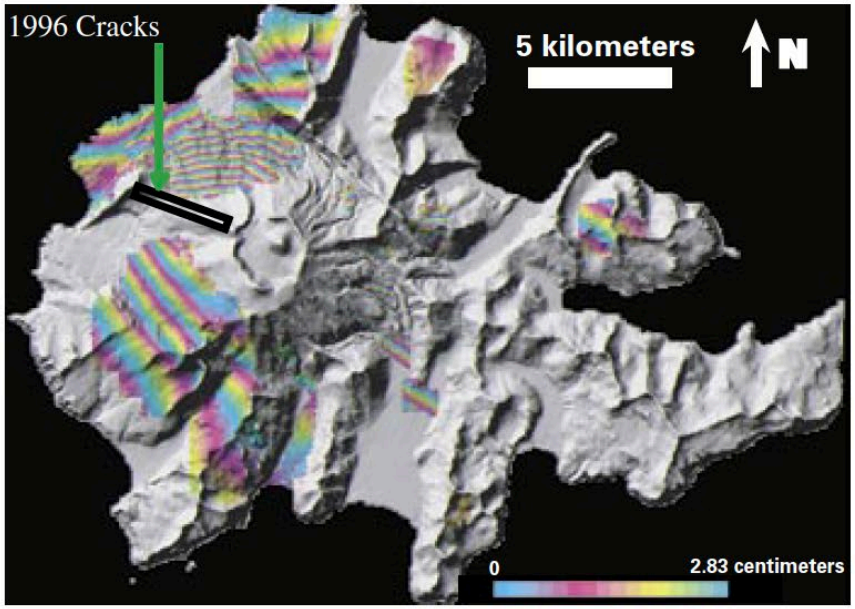

Figure 6. Interferogram showing deformation of Akutan Island (August 1993 to October 1996), draped over shaded-relief map of the island. Based on European Remote Sensing Satellite imagery (C-band radar). From Lu and others, 2005.

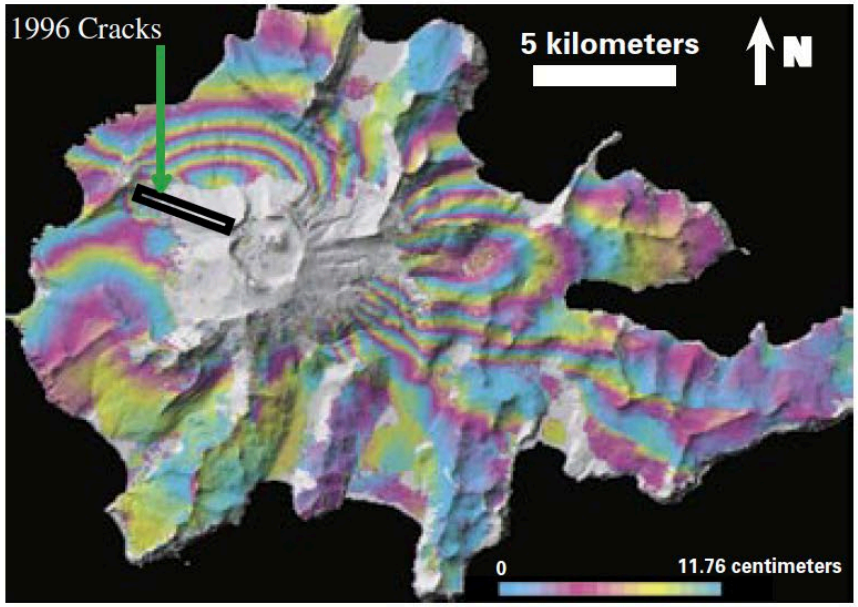

Figure 7. Interferogram showing deformation of Akutan Island (October 1994 to June 1997), draped over shaded-relief map of the island. Based on Japanese Earth Resources Satellite imagery (L-band radar). From Lu and others, 2005.

