BEHAVIOR OF SOME TC-4 ATMOSPHERIC PARAMETERS MEASURED BY SONDES AND NASA AIRCRAFTS

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COORDINATOR

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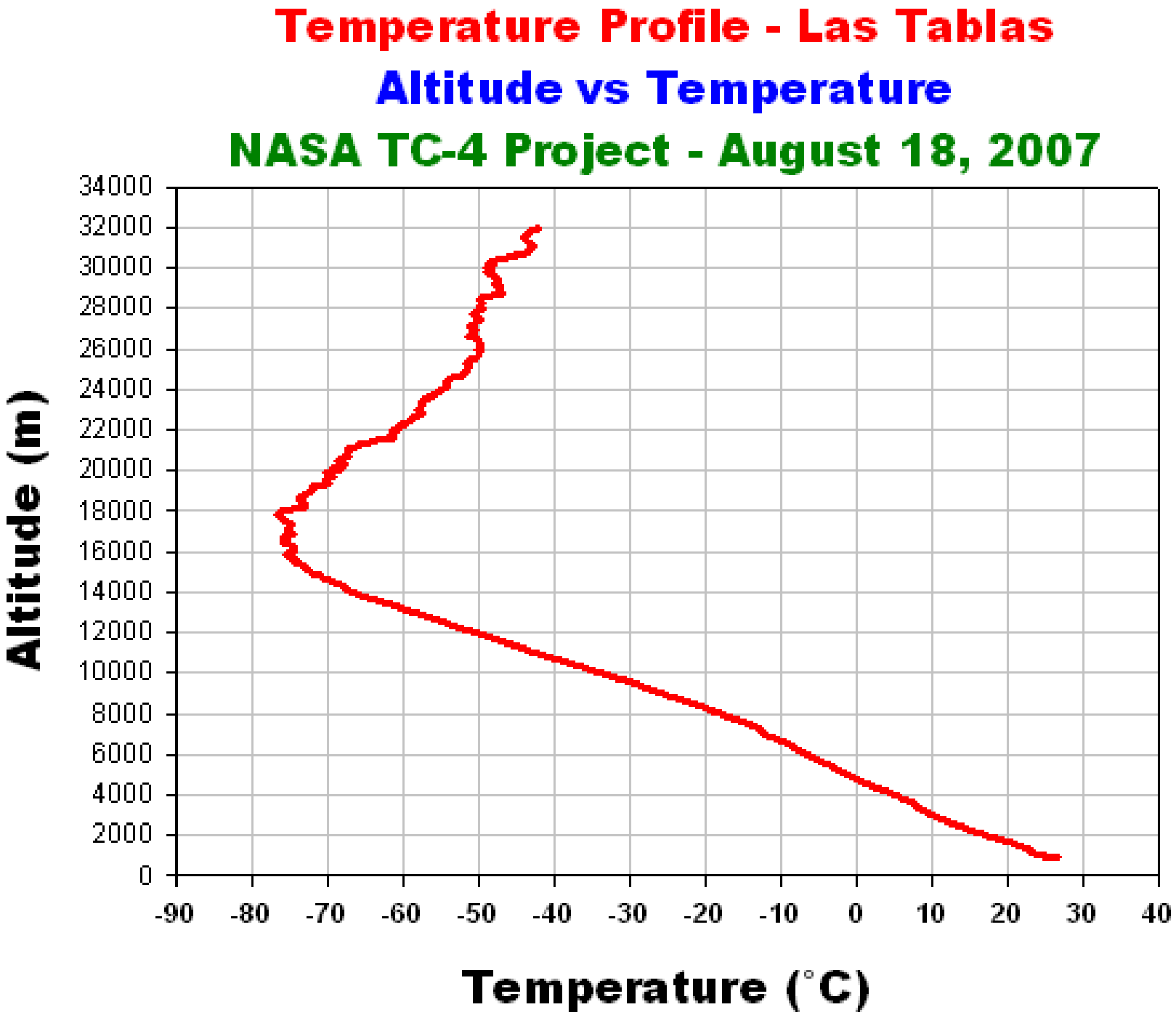
