Details

H13N-03 Strong Coupling Between Winter Climatic Fluctuations and Development of Phytoplankton in the Deep Lakes South of the Alps Assessed Using Long-Term in Situ and Satellite Temperature Data (Invited)

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Recent investigations showed that the winter climate in the lake district south of the Alps was strongly affected by specific prominent modes of low-frequency atmospheric variability relevant for the Mediterranean area (namely the East Atlantic pattern, EA, and the Eastern Mediterranean Pattern, EMP). In Lake Garda, the winter interannual fluctuations of EA and EMP triggered a long-chain of causally-linked effects on the physical structure of the lake and biological communities. Since 1991, and contrary to the summer months, the long-term increase of the mean winter water temperatures in the mixolimnion (0-50 m, ca. 0.01 °C yr^{-1}) was statistically not-significant, coinciding, as confirmed by longer annual 1971-2014 series, with a period of relatively winter stable temperatures. Superimposed to the long-term trend, the deep hypolimnion showed different periods of warming caused by a downward transport of heat by turbulent diffusion during stratification. These phases were terminated by sudden cooling and overturn during harsh winters associated with negative EA and positive EMP values. The long term saw tooth temperature dynamics had a strong impact on the transport of hypolimnetic nutrients towards the surface, fuelling the development of eutrophic species, namely toxic cyanobacteria during the summer months. Other changes in the trophic webs included modifications in the phenology of the dominant zooplankton cladocerans. In the subalpine lake district, changes were documented not only at the level of species, but also genotypes, with a positive selection of cyanobacterial strains with strong gas-vesicles (i.e. best adapted to higher hydrostatic pressures) in lakes experiencing deep mixing. The study of the effects of climatic fluctuations and long-term changes was based on monthly field data. In this work, the evaluation will be further investigated also using high resolution satellite temperature data recorded using Moderate-resolution Imaging Spectroradiometer (MODIS) and Along Track Scanning Radiometer (Advanced ATSR/ATSR-2) sensors.

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