LOOKING FOR THE MARINE CO_2 PROCESSES ON LAND

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ABSTRACT
Begur-Pals site (41,58ºN, 3,14ºE, Catalonia, Spain) is weekly sampled for CO_2 and other GHG (CH_4, CO, N_2O, SF_6) since January 2000. This CO_2 serial data shows at the middle of each summer a sudden increase and decrease of the CO_2 peak. It is a process that can be either attributed to a highest transpiration rate than ecosystem production due to the lack of summer precipitation, to biomass burning from Mediterranean forest fires, to tourist activities in the coast, or to CO_2 pumping from waters in the Western Mediterranean sea (according to wind backtrajectories). A sampling strategy using sites with high towers with continuous measurements has been developed. Sites are placed at the vortexes of a rhombus: two extremes are continental sites in the center of the Ebro's watershed and a marine site is located in the Menorca Island. The other two are high towers in the Catalonian coast.

INTRODUCTION
The North Western Mediterranean Region is characterized by a lack of atmospheric Greenhouse gases measurements. Begur-Pals is located in the Catalan Mediterranean Coastline (41,58ºN;3,14ºE). Atmospheric measurements of CO_2, CO, CH_4, N_2O and SF_6 are being carried out weekly since January 2000. Although the atmospheric record is not long, some repeated peaks are identified at selected intervals within the year. The most noticeable ones are those which take place in the middle of summertime. As the CO_2 atmospheric concentration is a footprint of different processes occurring either in land, at sea or by societies, the assessment of these peaks should yield a deeper understanding of NW Mediterranean dynamics.

CO_2 MEASURES IN BEGUR-PALS
Fig. 1. shows the CO_2 atmospheric concentration at Begur-Pals from 2000 through 2005. The baseline is defined as the minimum values registered in the long-term record. These minimum values represent the maximum ecosystemic ability to soak up CO_2 from the atmosphere. Above the ecosystemic capacity, the human metabolism, synoptic events and other natural processes modify this CO_2 baseline. This new way of defining CO_2 base implies that ecosystem metabolism is the only factor influencing seasonality patterns. Other factors release CO_2 to the atmosphere without such a clear seasonality. Residuals are defined as the difference resulting from the extraction of the seasonal trend with regard to atmospheric measures.

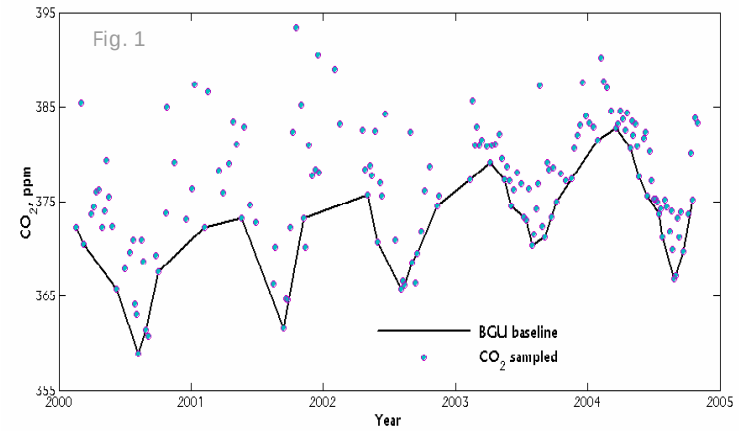

Fig. 1. CO_2 atmospheric concentration since January 2000. 'Seasonal trend' is shown (solid line) superimposed on atmospheric measures (dots). Seasonal trend is calculated as the all-minimum values representing the ecosystem maximum capacity to soak up CO_2 from the atmosphere. This process becomes the main factor driving the seasonal trend in CO_2 atmospheric concentration.