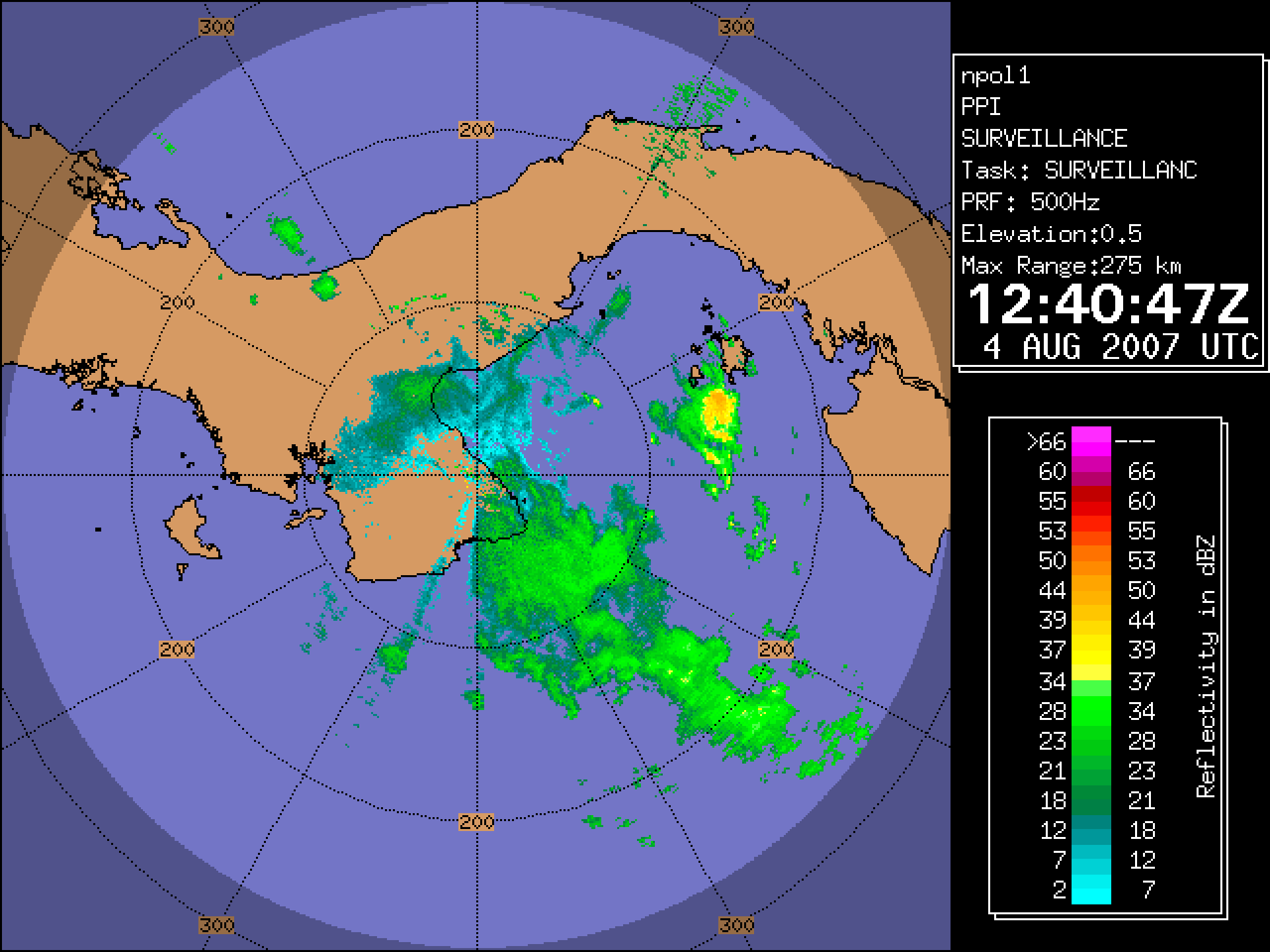
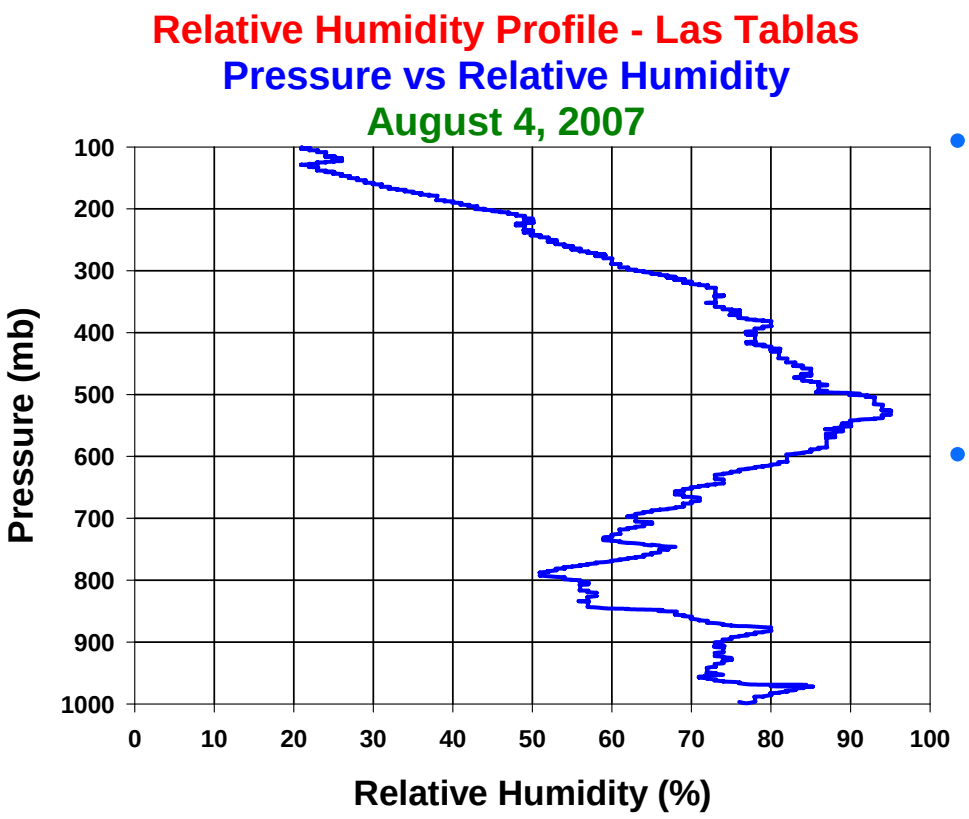
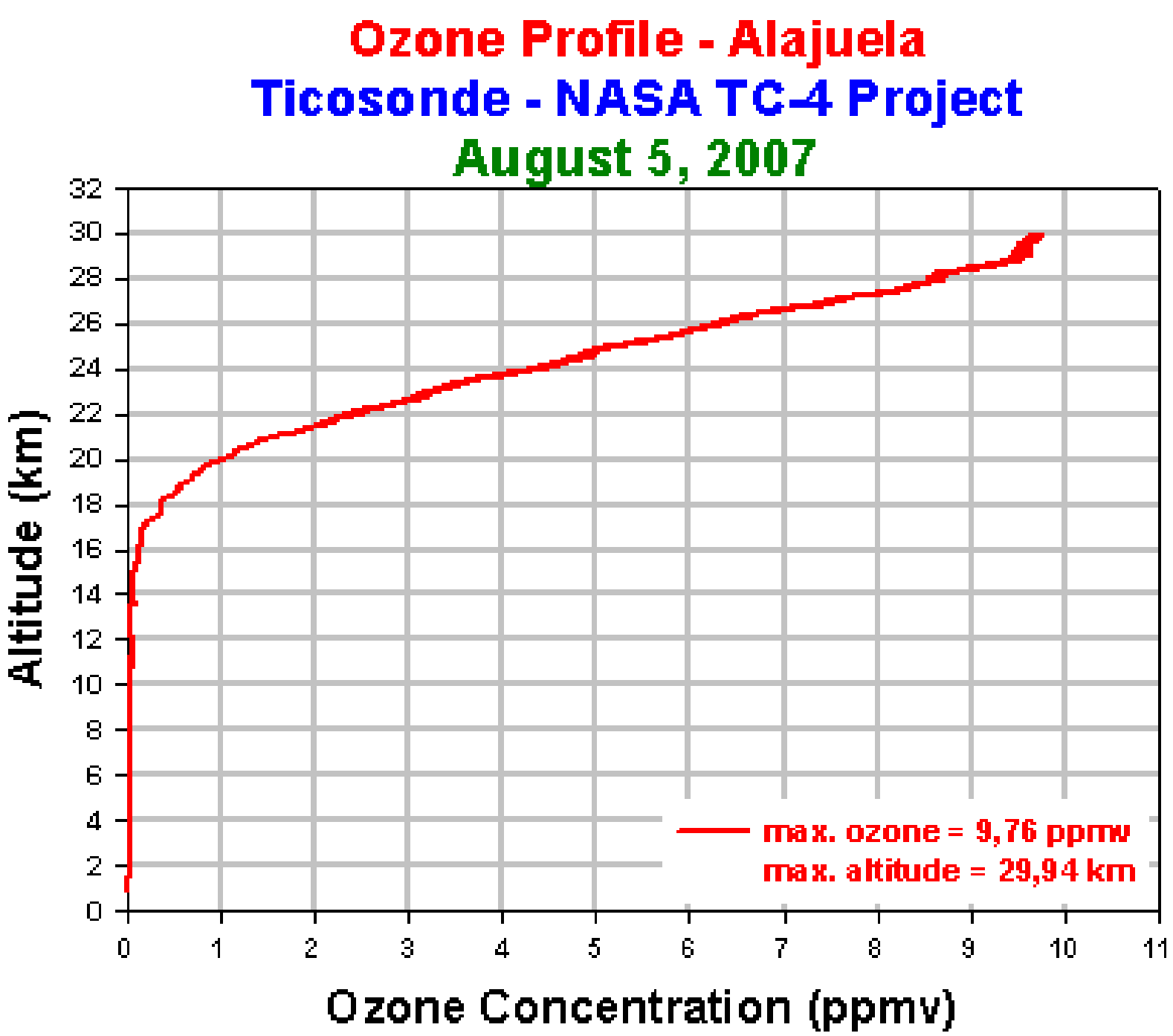

