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TITLE: Seagrass meadows as a globally significant carbonate reservoir

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ABSTRACT:

Abstract. There has been growing interest in quantifying the capacity of seagrass ecosystems to act as carbon sinks as a natural way of offsetting anthropogenic carbon emissions to the atmosphere. However, most of the efforts have focused on the particulate organic carbon (POC) stocks and accumulation rates and ignored the particulate inorganic carbon (PIC) fraction, despite important carbonate pools associated with calcifying organisms inhabiting the meadows, such as epiphytes and benthic invertebrates, and despite the relevance that carbonate precipitation and dissolution processes have in the global carbon cycle. This study offers the first assessment of the global PIC stocks in seagrass sediments using a synthesis of published and unpublished data on sediment carbonate concentration from 403 vegetated and 34 adjacent un-vegetated sites. PIC stocks in the top 1 m of sediment ranged between 3 and 1660 Mg PIC ha?1, with an average of 654 ± 24 Mg PIC ha?1, exceeding those of POC reported in previous studies by about a factor of 5. Sedimentary carbonate stocks varied across seagrass communities, with meadows dominated by Halodule, Thalassia or Cymodocea supporting the highest PIC stocks, and tended to decrease polewards at a rate of ?8 ± 2 Mg PIC ha?1 per degree of latitude (general linear model, GLM; p < 0.0003). Using PIC concentrations and estimates of sediment accretion in seagrass meadows, the mean PIC accumulation rate in seagrass sediments is found to be 126.3 ± 31.05 g PIC m?2 yr?1. Based on the global extent of seagrass meadows (177 000 to 600 000 km2), these ecosystems globally store between 11 and 39 Pg of PIC in the top metre of sediment and accumulate between 22 and 75 Tg PIC yr?1, representing a significant contribution to the carbonate dynamics of coastal areas. Despite the fact that these high rates of carbonate accumulation imply CO2 emissions from precipitation, seagrass meadows are still strong CO2 sinks as demonstrated by the comparison of carbon (PIC and POC) stocks between vegetated and adjacent un-vegetated sediments.

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