



π IN THE SKY⁷

How deep is the ocean under this coral-mapping mission? NASA solves this real problem to explore Earth and – with pi as your guide – so can you!

CORAL CALCULUS

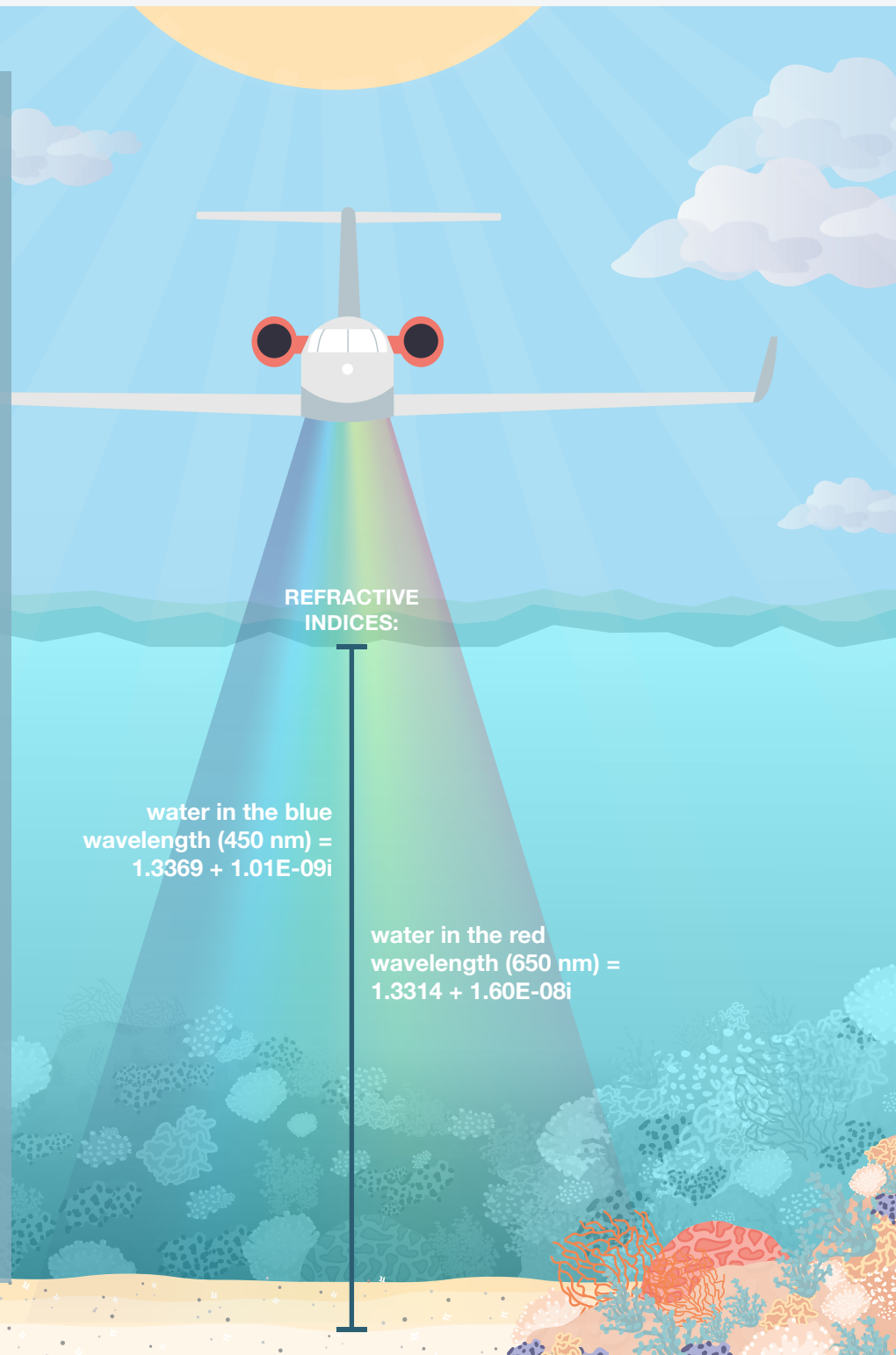
Flying aboard an aircraft, NASA's CORAL mission uses spectroscopy to study the health of coral reefs and the threats they face. To differentiate among coral, algae and sand on the ocean floor, CORAL computes the depth of every point it maps. The water's depth can be determined using the absorption coefficient, indicating how much light is absorbed through a given depth of water.

Imagine CORAL collects a light measurement reflected by white sand covered by an unknown depth of water that is 76% in the blue and 4.5% in the red. Using the formulas below, calculate the water's depth. Note that sunlight passes through the water twice: when traveling from the Sun to the ocean floor and when reflecting up to the aircraft.

absorption coefficient, $\alpha = (4\pi k)/\lambda$
 k = coefficient of the imaginary number portion of the refractive index
 λ = wavelength (meters) of light observed

Beer-Lambert law, $T = e^{(-\alpha \cdot d)}$
 T = observed reflectance, or transmittance (T), of light through a distance (d) of water

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REFRACTIVE INDICES:

water in the blue wavelength (450 nm) = $1.3369 + 1.01E-09i$

water in the red wavelength (650 nm) = $1.3314 + 1.60E-08i$