In-situ investigation into the photoinduced alternation of chromophoric dissolved organic matter in an alpine lake

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Due to the global warming, tree line advance is occurring in many alpine regions, potentially increasing the dissolved organic matter (DOM) input into the alpine lakes. The photodegradation could be an important transformation pathway for the CDOM in the alpine lake because of the intensive light irradiation in the high altitude regions. In this study, *in-situ* photoinduced alternation of chromophoric dissolved organic matter (CDOM) during 5-day solar irradiation was investigated in a typical alpine lake surrounded by the ancient forest, i.e., Tiancai Lake (with an altitude of 3880 m). The removal of DOC, the alteration of optical properties and EEM-PARAFAC (emission matrix fluorescence and parallel factor analysis) components under three light treatments (Visible light (Vis), Vis+UVA and Vis+UVA+UVB) were compared. In all three light treatments, the photobleaching of CDOM molecules and the removal of DOC were observed. UV light enhanced the photodegradation of CDOM. Five EEM-PARAFAC components, including three terrestrial humic-like substances (C2, C3 and C4), one microbial humic-like substance (C1) and one tryptophan-like substance (C5) were identified. In Vis+UVA+UVB and Vis+UVA treatments, C1, C2, C3 and C5 were photolabile, and the photodegradation rates followed the order of C3>C2>C5>C1. In Vis treatment, only C2 and C5 were degraded. C4, a component with high aromatic content, was the photoproduct of C2 and increased in all treatments, which contributed to the increase of HIX and $SUVA_{254}$. The photoreactivities of the EEM-PARAFAC components to visible and UV light explained the changes of FI and HIX in the various light treatments. This study provides the information on CDOM transformation in alpine lakes, which is helpful for understanding the global carbon cycle under the climate change scenario.