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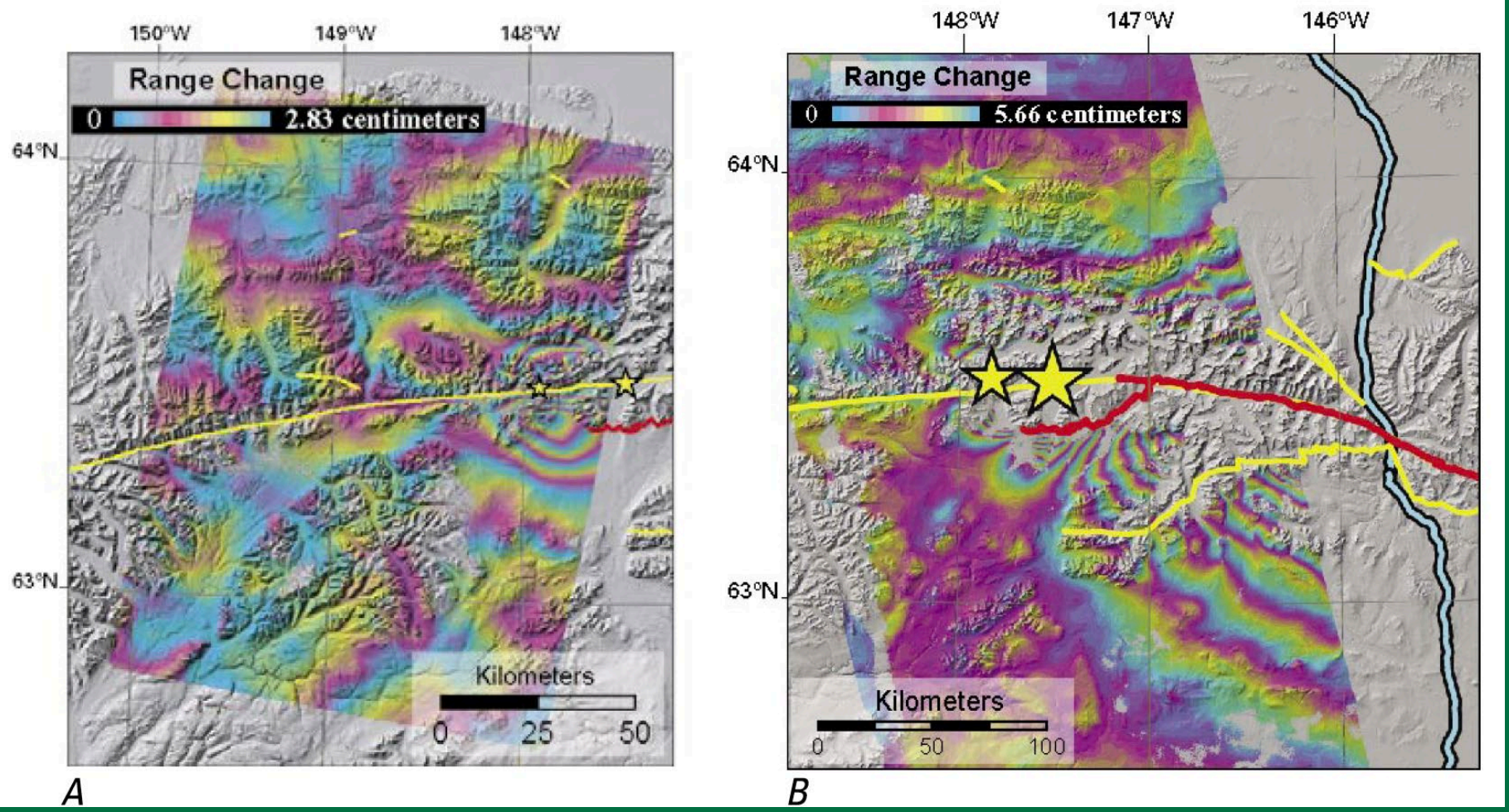
150°W
149°W
148°W
Range Change
0
2.83 centimeters
64°N
63°N
Kilometers
0
25
50
A
148°W
147°W
146°W
Range Change
0
5.66 centimeters
64°N
63°N
Kilometers
0
50
100
B

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Challenges:

- You need at least 3 passes - 2 to get topography, the 3rd is the first to measure changes.
- Not good if topography changes between the first two “topo” passes so new designs work with tandem antennae or spacecraft to get topo in one pass

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Challenges:

- You need to have the spacecraft in the "same" location for each pass. Within 300 m to 20 km (tighter tolerance for shorter wavelengths).
- Power: 2-10 kW (1000x typical science instruments)
- Mass: +1000 kg

