

OPEN WATER EVAPORATION

NWRI

Raoul Granger
October/06

Newell Hedstrom



Objectives of Evaporation Studies

- Provide a correct description of the open water evaporation for short-term (hourly, daily) calculations.
 - The advection process.
 - Application to remote sensing

Evaporation Models are parameterizations of one or more of the conditions required for evaporation to occur:

For evaporation to occur there must be:

- a **supply of water** at the surface,
- a **supply of energy** to satisfy the requirement for the phase change, and
- a **transport mechanism** to carry the vapour away from the surface (wind, vapour gradient).



Open Water Evaporation

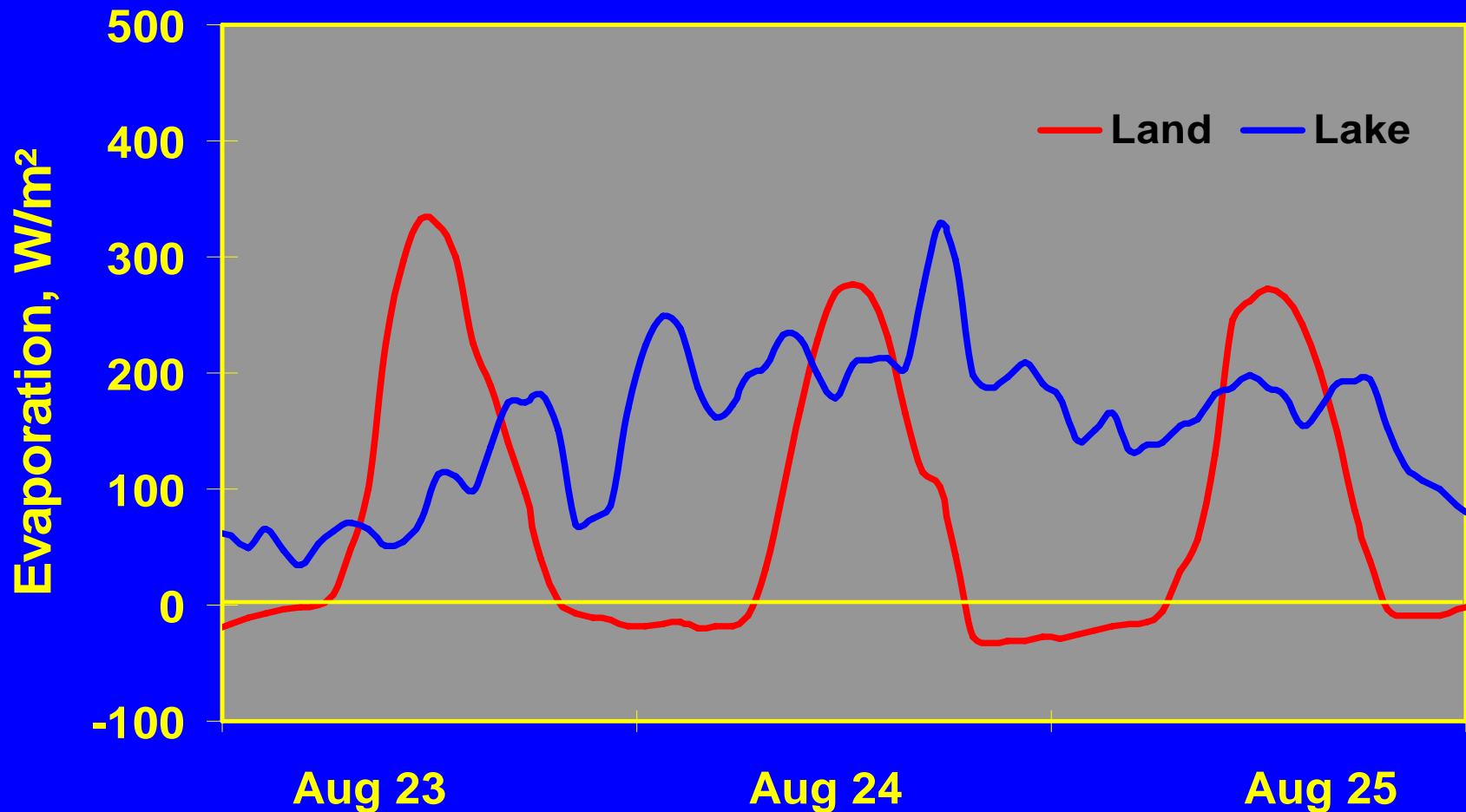
- **Hydro-Myth #1**

The land and the sea are in harmony... so we can transfer our knowledge of the land surface to the open water...right?

