

NRL Solar and IR Radiometric Measurements During POST



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NRL Scientific Objectives:

- Quantify the impact of **solar radiative heating** and **infrared radiative cooling** on the evolution and persistence of **marine stratocumulus** clouds
- Quantify the radiative properties and effects of the **Entrainment Interface Layer (EIL)**

NRL Measurements:

- **Solar and Infrared Irradiance – surface to above cloud tops:**
 - Platform: CIRPAS Twin Otter
 - Solar and IR heating and cooling rates
 - Solar reflectivity (albedo) of cloud tops



Marine stratocumulus

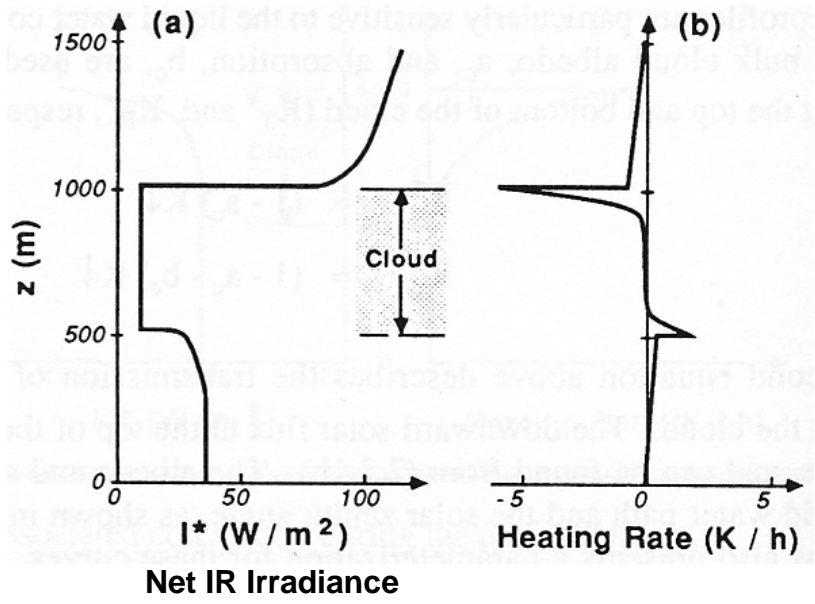
Navy Applications:

- Improvement of Navy Large Eddy Simulation models of marine boundary layer

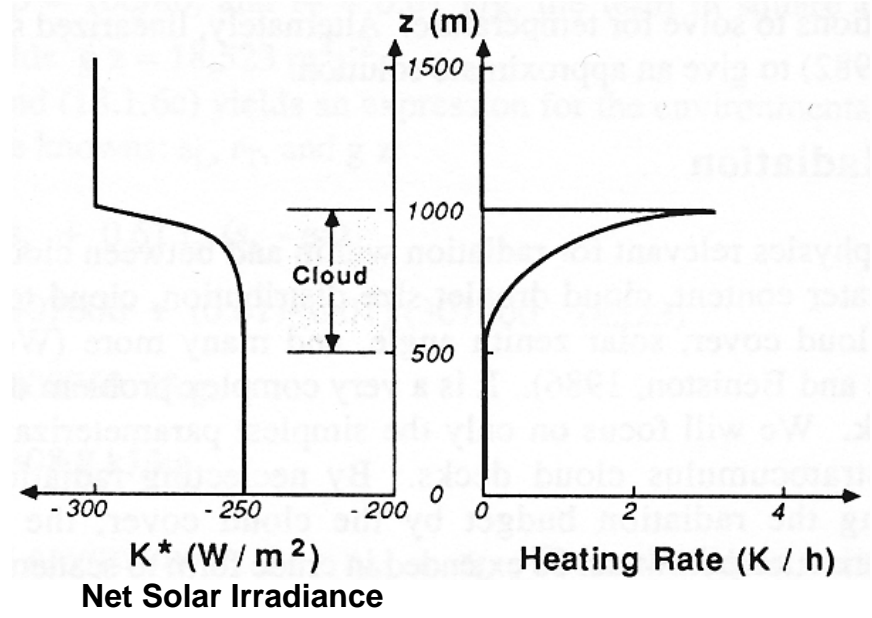
Classic Radiative View of an Idealized Stratocumulus Cloud (Stull, 1988)