Temperature Profile - Las Tablas
Altitude vs Temperature
NASA TC-4 Project - August 18, 2007
Altitude (m)
34000
32000
30000
28000
26000
24000
22000
20000
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-90
-80
-70
-60
-50
-40
-30
-20
-10
0
10
20
30
40
Temperature (˚C)


300
300
200
200
200
200
200
300
300
npol1
PPI
SURVEILLANCE
Task: SURVEILLANC
PRF: 500Hz
Elevation:0.5
Max Range:275 km
12:40:47Z
4 AUG 2007 UTC
>66 ---
60 66
55 60
53 55
50 53
44 50
39 44
37 39
34 37
28 34
23 28
21 23
18 21
12 18
7 12
2 7
Reflectivity in dBZ

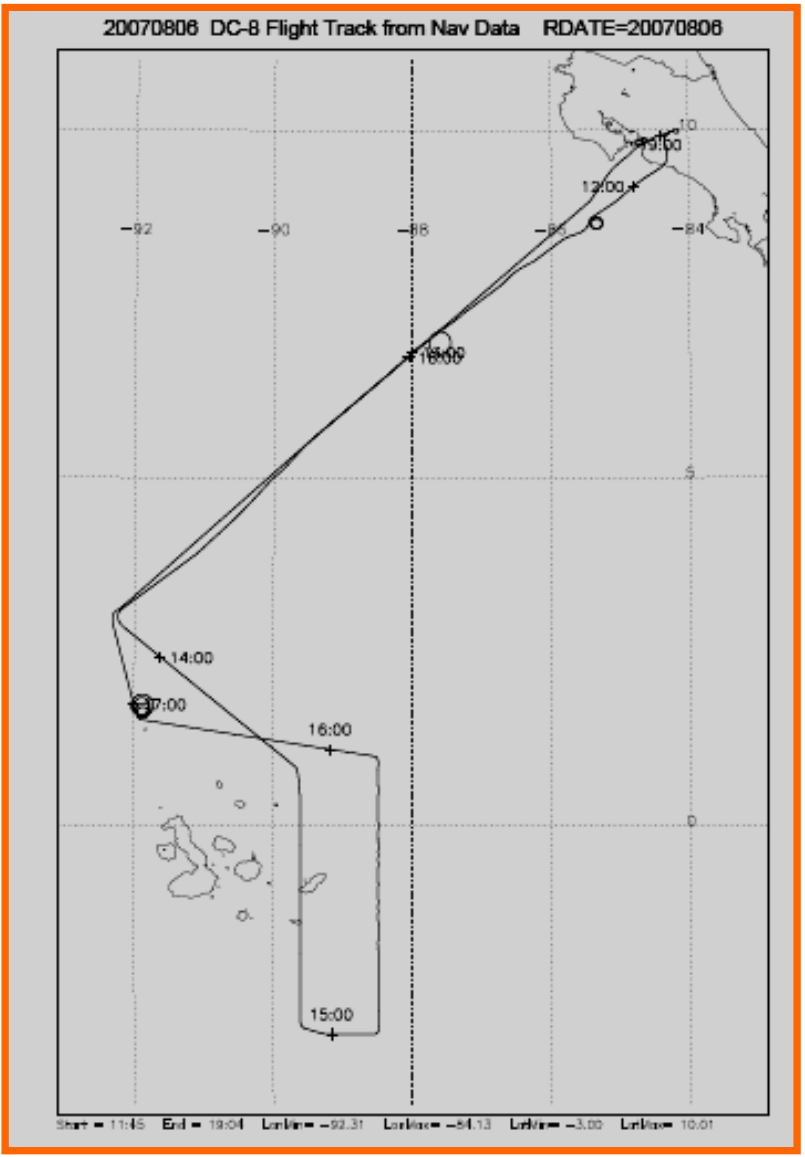
RESULTS AND DISCUSSION

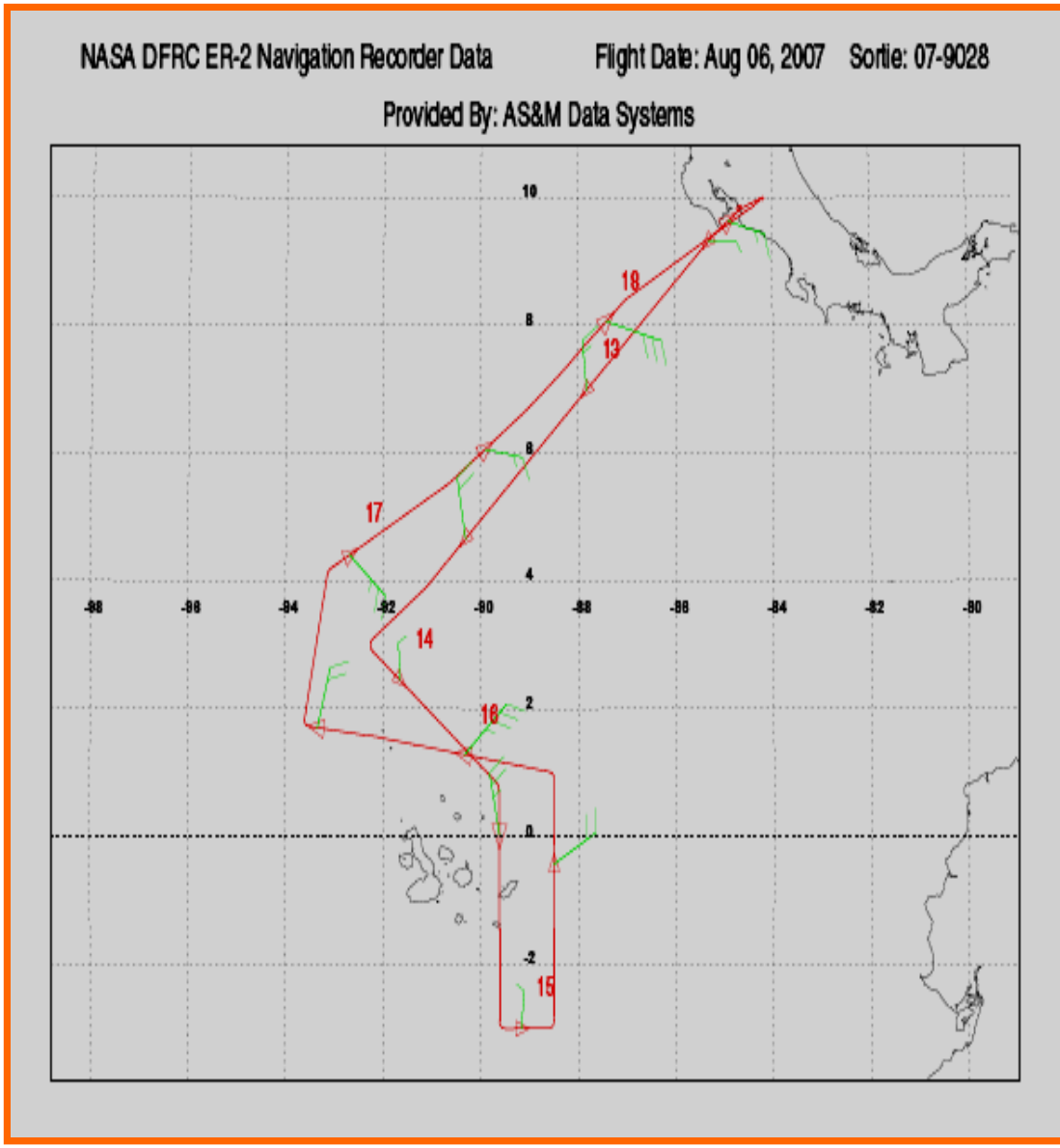


- In the graphic at left, an inversion layer near 550 mb is relevant.
- This inversion layer, known as a tropical inversion near the 0° C level is typical of deep convection.
- The increseasing values of relative humidity corresponding to the inversion layer, could be interpreted as