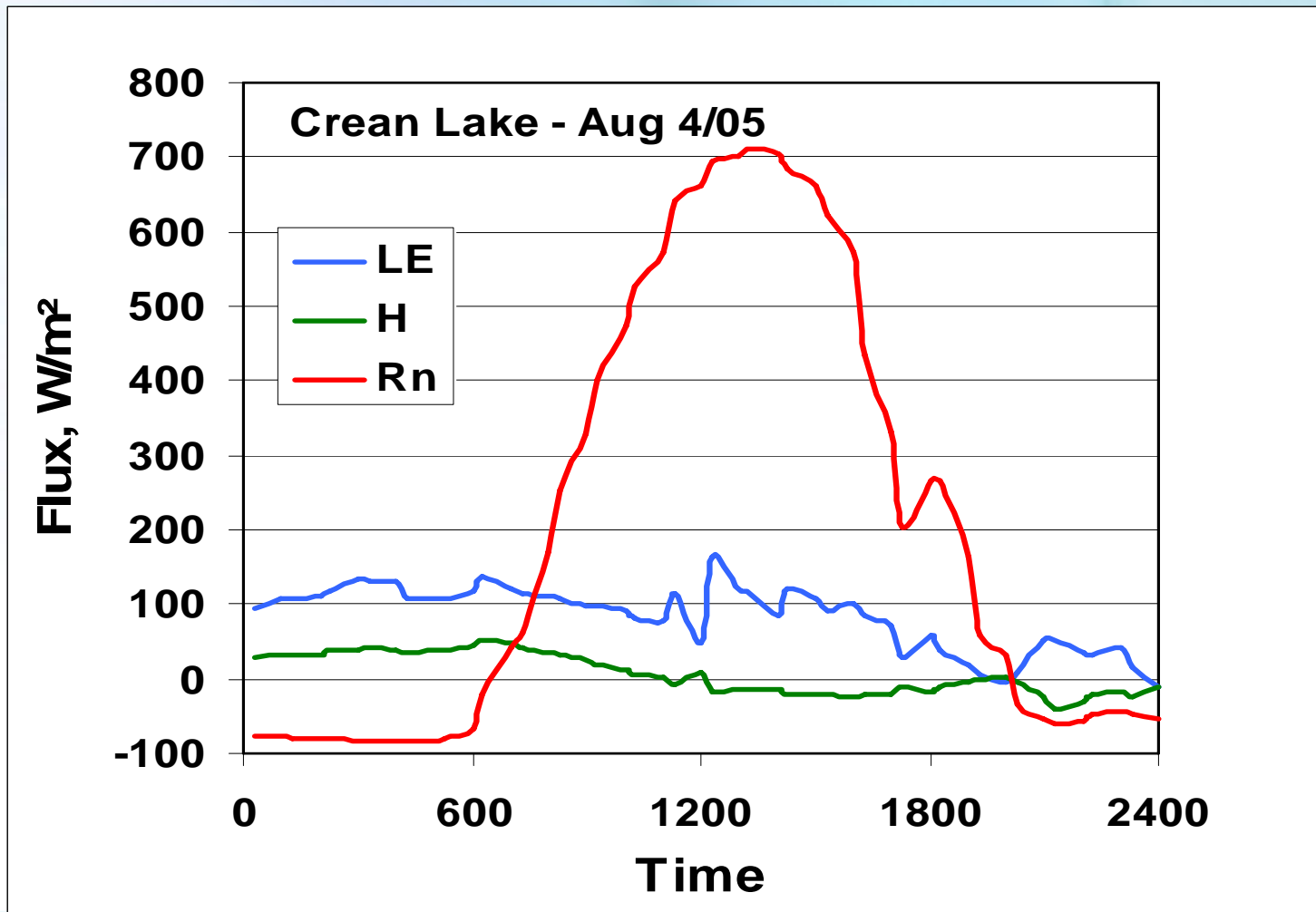
- **Hydro-Myth #2**

For a lake, availability of water is not an issue, so evaporation must be related only to the energy supply...right?

