Impact of Synoptic Weather Systems on the Surface Energy Budget over a Large Inland Water Body

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Introduction

A large inland water body’s surface energy budget is subject to a variety of changing meteorological conditions, which are usually associated with frequent passages of synoptic weather systems. The water surface energy budget consists of net radiation, latent heat flux, sensible heat flux, and heat storage in water. Therefore, it is important to understand how the surface energy budget is impacted by varying meteorological conditions. We analyzed diurnal and monthly changes in the water surface energy budget with the data collected from an eddy covariance system over the Ross Barnett Reservoir in Ridgeland, Mississippi. We studied the influence of the passages of synoptic weather systems on the water’s surface energy budget during the period of March and April of 2008.

Objectives

- Understand water surface energy budget and analyze diurnal cycles in the surface energy budget.
- Determine what factors contribute to significant fluctuations in the surface energy budget.
- Determine how the passage of cold fronts affect the surface energy budget
- Examine how the surface energy budget will vary with different synoptic weather systems.

Methods

Data that the Ross Barnett Reservoir flux tower collected in 2008 were analyzed from March 1st to March 31st and April 1st to April 30th. A CNR4 net radiometer measured net radiation. An eddy covariance system measured sensible heat and latent heat fluxes. Other meteorological variables were also measured, including wind speed, air temperature, humidity, pressure, and water surface temperature. Twelve cold fronts were observed during the two month period; two of which were analyzed in greater detail. Synoptic weather maps were used to determine synoptic weather conditions for any given day during this period.

Data

Conclusion

- Out of 12 cold fronts found to have passed the RBR area during the months of March and April, 2008, the two used in this analysis were chosen because of their key differences in size and strength.
- The cold front observed in March was significantly larger, lower in pressure, and took longer to traverse through the state.
- Weak cold fronts had less of an impact on surface energy budget than stronger cold fronts.
- Sensible and latent heat fluxes were typically above average after the passage of cold fronts.
- Instances where sensible heat fluxes were enhanced when the air temperature fell significantly lower than the water skin temperature, causing heat release from the relatively warm water.
- Cold fronts affect the surface energy budget by decreasing net radiation and increasing sensible and latent heat. The strength of these effects can be determined by the size of the system, differences in pressure, and its speed.
- Latent heat fluxes were enhanced by the passage of cooler, dryer air over the relatively warm and humid water.

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