Broadband Surface Irradiances and Aerosol Optical Depth from Chebogue Pt., N.S., July-Aug 2004
Bonus topic: Thick Fog Identification

E. G. Dutton, G. Carbaugh, D. Longenecker and E. Andrews
NOAA, CMDL Aerosol and Radiation Group
Boulder, CO 80305
Measurements – 1-min. resol.

Broadband Downwelling Irradiance
- Direct Solar (2)
- Diffuse-sky solar (2)
- Total (Global) solar (2)
- Thermal IR

Narrowband Direct Solar
- 368, 412, 500, 610 nm
- 675, 778, 862 nm

Meteorology (4-m)
- Air Temp., RH, Ws & Dir, Pres.

100% raw data recovery
Solar Radiation, NENA, Chebogue Point, NS, Jul-Aug '04

- D_Global
- Direct
- Diffuse
Solar Radiation, NENA, Chebogue Point, NS, JulAug ‘04
Solar Radiation, NENA, Chebogue Point, NS, Jul-Aug ‘04

D_Global  Direct  Diffuse
Solar Radiation, NENA, Chebogue Point, NS, JulAug ‘04

D_Global  Direct  Diffuse
Solar Radiation, NENA, Chebogue Point, NS, JulAug ‘04

- D_Global
- Direct
- Diffuse

NOAA/CMDL/STAR
Solar Radiation, NENA, Chebogue Point, NS, Jul-Aug '04
Aerosol Optical Depth, NENA, Chebogue Point, NS, Jul-Aug ‘04

Aerosol + cloud OD

Cloud screened AOD
Direct Aerosol Solar Forcing (net, surface)

Cheboque Pt. N.S. 2004

Slope \sim 75 - 85 \text{ W m}^{-2} \text{ per unit AOD (500nm)}

(24-hour avg, net surface solar; Alb=0.06 - 0.12)

ACOS(MEAN COS(Z)) = 69.3 DEG
MEAN Z = 66.7
DOY = 200
Preliminary Angstrom Exponents
Chebogue Pt. Broadband Solar and IR Downwelling Irradiance

Overcast  Pt. Cldy  Overcast  Clear

Direct
IR
Total solar
Diffuse

NOAA/CMDLSTAR

NENA, DOY: 220, edited
TIME (LST)
7-AUG-2004
Potential thick fog times from IR obs only

Chebogue Pt. 2004

[Graph showing potential thick fog times from IR observations for the year 2004.]
Fog potential determined from IR and RH obs.

**Favorable Thick Fog Conditions**
Down/Up IR > 0.99, RH > 99%

**Un-favorable Fog Conditions**
Down/Up IR < 0.94, RH < 95%

**Marginal Fog Conditions**

Chebogue Pt. 2004
Times = GMT (UT)
Webcam versus IR flux
Summary

- Acquired 100% of possible downwelling solar and IR fluxes as well as 4-m met data.
- 38 hours of cloud screened, daytime spectral AOD obtained
- 500 nm AOD ranged from about 0.05 to 0.5
- Direct aerosol net solar radiative forcing at the surface found to be about 80 Wm\(^{-2}\) / unit AOD (essentially - DOY 194 vs. DOY 223)
- Radiation measurements contribute to detection of vertically thick fog conditions
- It's foggy a lot at Chebogue Pt. in July
Improving Calibration Standards

History of the World Radiation Reference for Direct Solar Beam Measurements at the Earth’s Surface

- Smithsonian, 1907
- WRR, 1975
- SI/WRR 1991
- SRR
- IPS, 1956 initial
- SI/WRR 1996
- IPS, 1956 Final
- Corrected Angstrom
- Angstrom, 1905

Improvements in Pyrgeometer (Downward IR) Accuracy

Sources of Uncertainty
- Routine Field Operations
- Ideal Operations
- Calibration Reference

Clear-Sky Diffuse (Model – Measured Bias in W/m²)


Diffuse Radiometer Performance Relative to Mean of Stable Eleven (Wm⁻²)

Offset-Corrected with Shade/Unshade Calibrations Modified to Force 11 to Agree for Cloudy Skies