Lake Evaporation Observations: Quill Lake, 1993 - open water and land surface



Lake Evaporation Observations: Crean Lake 2005



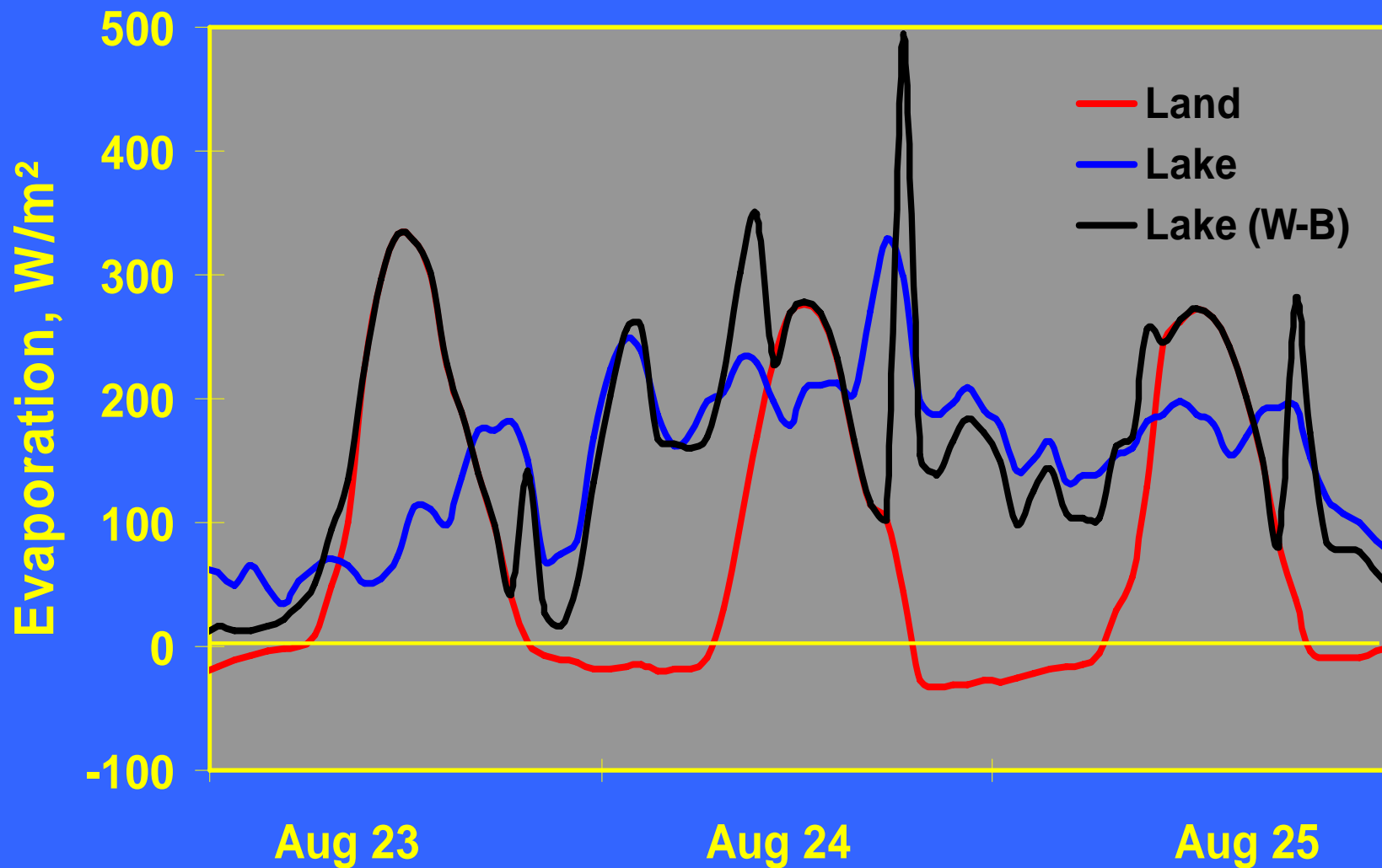
Weisman and Brutsaert (1973) showed that lake evaporation involves advection, and that one needs to have information on both the land and water surfaces.

