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Relationship between Greenhouse Gases and Global Temperature: Atmospheric Observations vs the Ice Proxy

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Changes of atmospheric composition during the 20th century involve an increase of greenhouse gases. Their interpretation rests on proxy evidence of previous atmospheric composition, principally from ice cores. The proxy record of atmospheric properties is dictated by two contributions: (i) the signature of those properties imprinted initially at the surface layer and (ii) nonconservative influences, largely undocumented, which have subsequently modified that signature.

The relationship between properties, which must likewise be imprinted initially at the surface layer, is used to assess these contributions. The proxy record is found to obey a clear two-pronged relationship between composition and temperature. A counterpart relationship is then found in the modern record of atmospheric observations. The relationship in the observed record differs fundamentally from the one in the proxy record. Supporting analysis then shows that the two relationships are connected. Their connection reveals a common physical mechanism behind recorded changes of greenhouse gases, as well as the roles of contributions (i) and (ii) to the ice proxy of atmospheric composition. In light of these features, observed changes of greenhouse gases during the 20th century may not be unprecedented, indeed, comparatively small.