Summer peaks
The residuals trend during summertime is presented in Fig. 2. Surprisingly, the same CO_2 peak is repeated approximately the same days each year (the end of July to the end of August). Summertime is characterized in

the NW Mediterranean area by high temperatures and lack of precipitation. These meteorological conditions enhance terrestrial evapotranspiration rates which might translate in a rise of the CO_2 atmospheric concentration. Linked to the meteorological conditions, Mediterranean forest fires are frequent in summer. In addition to terrestrial evapotranspiration forcing, human society modifies the atmospheric concentration, especially during this period of year and in the region considered. Tourism and leisure activities related with the sea can increase the atmospheric CO_2. Another possible explanation to these residuals peaks is associated with seawater summer structure. In summertime, this area presents the strongest thermocline and it is also registers the highest temperature in the Western Mediterranean (more than 27ºC in July), forming instead a homogenous layer in November, with lower temperatures (~14ºC). These vertical structure in the Western Mediterranean seawater column can be recovered from the atmospheric record. Back trajectories to 72 hours for the summer 2004 (Fig. 3) are calculated with Hysplit (Hybrid Single Particle Integrated Trajectory) from the ARL-NOAA Laboratory. Residuals peaks of CO_2 (Fig.2) in 2004 are related for those days with wind sea trajectory (23th Aug 04).

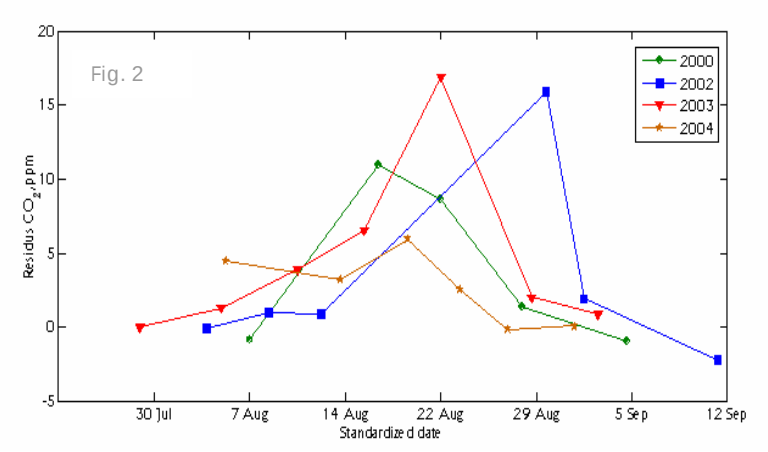

Fig. 2. CO_2 residuals in summertime for each sampled year. Residuals are calculated as the difference between the atmospheric measures and the seasonal trend. The same peaks occur during the same period of summer.

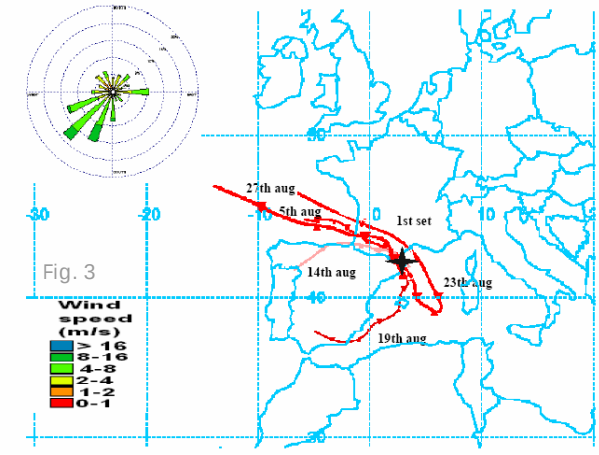

Fig. 3. 72 hours back trajectories for summer 2004 and wind direction chart for the same period of year.

Fig. 4. The new sampling strategy developed in the Climate Research Laboratory, covering the Ebro's basin and the NW Mediterranean Sea.

As the discrete sampling strategy can't monitor the daily CO_2 variations and relates with the wind origin, a new continuous sampling strategy has being designed in order to model the NW Mediterranean Dynamics and its print into the atmosphere (Fig. 4). At the vortex of a rhombus there are the sites of La Muela (41º35.7'N 1º5.9'W)-Menorca (39º 59'N 04º 06.75'E)-Pals(41º59'N, 3º12'E)-Delta de l'Ebre (40º38'N, 0º16'E). The new integrated research facility covers the Ebro's basin and the Catalonia and the NW Mediterranean Area. New samples should provide a better understanding of the processes and their signatures in the atmospheric record.