$$E_l = E_a + a\rho u_* \cdot (q_s - q_{as}) \cdot (X_f / Z_o)^{-b}$$

Where the coefficients *a* and *b* are related to dimensionless advection parameters



Quill Lake, 1993



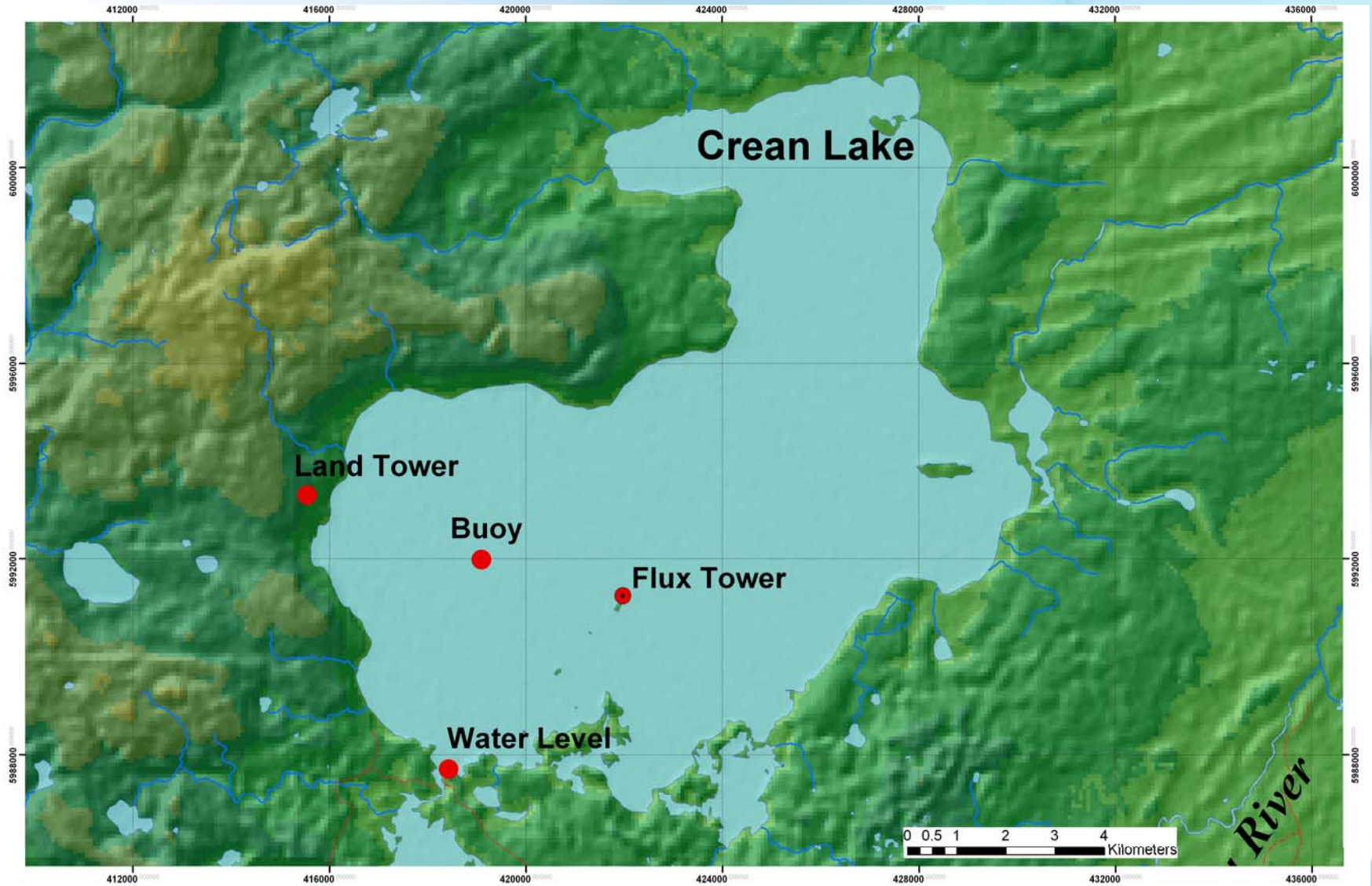
Estimating Lake Evaporation

Will require a knowledge of the water surface temperature, combined with a boundary layer model capable of representing the advection of energy.

