Appendix I Calculation of global energy consumption by evapotranspiration

1. Data

Total terrestrial evapotranspiration: 65.5×10^3 km^3/y (Oki and Kanae, 2006)

Solar absorbed at the terrestrial surface: 145.1 W/m^2 (Trenberth et al, 2009)

Latent heat of water: (Wikipedia, latent heat)

Density of water: 1×10^3 kg/m^3

Calorific value of oil: 41.868 kj/kg

Energy use: 11,787,115.3 kt oil/y (World Bank Database, Energy use)

Land area: 1.489×10^8 km^2

2. Calculations

Calculation of energy cost of ET

$$P_{ET} = 65.5\times10^3 km^3 / y \times 1\times10^3 kg / m^3 \times 2260 kJ / kg$$
$$= 148.03\times10^{21} J / y$$

Calculation of solar energy income

$$P_{Solar} = 145.1 W / m^2 \times 1.489\times10^8 km^2$$
$$= 216.05\times10^{14} W$$
$$= 6.81\times10^{23} J / y$$

Calculation of human energy cost

$$P_{human} = 41{,}868 kJ / kg \times 11{,}787{,}115.3 kt / y$$
$$= 493.50\times10^{15} J / y$$

The proportions

$$\frac{P_{ET}}{P_{solar}} = \frac{148.03\times10^{21} J / y}{6.81\times10^{23} J / y}\times100\% = 21.74\%$$

$$\frac{P_{ET}}{P_{human}} = \frac{148.03\times10^{21} J / y}{493.50\times10^{15} J / y} = 3.00\times10^5$$

3. Results

The energy cost of ET:

The proportion of ET to solar: 21.74%

The proportion of ET to human: 300000

4. References

Oki T, Kanae S. 2006. Global hydrological cycles and world water resource. *Science*, 313, 1068, 1068-1072.

Trenberth K E, Fasullo J T, Kiehl J. 2009. Earth's global energy budget. *American Meteorological Society*, 3, 311-323.

World Bank Database.