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One more thing…

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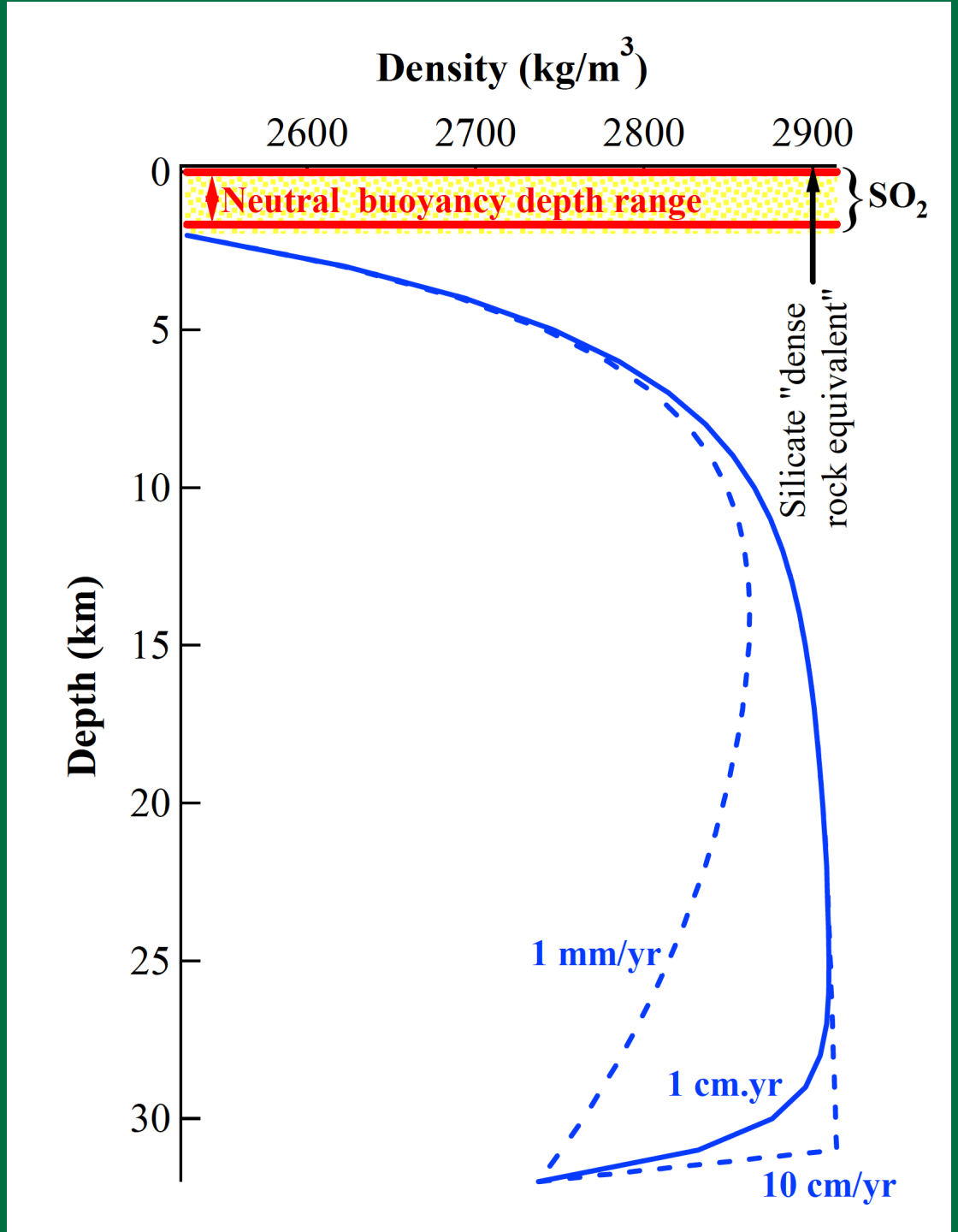
Density (kg/m3)
2600
2700
2800
2900
0
5
10
15
20
25
30
Depth (km)
Neutral buoyancy depth range
SO2
Silicate "dense rock equivalent"
1 mm/yr
1 cm.yr
10 cm/yr

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