IR



Solar



• **IR cooling** at cloud top (and warming at cloud base) => **Primary driver of convection**

• **Solar heating offsets IR cooling**

• **What is radiative effect of Entrainment Interface Layer**

• **Location of cooling/heating spikes uncertain**

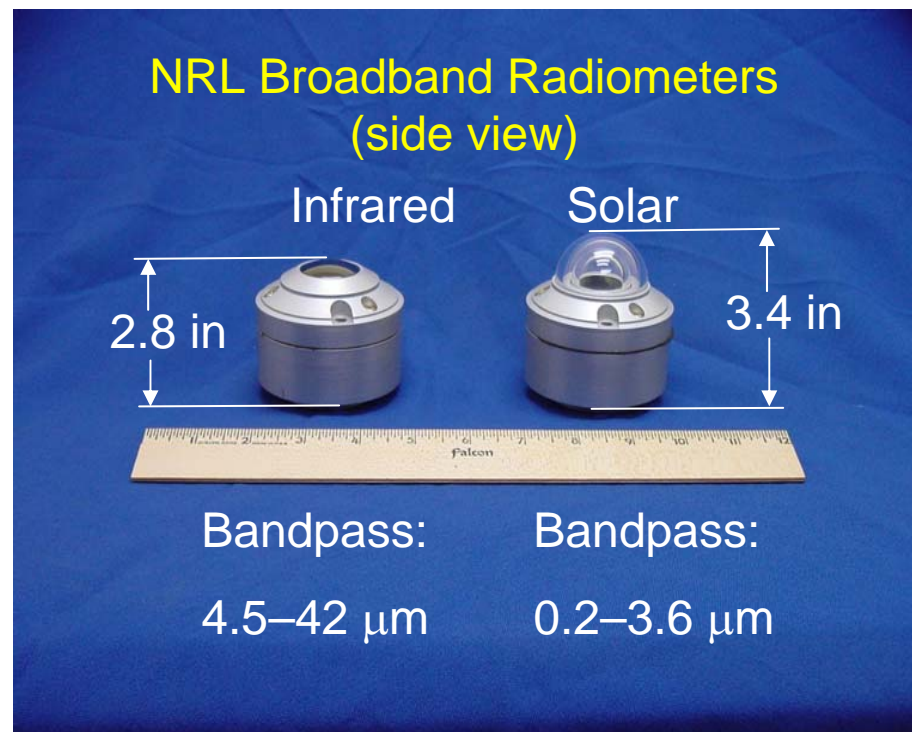
- **Dependent on:**
 - **cloud properties**
 - **time of day (solar zenith angle)**

NRL Solar and IR Radiometers: Instrument Description



Description:

- **Modified** Kipp & Zonen CM-22 pyranometers (solar) and CG-4 pyrgeometers (IR)
 - **Amplification of signal at sensor:**
 - New housing
 - Current loop mode operation
- **Fully calibrated** pre- and post-mission at CIRPAS Radiometer Calibration Lab
- Hemispheric field-of-view
- Solar and IR radiometer pair on top and bottom of Twin Otter



Basic Quantities Measured:

- **Up- and down-welling broadband solar and IR irradiance**
- Estimated accuracy: 3% (precision < 1%)

Derived Quantities:

- Net solar and IR flux
- Solar and IR absorption and heating rates
- Cloud albedo

NRL Solar and IR Radiometers: Operational Requirements



- **Level Flight During Data Runs**
 - Pitch/Roll limits: +/- 2 deg ideal, +/- 5 deg max
 - Not as critical for IR measurements
- Airspeed: N/A
- Desired Flight Altitudes:
 - Multiple levels throughout atmospheric column (surface to above boundary layer)
 - Flat descents and ascents
- Undesirable Flight Conditions:
 - Spiral ascents and descents