



A new Alpine Geo-Lithological Map (Alpine Geo-LiM) and global carbon cycle implications

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On geological time-scales, the CO_2 concentration in the atmosphere mainly derives from the balance between the CO_2 produced by volcanic and metamorphic processes, and the atmospheric CO_2 consumed by chemical weathering of silicates and carbonates. The chemical composition of river waters is a good indicator of weathering processes since weathering reactions of silicates and carbonates consume atmospheric/soil CO_2 and produce an increase of the solution alkalinity. The dominating factors controlling these processes are lithology and runoff, for this reason we introduced a new simplified geo-lithological map of Alps (Alpine Geo-LiM) elaborated adopting a lithological classification compliant with the methods most used in literature for estimating the consumption of atmospheric CO_2 by chemical weathering. The map was used together with published alkalinity data of the 33 main Alpine rivers (i) to investigate the relationship between bicarbonate concentration in the sampled waters and the lithologies of the corresponding drained basins, and (ii) to quantify the atmospheric CO_2 consumed by chemical weathering. The analyses confirm (as known by the literature) that carbonates are lithologies highly prone to consume atmospheric CO_2 . Moreover, the analyses show that sandstone (that could have a non-negligible carbonate component) plays an important role in consuming atmospheric CO_2 . Another result is that in multi-lithological basins containing lithologies more prone to consume atmospheric CO_2 , the contribution of igneous rocks to the atmospheric CO_2 consumption is negligible. Alpine Geo-LiM represents a novelty if compared with published global geo-lithological maps. The first novelty is due to the attention paid in discriminating metamorphic rocks that were classified according to the chemistry of protoliths. The second novelty is that the procedure used for the definition of the map was made available at the web (<http://doi.org/10.5281/zenodo.2432045>) to allow the replicability and reproducibility of the product.