

# Carbon dioxide dynamics and air-sea CO<sub>2</sub> fluxes in the SES : Synthesis of the SESAME cruises

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- In the frame of the European Integrated Project "Southern European Seas: Assessing and Modelling Ecosystem changes" (SESAME), two sets of cruises were carried out in spring and fall 2008 to cover all of the Southern European Sea (SES) regions. Here, we report on the dynamics in surface waters of the partial pressure of CO<sub>2</sub> (pCO<sub>2</sub>) either measured directly by equilibration or computed from pH and total alkalinity.

- Sea surface temperature (SST) ranged between 12°C in the Black Sea in spring to 29°C in the Cilician basin in fall. In all the SES regions SST increased from spring to fall, on average by 8.0°C, ranging between 6°C (Alboran) to 11°C (Cilician).

- pCO<sub>2</sub> at in-situ temperature (pCO<sub>2</sub>@SST) ranged from 260 ppm in the Black Sea in fall to 450 ppm in the Cilician basin in fall. In most the SES regions pCO<sub>2</sub>@SST increased from spring to fall, except in the Adriatic (pCO<sub>2</sub>@SST ± stable, despite large spatial variability (not shown)) and except in the Black Sea (decrease of pCO<sub>2</sub>@SST)

- Since an increase of 8°C in SST leads to an increase of pCO<sub>2</sub> of 145 ppm we normalized the pCO<sub>2</sub> data to a temperature of 20°C (pCO<sub>2</sub>@20°C). pCO<sub>2</sub>@20°C ranged from 540 ppm in spring to 270 ppm in fall in the Black Sea. In the Adriatic, Aegean, Black Sea, Cilician, Levantine, pCO<sub>2</sub>@20°C decreased from spring to fall, indicating a cumulated drawdown of CO<sub>2</sub> by biological activity. In the Alboran pCO<sub>2</sub>@20°C increased from spring to fall possibly indicative of upwelling (in agreement with a lesser increase of SST from spring to fall than the other SES regions). In the Marmara Sea, pCO<sub>2</sub>@20°C increased from spring to fall due to a strong decline in primary production (not shown).

- Air-sea CO<sub>2</sub> fluxes ranged from -5.7 mmolC m<sup>-2</sup> d<sup>-1</sup> in the Black Sea in fall to +2.5 mmolC m<sup>-2</sup> d<sup>-1</sup> in the Cilician basin in fall. In Spring, all the SES regions were sinks for atmospheric CO<sub>2</sub>. In fall, the more « open » SES areas were sources of atmospheric CO<sub>2</sub> (Alboran, Levantine, Cilician & Aegean). In fall, the more « coastal » SES areas remained sinks for atmospheric CO<sub>2</sub> (Adriatic, Marmara, Black Sea), but only in the Black Sea the CO<sub>2</sub> sink increased in fall.

