All study points showed that elevation of water temperature were correlated weakly with the increase of blue-green algae population (r^2 = 0.31 ~ 0.39). From regression equation between blue-green algae population and water temperature, blue-green algae population was estimated to be about 100 cells mL^{-1} at 21 ℃ ~ 22 ℃ of water temperature. Surveyed water temperature range of blue-green algae proliferation showed 12.6 ℃ ~ 32 ℃ (Paldang reservoir), 9.4 ℃ ~ 32.2 ℃ (Namhangang) and 18.5 ℃ ~ 29.2 ℃ (Bughangang), respectively. In addition, Increase of each dam outflow showed a tendency to lower water temperature.
Correlation between Paldang dam outflow and blue-green algae population indicated weak relationship (r^2 = 0.21). From 800 m^3 sec^{-1} of Paldang dam outflow, frequency of blue-green algae appearance sharply decreased (less than 1 time). In 2012 and 2013, correlation between Paldang dam outflow and blue-green algae population showed strong relationship (r^2 = 0.64, 0.73 respectively). In 2014 and 2015, extremely low dam outflow was observed than 2012 and 2013 (478 m^3 sec^{-1} in 2012, 607 m^3 sec^{-1} in 2013, 234 m^3 sec^{-1} in 2014, 177 m^3 sec^{-1} in 2015, yearly mean basis). These results implied that maintaining the dam outflow more than 800 m^3 sec^{-1} was desirable in order to protect the proliferation of blue-green algae in Paldang reservoir. From regression equation between Paldang dam outflow and blue-green algae population in 2013, blue-green algae population was estimated to be less than 200 cells mL^{-1} at 1,000 m^3 sec^{-1} of Paldang dam outflow.

44-O High sulfide production related to utilization of organic matters from cyanobacterial bloom biomass in a eutrophic lake.

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Cyanobacterial blooms frequently occur in eutrophic freshwater lakes, subsequently, substantial amounts of organic matters are produced. A majority of the algal-derived organic matters will be utilized by microbial communities in lakes. Bacterial community composition in cyanobacterial phycosphere was highly organized and showed obvious difference from phytoplankton. Furthermore, bacterial communities of different sized aggregates within the cyanobacterial phycosphere varied with dependence on aggregate size. Bacterial species on large and small-size aggregates likely have the ability to degrade high and low molecular weight compounds respectively, possibly operating in sequence and synergy to catalyze the turnover of complex organic matters. After decaying, cyanobacterial bloom biomass settles onto the lake sediments, which led to the occurrence of hypoxia and enhanced sulfate reduction. As a result, a larger amount of total dissolved sulfide (peak values of 5.90±0.36 to 7.60±0.12 mg L^{-1}) in the water column and acid volatile sulfide (1081.71±69.91 to 1557.98±41.72 mg kg^{-1}) in 0-1 cm surface sediments were detected. Moreover, increasing diffusive phosphate fluxes at the water-sediment interface were positively correlated with sulfate reduction rates. As increases in toxic sulfide and phosphate release rates deteriorated the water quality/ecosystem and even spurred the occurrence of black water problem in lakes, organic matters from cyanobacterial bloom needs to be considered in the management and remediation of freshwater ecosystems.

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44-P Specific detection of cyanobacteria blooms in lakes through remote sensing: the approach of the project BLASCO (Blending Laboratory And Satellite Techniques For Detecting Cyanobacteria).

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Algal blooms can have an impact on health care costs, on the costs associated with the treatment of water intended for human consumption and on the tourism industry. The implementation of early warning systems would reduce these costs and the efforts needed to face and control the harmful effects of an algal bloom. A system for monitoring the quality of the waters, which operates on a large scale and at high frequency, would allow to keep under control the evolution of a bloom. The observation by satellite permits such a monitoring: in particular, the project is focused on the development of techniques for the analysis of satellite images, in order to detect the early stages of bloom formation in lakes and identify the involved phytoplankton taxa. To reach this goal, it is necessary to analyze the characteristic spectral response of cyanobacteria and to develop algorithms to be applied to the analysis of satellite images. Therefore, experimental activities were carried out, using cyanobacterial cultures, to determine taxon specific reflectance and

absorption spectra, as well as a spectrofluorimetric analysis of the phycobiliproteins. Different approaches were applied and compared (HPLC, counting, in vivo fluorimetry, spectroradiometry) to quantify the amount of cyanobacteria.
The analysis of apparent and inherent optical water properties performed in the laboratory let us know in more detail the spectral responses of different photosynthetic pigments which can be found inside cyanobacteria. On the base of this knowledge specific algorithms are actually being implemented, which use the relations between spectral band ratios and algal concentration. These algorithms will allow the real time monitoring of the presence and concentration of cyanobacteria in the water using proximal sensing tools. The same algorithms will be applied to satellite images in order to derive presence/absence and concentration maps of cyanobacteria in the surface layer of lake waters.
The preliminary results of laboratory analysis show that the spectral response of Chlorophyll-a in the 680-720 nm spectral region can change with different stress conditions (e.g. temperature, irradiance and water turbulence) the cyanobacteria has been exposed to.
Field data on water optical properties and phytoplankton samples were also collected during blooms, for the calibration of the specific algorithms to be developed for the interpretation of satellite images.
During the first months of the Project some cyanobacteria blooms occurred in 2015 in Comabbio, Pusiano and Varese lakes, which have been mapped using LANDSAT-8 images and frequency of blooms in the past decades (2002-2012) were analyzed with dedicated algorithm for MERIS images.

44-P LANDSAT 8 satellite detection of harmful cyanobacteria blooms in Tasmanian inland waters.

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Cyanobacteria blooms in irrigation and drinking reservoirs pose a threat to public health and a significant challenge to water managers. The use of satellite imagery promises to greatly increase the spatial reach of monitoring regimes. This study evaluates the effectiveness of the Landsat 8 and Sentinel 2A platforms in monitoring cyanobacteria biomass in inland waters in Tasmania, Australia. Four in-situ monitoring buoys were deployed in late 2015 in separate lakes and reservoirs to monitor phycocyanin and chlorophyll-a concentrations and other water quality parameters. In-situ radiometric readings were taken from Lake Trevallyn, coincident to Landsat 8 overpass, to evaluate the accuracy of atmospheric correction and to develop new remote sensing models for chlorophyll-a and phycocyanin retrieval. Models were developed using multiple regression and principal component analysis based on satellite bands and ratios. Satellite retrievals based on a four band Landsat 8 multiple regression model show good agreement (R^2=0.66) with in-situ chlorophyll-a measurements taken from Lake Trevallyn which we expect will enable detection of increases in cyanobacteria biomass generally associated with bloom conditions.

44-P A study of absorption and fluorescence characteristics of cyanobacteria.

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Over the last decades, remote sensing of chlorophyll pigments has been proven to be a powerful tool for investigating phytoplankton both in the ocean and in inland waters. However, pigment identification as needed for a monitoring of potentially harmful algae blooms still imposes a high challenge to researchers.
Due to their specific pigment composition, cyanobacteria offer optical characteristics that, in principle, allow for a separation from other algae. But these properties are highly variable, which adds strong uncertainty on the identification. For a better characterization and to disentangle different environmental effects on the absorption and fluorescence properties of cyanobacteria, we have developed a laboratory setup that permits us to grow phytoplankton under well-defined light, temperature and nutrient conditions. Changes in the absorption and fluorescence properties are monitored using a double beam spectrophotometer and a fluorometer. Here, we present first findings of our studies in which we investigate the variability of different cultures of cyanobacteria. These studies form the basis for improving bio-optical models used for remote sensing of cyanobacteria.