The development of shallow lake land surface model and its' coupling application
浅水湖泊陆面模型的发展及耦合应用

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湖泊是我国重要的地表类型。然而目前并无适合中国浅水湖泊的陆面模型。本研究拟以太湖为对象，研究浅水湖泊陆气交换的关键过程。首先 U*，Zom，Zoh 等参数的计算方案对浅水湖表通量计算至关重要。其次浅水湖泊的热量传递、水汽交换、表面应力等对天气尺度及日尺度大气变化的响应灵敏。同时湖泊浮游植物生长、底泥悬浮等过程对湖表反照率，湖体消光系数以及湖体辐射能量收支影响也非常关键。针对以上过程改进已有的 NCAR 湖泊子模型，使之适用于浅水湖泊的陆面模拟。将新建浅水湖泊陆面模块耦合进入 WRF/NOAH 模型，并用太湖中尺度通量网观测数据有效验证。预期目标为建立适用于我国湖泊与大气相互作用的完整湖泊-区域天气/气候耦合模型。在湖泊—大气相互作用的相关前沿问题上产生理论创新，产生浅水湖表面粗糙度、波浪运动和风三者相互作用的新认识；建立水体导热率与水深、热分层和高空气流之间关系的参数化方案。

Lake is an important land surface type in China. However there is no suitable land surface model for China's shallow lakes. This research focuses in Taihu lake, studying the key process of the lake-air exchanges. Firstly, this work aims at establishing the suitable parameterization scheme of key elements, e.g. U*, Zom, Zoh, etc, to calculate the lake surface flux. Secondly, the numerical procedure of shallow lake heat transfer, water-vapor exchange and surface stress etc, must respond to the atmosphere changes of synoptic scale and day time-scale. Meanwhile, the influence on surface albedo, extinction coefficient and radiation energy balance of lakes caused by the growth of phytoplankton and the suspension of bottom sediment will also be considered in this progress. The existing NCAR lake model will be improved to be more suitable for surface simulation of shallow lakes according these processes above. At last, this model will be coupled into WRF/NOAH model, and verified effectively with observation data of Taihu Lake mesoscale flux nets. The expected goal is to establish a integrated lake-regional weather/climate coupling model which applies to China’s lake-air interactions. Theoretical innovation should be made on the frontier issues of the interaction between lakes and atmosphere, such as new cognitions on the interaction of shallow lake surface roughness, wave motion and wind, and parameterization schemes on the relationship between water thermal conductivity and water depth, thermal stratification and upper air wind.