Need to redo Weisman-Brutsaert development with better parameterizations for stable conditions.



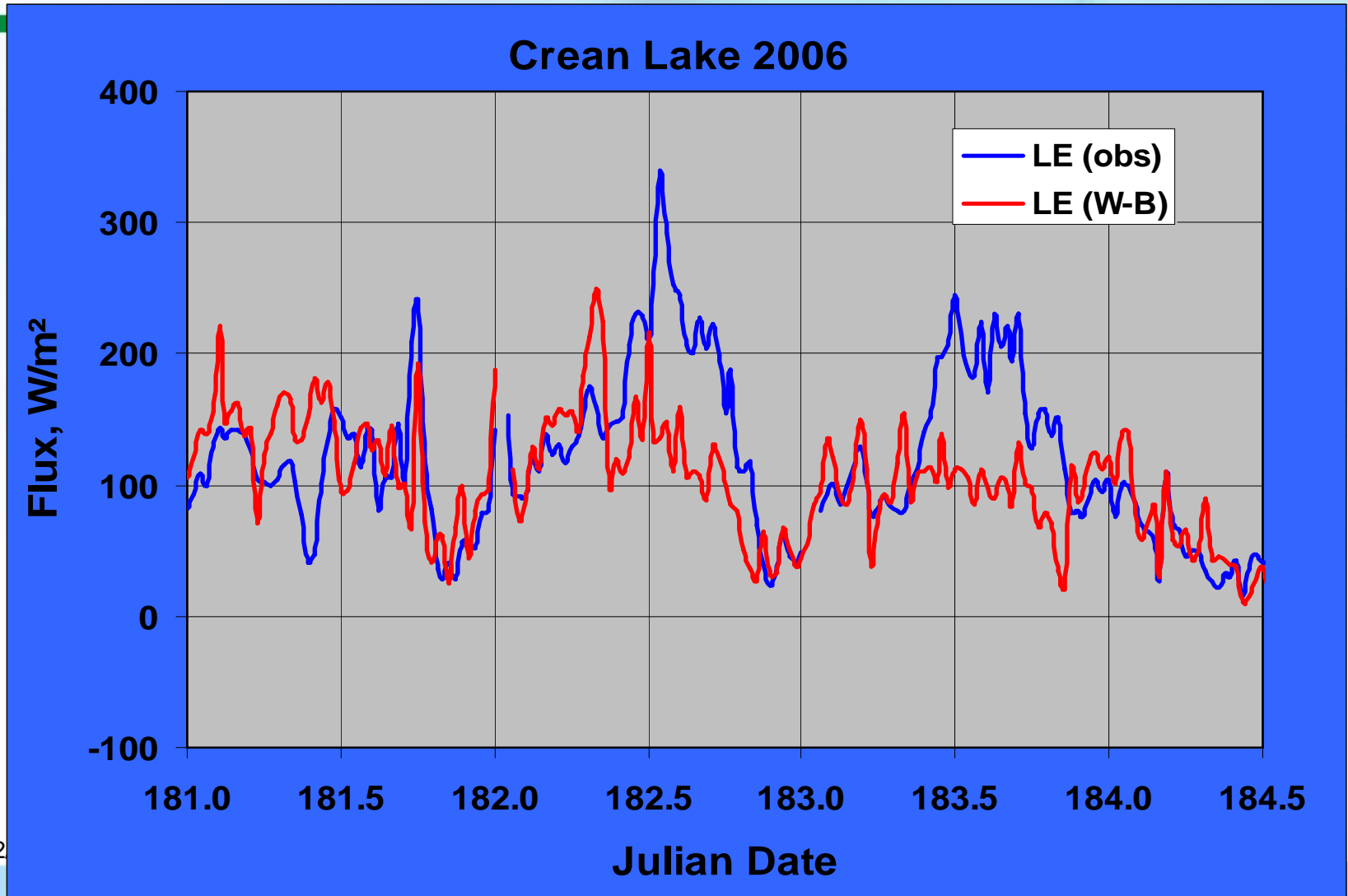
Crean Lake, 2006



Crean Lake, 2006



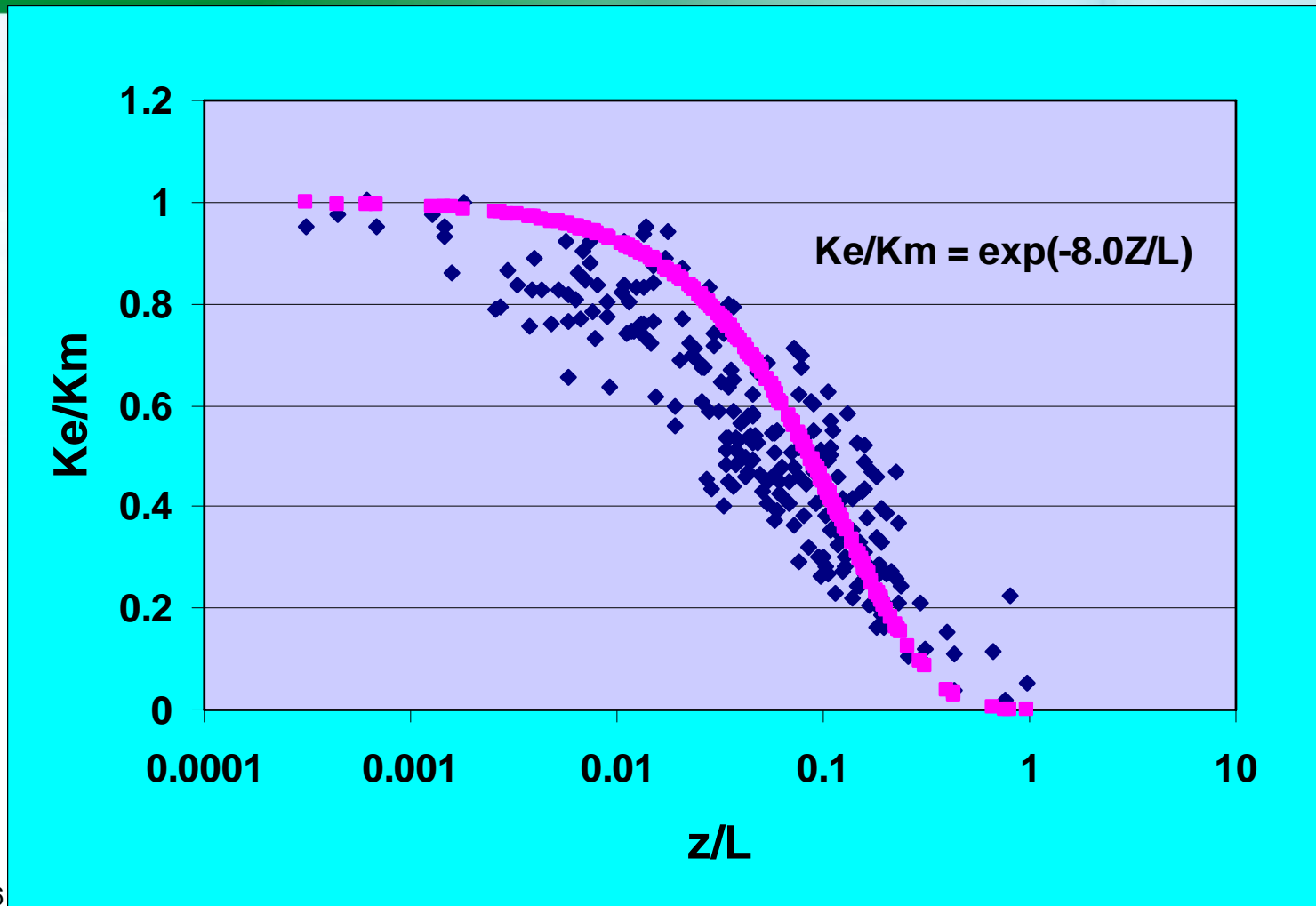
Crean Lake, 2006



11/22



Ratio of transfer coefficients : stable conditions

