Observational Challenges of Closing the Surface Energy Budget: Introduction

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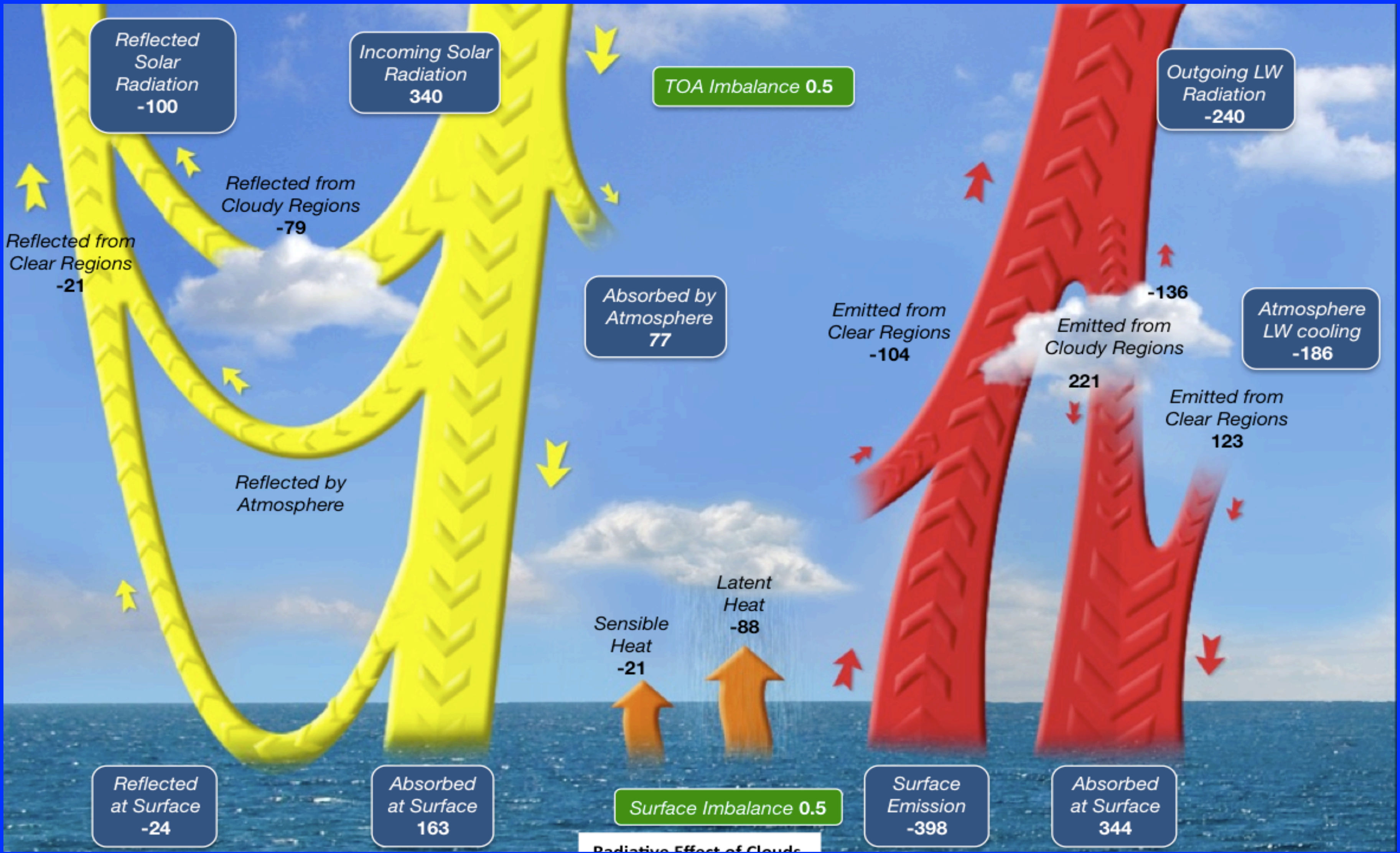
Earth's Energy Budget (2013)



The radiative imbalance between the surface and atmosphere determines how much energy is available to drive the hydrological cycle and the exchange of sensible heat between the surface and atmosphere.

Earth's Radiation Budget (1917)

