



## **Can we use the difference between total alkalinity and dissolved inorganic carbon ([TA–DIC]) as a proxy for carbonate calcium saturate state and pH?**

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Although ocean acidification (OA) is primarily due to increasing atmospheric CO<sub>2</sub>, it also can be modulated by some local physical and biogeochemical processes such as sea ice melting, river input, upwelling, and eutrophication. Thus, in fact it is challenging to identify the acidification drivers and the acidification extent in the ocean due to the superposition of these processes over increasing atmospheric CO<sub>2</sub>. Here we calculate carbonate calcium saturate state ( $\Omega$ ) and pH based on total alkalinity (TA) and dissolved inorganic carbon (DIC) from the Global Ocean Data Analysis Project Version 2 (GLODAPv2) database collected in the global ocean. We find that the difference between TA and DIC ([TA–DIC]) shows good relationships with  $\Omega$  and pH in the global ocean and that [TA–DIC] can be used as a proxy for  $\Omega$  and pH. We further show how typical physical and biogeochemical processes including air-sea CO<sub>2</sub> exchange, ocean mixing and biological metabolisms would affect [TA–DIC]. Using [TA–DIC] as a proxy for  $\Omega$  and pH can better determine the influence of local processes on OA and/or decipher the processes associated with OA rates, considering that it is challenging to determine how physical and biogeochemical processes influence  $\Omega$  and pH due partly to their non-linearity.