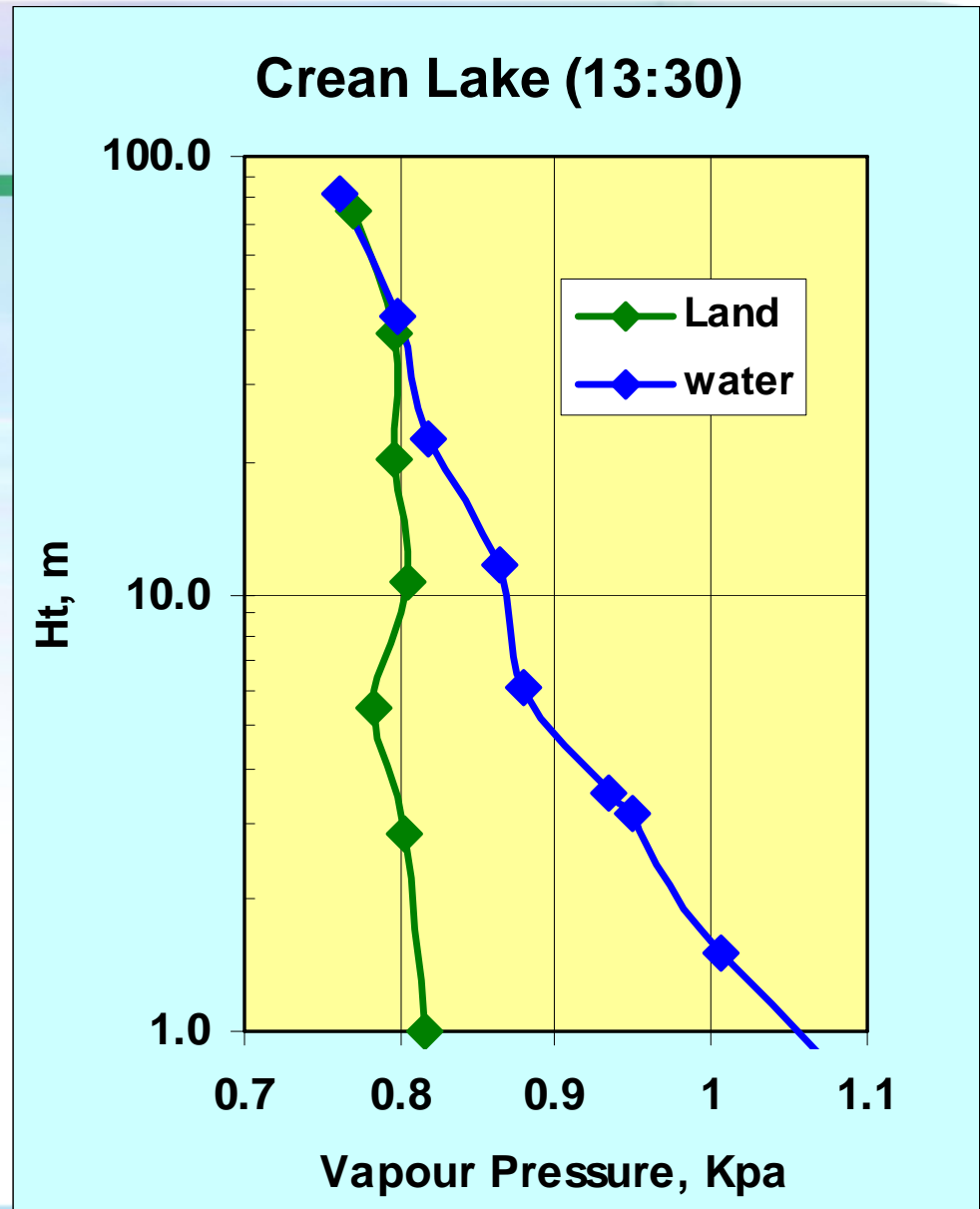


11/22/2006

Boundary Layer Investigation

- Upwind and Downwind tethered sonde profiles were obtained on Sept. 1/06
 - Validation of boundary layer development
 - Estimation of Evaporation from Boundary Layer Integration

Humidity Profiles



11/22/2006



Things to do

- Redo Weisman-Brutsaert advection analysis with better parameterizations for stable conditions.
- Complete the boundary layer integration work.
- Begin collection of MODIS images; test for applicability with remote sensing.



Thank you!



Contents

- Text

Contents

- Text