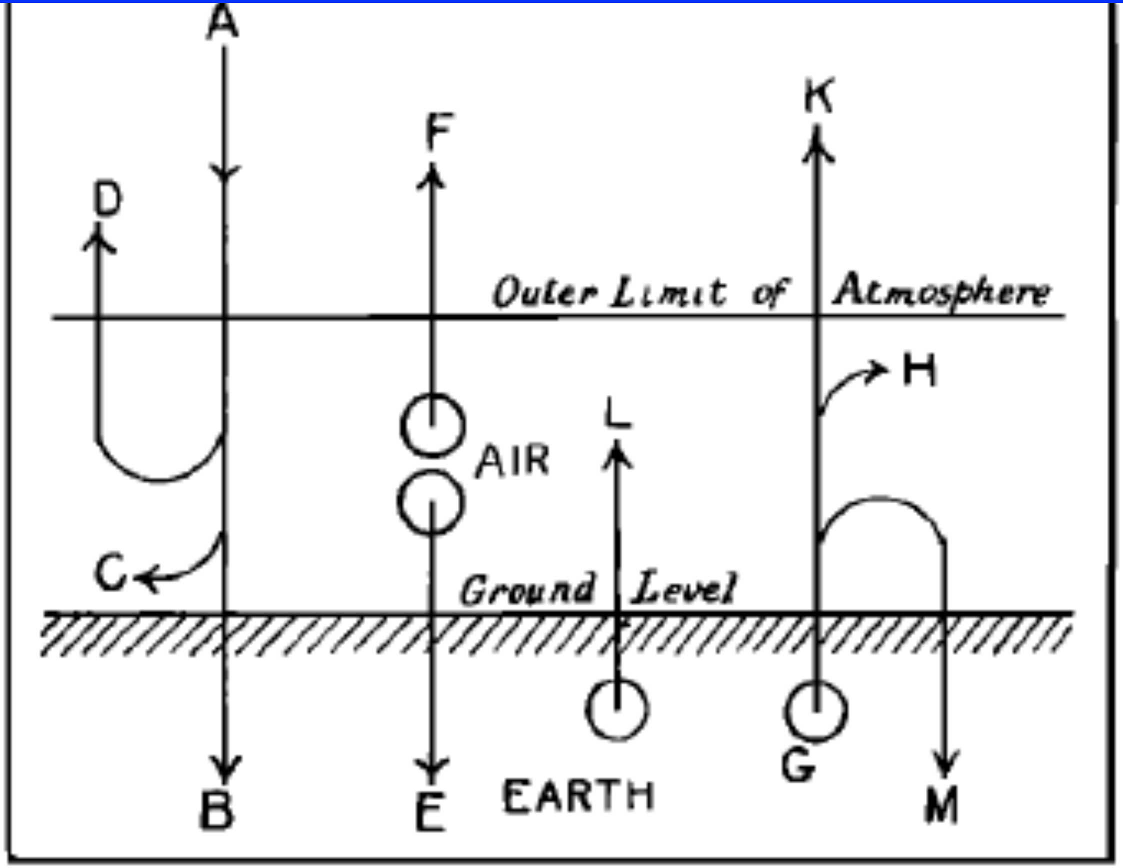


Fig. 2. Heat balance of the atmosphere: (A) radiant energy reaching the atmosphere, part of which is (B) absorbed by the earth, (C) absorbed by the air, and (D) reflected by the earth or air; (G) radiation of the earth, part of which is (M) reflected back, (H) absorbed, and (K) transmitted; (E and F) downward and upward radiation of the air, respectively; and (L) heat passing from the earth to the air other than by radiation [after *Dines*, 1917].

Global Surface Energy Budget

$R_n(SW) + R_d(LW) – R_u(LW) – S – LE = N$

Wm^{-2}	$R_n(SW)$	$R_u(LW)$	$R_d(LW)$	R_n	S	LE	S + LE
KT97	168	390	324	102	24	78	102
TFK09	161	396	333	98	17	80	97
ISCCP FD	165	396	345	114			
SRB	166	397	343	112			
CERES EBAF-SFC	163	398	345	110			
Stephens et al (2012)	165	398	346	113	24	88	112
ERA-I	164	398	342	108	18	84	102
MERRA	169	394	330	105	18	76	94

- Radiation datasets suggests net surface radiation (R_n) is 12-16 Wm^{-2} larger than TFK09, which determines R_n as residual of S + LE + N, where S is determined from reanalysis, LE is inferred from global precipitation (LP=LE), and N is energy imbalance (~0.9 Wm^{-2} in KTF09).
- Can we explain the difference? Is S+LE too low? R_n too high? What are the uncertainties? Do the difference impact our ability to track year-to-year and longer-term changes in surface energy budget?

GOAL of Invited Presentation Session

Bring together the experts in each of the relevant areas (radiation, turbulent surface heat flux, precipitation) to discuss the current state-of-the-art in surface energy budget determination from observations.

Presenters asked to consider covering the following areas:

1) High-level introduction summarizing how your area of interest fits into the big picture.

2) Methodology (e.g., observations and analysis method). How are your specific variables determined? What assumptions are made?

3) Validation Strategy (e.g., comparisons with ground obs; closure studies, etc.)

4) Estimate of uncertainty as a function of time and space scale

5) How well are changes represented (e.g., interannual variability)?

6) What tall poles in current state-of-the-art are likely to improve in the future (e.g., through new surface measurements and/or satellite missions)?

Invited Science Presentations

8:30 am	Introduction	*N. Loeb*
8:45 am	Surface Radiation Budget from CERES & A-Train	*S. Kato*
9:30 am	Surface Turbulent Heat Fluxes	*C. Clayson*
10:15 am	**Break**	
10:45 am	Mean Global Precipitation and Error Estimates: GPCP, TRMM and CloudSat	*B. Adler*
11:30 am	Observational Challenges and Uncertainties in Estimating Global Precipitation from Satellites	*W. Berg*
12:15 pm	**Lunch**	
1:45 pm	Cloudsat & TRMM Precipitation, Closing the Surface Energy Budget	*T. L'Ecuyer*
2:30 pm	Discussion	
3:00 pm	**Break**	