Hydrogen isotope analyses of hydrous glasses by TC/EA system

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We report 75 δD analyses of 6 synthetic and 9 natural hydrous glasses with varying H_2O (0.1-5.5 wt%) and SiO_2 contents (48-74 wt.%) obtained with a TC/EA-MAT253 continuous flow system. Most samples were 1-2 mg, but up to 9 mg was used for H_2O-poor samples. The complete water extraction from samples allows 1) determination of the total water (H_2O+OH) content with a 5% (±0.15 wt%) 2σ error; and 2) the determination of δD with an overall reproducibility of <3.5‰ (2σ) and an average of 2.1 ‰ (2σ), based on replicates (2<N<4) of 10 samples in 5 different sessions. Experimental hydrous glasses of 5 different grain sizes, from <50µm up to single ~1 mm glass chunks, yield similar results for δD values and wt.% H_2O. Therefore, we advocate that the TC/EA system is a high throughput quantitative technique appropriate for the determination of the total water contents and D/H ratios in hydrous glass materials

Six experimental silicic glasses were generated in equilibrium with –25 ‰ and –150 ‰ waters. These glasses return systematically 25-30 ‰ lower δD values, reflecting D/H isotope fractionation between melt and water. We also measured D/H ratios in mafic and silicic hyaloclastites (subglacially hydrated volcanic glass with 2-5 wt% of environmental water) from Iceland. The analyses yielded the range in δD values from -135 ‰ to -105 ‰ in agreement with inferred δD values of the contemporaneous waters and the isotopic fractionation during glass hydration.

Satellite remote sensing estimate of global ground-level aerosol concentrations and precursors

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We begin with an overview of satellite remote sensing of air quality, and then describe our efforts to develop a global satellite-based estimate of ground-level fine aerosol concentrations ($PM_{2.5}$). Aerosol optical depth from the MODIS and MISR satellite instruments are combined for 2001-2006. A chemical transport model (GEOS-Chem), is used to estimate the relationship between aerosol optical depth and $PM_{2.5}$. We evaluate our approach and estimate with observations from the CALIPSO satellite instrument, the AERONET ground-based network, and ground-based *in situ* observations. The global accuracy of the ground-level $PM_{2.5}$ estimate is within 5 $\mu g/m^3$ ± 25% globally. Annual mean concentrations exhibit stark spatial variation, with regional values of more than 50 $\mu g/m^3$ in parts of India and China. We interpret the $PM_{2.5}$ estimates in light of observations of SO_2 and NO_2 from the SCIAMACHY and OMI satellite instruments.