Carbon fluxes of an alpine peatland in Northern Italy

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Background

Peatlands hold the largest terrestrial soil carbon pool in the world (Gorham 2008). Northern peatlands store 547 (473-621) PgC (Yu et al. 2010), which is around 20 % of the total amount of the world soil organic carbon. The most studied peatlands are in high latitude region and are studied for the vulnerability of their carbon storage. Peatlands also occur in high altitude areas; for instance in the Alps there are numerous small peatland fens, which are being threatened by rising temperatures and a decrease of precipitation

Objectives

Three years of carbon fluxes of a peatland in the Italian Alps are analysed. The objectives of this study were (i) to quantify the carbon and methane fluxes and (ii) to get an insight in the carbon fluxes of alpine peatlands.

Materials and methods

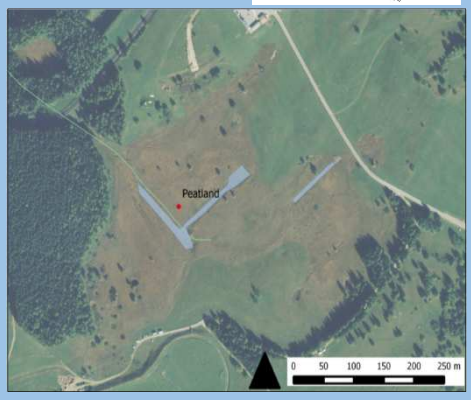
Eddy covariance tower with, open and enclosed path CO2 H2O analyser (LI7500 and LI7200).
Methane sensor (LI7700) applied for one year (2014)
Analysed with EddyPro 5.1.1
Gap filled with Reichstein online tool

Site

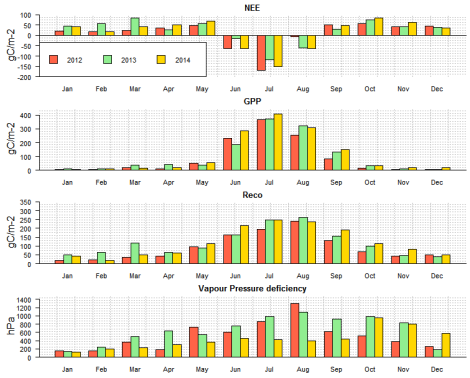
10 hectares minerotrophic fen located at 1563 m a.s.l. on the Monte Bondone plateau, in the Italian Alps (latitude 46°01' N, longitude 11°02' E). The vegetation of the area is heterogeneous, with mainly grasses in the higher areas, *Molinia caerula* and *Carex nigra*, while in the lower areas the main vegetation consists of *Carex rostrata*, *Scorpidium cossonii* and *Sphagnum* spp

Long-term average precipitation (1958-2008) was 1290 mm/year with an average air temperature of 5.4 °C (Eccel et al., 2012). The snow-free period typically lasts from early May to late October-November.

The runoff of the complete catchment flows on deep impermeable morainic strata.

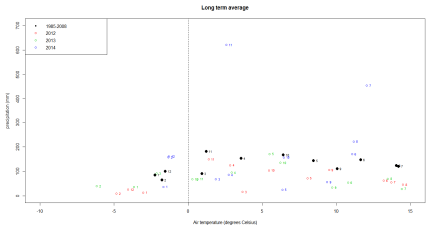


Results

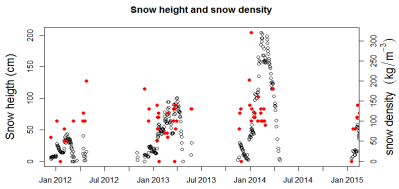


Monthly values for CO_2 exchange variable across 3 years: sums of NEE, GPP, R_{eco} and average vapour pressure deficiency.

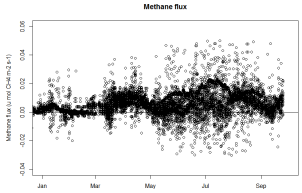
Monthly values for meteorological variables across 3 years: average air temperature with the ten-year average (Eccel et al. 2012) as a solid line, total precipitation and average photosynthetic active radiation.



Monthly average air temperature and precipitation for 2012, 2013 and 2014 compared with the long-term average (1985-2008, (Eccel et al. 2012))



Measured snow height and snow density during the years 2012, 2013 and 2014. The snow height is depicted by the black line and the snow density by the red points.



Half-hourly data points of measured CH_4 fluxes.

Conclusion

The peatland acted as a significant carbon source, based on CO_2 emissions (+180.7 g C – CO2/m-2 (± 65.2)). This is a major contrast to all other untouched peatlands studied to date which are sinks for carbon, most of which are at elevations below 300 m.a.s.l and located in the Northern hemisphere.
The methane emissions of this site were very low, possibly due to chemicals in the seepage water. The active carbon uptake period of this peatland was 73 ± 7 days. We found evidence that the snow density had a big influence on the annual CO_2 balance. In addition, the length of the snow-covered period was very important.
The findings at this site suggest that bigger interannual variability of temperature and precipitation due to climate change can have a big impact on the carbon balance of the peatlands of the Alp.

References

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