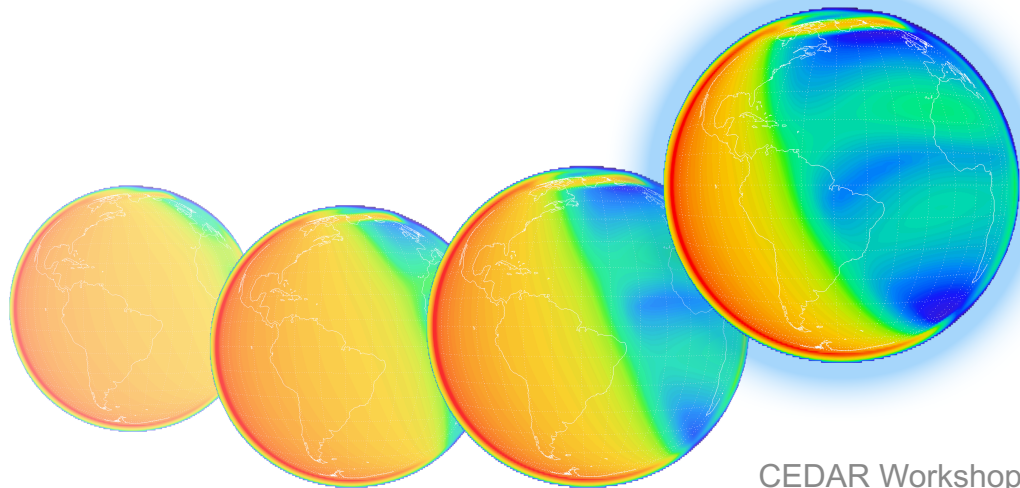
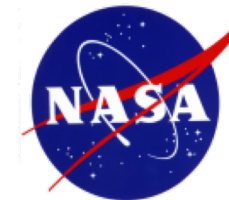


