

Post-Dual Impact Atmospheric Profile

Simulation Analysis: Simultaneous 60km Asteroid Hits at Martian Poles

1. Executive Summary

The double impact of 60 km diameter asteroids at both the North (Planum Boreum) and South (Planum Australe) poles represents a "Total Volatilization Event." This scenario involves the instantaneous conversion of carbon dioxide (CO₂) and water (H₂O) ice into high-pressure gases, fundamentally altering the Martian climate.

2. Projected Atmospheric Composition

The following table estimates the composition of the atmosphere 12–24 months post-impact, once the initial thermal chaos has stabilized into a new equilibrium.

Gas Component	Pre-Impact Abundance	Post-Dual Impact (Estimated)	Primary Source
Carbon Dioxide (CO ₂)	~95.3%	~88.5%	South Polar Dry Ice Vaporization
Water Vapor (H ₂ O)	0.03%	~6.2%	North Polar Ice Cap Melting
Nitrogen (N ₂)	2.7%	1.8%	Relative dilution by new gases

Gas Component	Pre-Impact Abundance	Post-Dual Impact (Estimated)	Primary Source
Oxygen (O ₂)	0.13%	~3.4%	H ₂ O and CO ₂ Dissociation
Argon/Trace	~1.9%	~0.1%	Minor components diluted

3. Global Consequences

A. Atmospheric Pressure Surge

Total surface pressure would likely rise from **6.1 mbar** to approximately **35-50 mbar**. While still less than 1/20th of Earth's pressure, this is enough to allow liquid water to exist on the surface without boiling away instantly.

B. The "Hydrological Awakening"

With a 6.2% water vapor concentration, Mars would experience its first global rainfall in billions of years. This would lead to the formation of temporary lakes in low-lying basins like Hellas Planitia.

C. Violent Global Dust Storms

The energy of the impacts would suspend billions of tons of silicate dust. This "Impact Winter" effect would block 90% of sunlight for the first year, causing temperatures to drop sharply before the greenhouse gases eventually trigger a warming trend.

D. Ozone Formation

Increased oxygen levels (3.4%) would permit the formation of a rudimentary ozone layer, providing the first significant protection against solar UV radiation in Martian history.

4. Long-term Stability

Without a magnetic field, these newly released gases will eventually be stripped away by solar winds over millions of years. However, in the short term (centuries), Mars would possess a thick, moist, and oxygen-enriched atmosphere significantly more hospitable to robotic and eventual human exploration.