Global-scale Observations of the Limb and Disk (GOLD) – On-orbit Calibration

Richard Eastes and
William McClintock



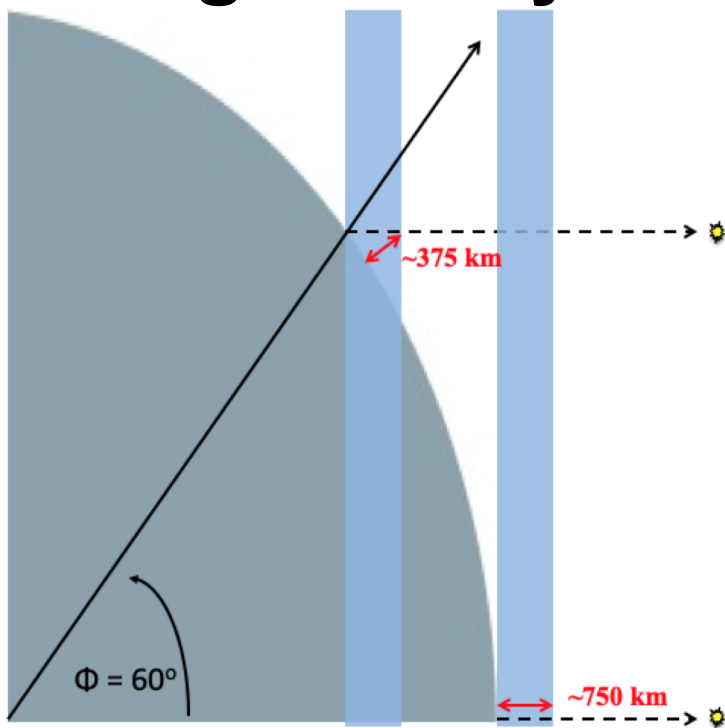
CEDAR Workshop, June 2019



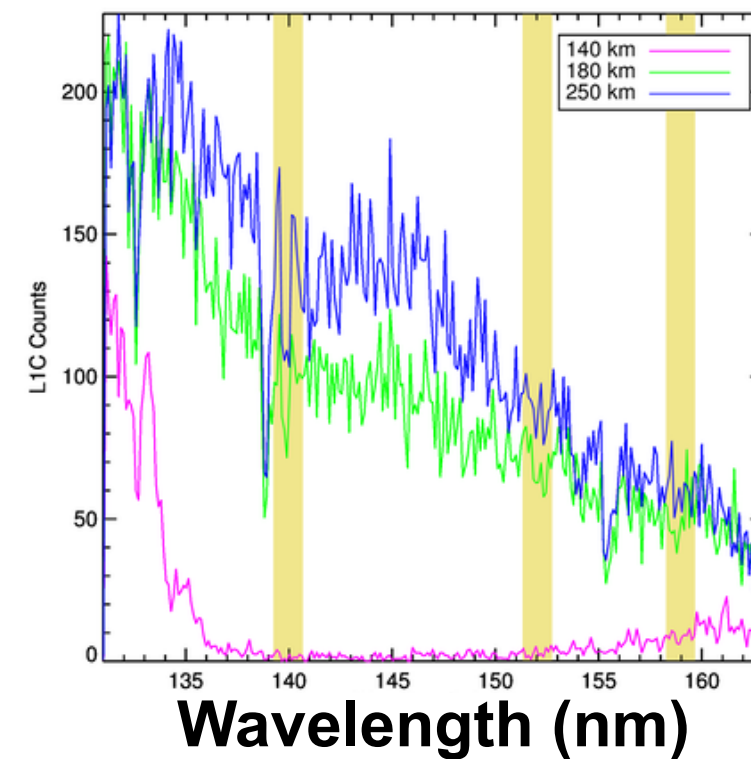
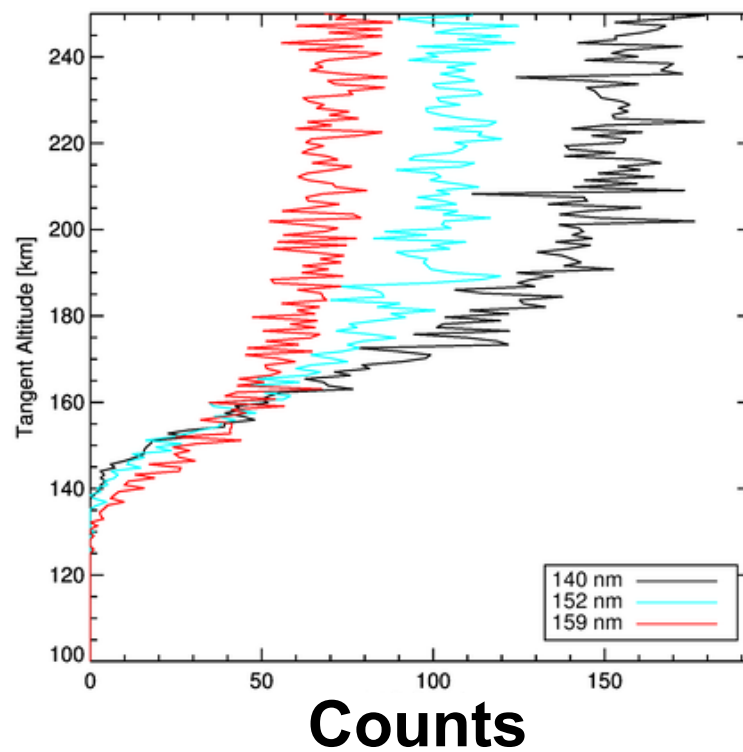
Laboratory for Atmospheric and Space Physics
University of Colorado Boulder

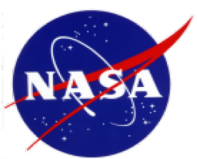


Occultation slit geometry



Occultation Measurement



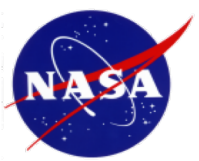


GOLD, Stars for In Flight Calibration

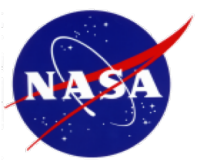


- In-flight calibration from bright O-B stars
- All stars near ecliptic, many near same Right Ascension
- Some error sources
 - Uncertainties in brightness of stars (~15% from IUE data uncertainties)
 - GOLD counting statistics
 - Uncertainties in the relative response across the GOLD detectors after flat-field correction

GOLD Calibration Stars				
Name	RA (hr)	DEC (deg)	Spectral Type	Visual Magnitude
Del Cet	2.65	-0.3	B2	4.07
Nu Eri	4.5	-3.3	B2	3.92
Mu Eri	4.76	-3.25	B5	4.02
Pi4 Ori	4.8	5.5	B2	3.68
Pi5 Ori	4.9	2.2	B3	3.72
Psi Eri	5.0	-7.2	B8	4.81
Bet Ori	5.1	-8.2	B8	0.15
Tau Ori	5.3	-6.9	B5	3.58
Eta ORI	5.3	-2.3	B1	3.35
Gam Ori	5.3	6.2	B2	1.63
Psi Ori	5.4	3.1	B2	4.59
Ups Ori	5.5	-7.3	B3	4.62
	5.5	-1.6	B2	4.50
Iot Ori	5.6	-5.9	OE	2.76
Eps Ori	5.6	-1.2	B0	1.69
Ome Ori	5.7	4.1	B3	4.57
Zet Ori	5.9	-1.94	B0	2.05
	6.2	-6.6	B3	5.05
19 Mon	7.0	-4.2	B3	4.99
Eta Hya	8.7	3.4	B3	4.30
Thet Hya	9.2	2.5	B9	3.88
67 Oph	18	3	B5	3.96
66 Oph	10.0	4.4	B3	4.64
Lam Aql	18.1	-5	B9	3.43
Thet Aql	20.15	-1	B9	3.24
Pi Aqr	22.4	1.4	B1	4.66



- Coincident measurements with Low Earth Orbiting satellites occur ~10 times per day
- Some candidates are:
 - GUVI on TIMED
 - DMSP UV sensors
 - ICON (future)



Nighttime EIA Observations

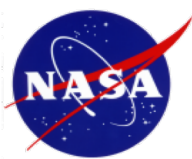


GOLD Data

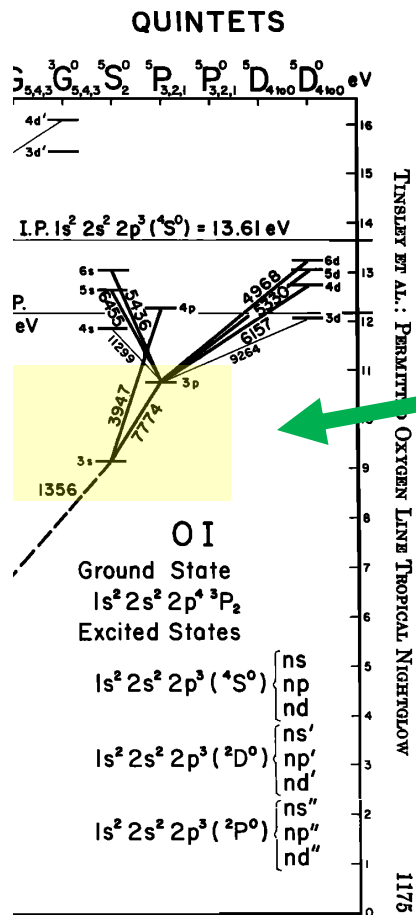
1. Images of OI 135.6 nm at night

Ground Based

1. Radars
2. Ionospheric Sounders
3. OI 777.4 nm images



Comparison to Ground Based Measurements?



Tinsley et al. 1973

O I 135.6 and O I 777.4 nm from recombination are coupled

Brightness of O I emissions at 135.6 nm and 777.4 nm at night expected to be nearly equal

TABLE 2. Effective Recombination Coefficients For O I Lines at 0.1 eV

Line, Å	Transition	Present Result		Tinsley et al. [1973]*
		Thin	Thick	
<i>Triplet Lines</i>				
905-910	$e+O^+ \rightarrow 2p^4 \ ^3P$	4.4		3.5
1304	$3s-2p^4$	0.49	2.8	3.7
8446	$3p-3s$	0.45	2.6	2.4
1027	$3d-2p^4$	1.2	0	0.8
11287	$3d-3p$	0.34	1.7	
4368	$4p-3s$	0.012	0.070	0.07
7002	$4d-3p$	0.020	0.20	
7254	$5s-3p$	0.004	0.065	
5959	$5d-3p$	0.004	0.056	
<i>Quintet Lines</i>				
1356	$3s-2p^4$	4.9		7.5
7774	$3p-3s$	4.8		5.4
9264	$3d-3p$	2.7		
3947	$4p-3s$	0.064		
6157	$4d-3p$	0.43		
6455	$5s-3p$	0.13		
5330	$5d-3p$	0.13		

Units are $10^{-13} \text{ cm}^3 \text{ s}^{-1}$.

*Converted from 1000°K by assuming a $T^{-0.5}$ temperature variation.

Julienne, Davis and Oran;
1974

Direct comparison with electron lamp spectra acquired during ground calibration shows that the relative band strengths are in **good but not perfect** agreement with Franck- Condon factors derived in the laboratory

Comparison of Laboratory Electron-Impact Spectrum and Flight Data