melting and evaporation of ice crystals in the precipitation systems associated with deep convection.

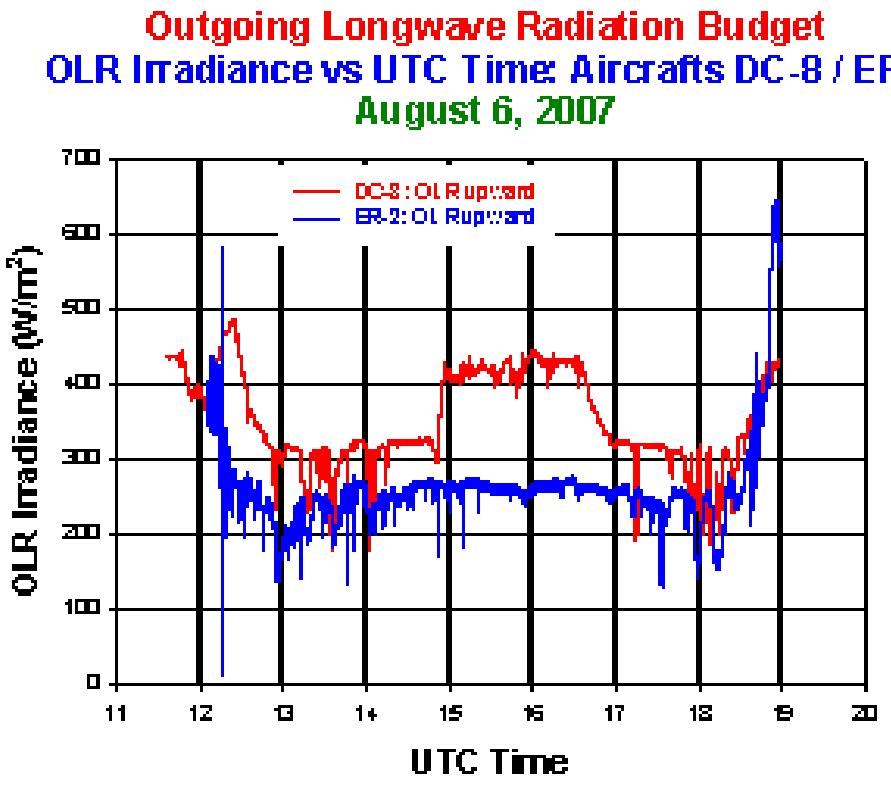

Ozone Profile - Alajuela
Ticosonde - NASA TC-4 Project
August 5, 2007
Altitude (km)
Ozone Concentration (ppmv)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
0
1
2
3
4
5
6
7
8
9
10
11
max. ozone = 9,76 ppmv
max. altitude = 29,94 km

COORDINATED FLIGHTS: DC-8 AND ER-2
August 6, 2007





RESULTS AND DISCUSSION

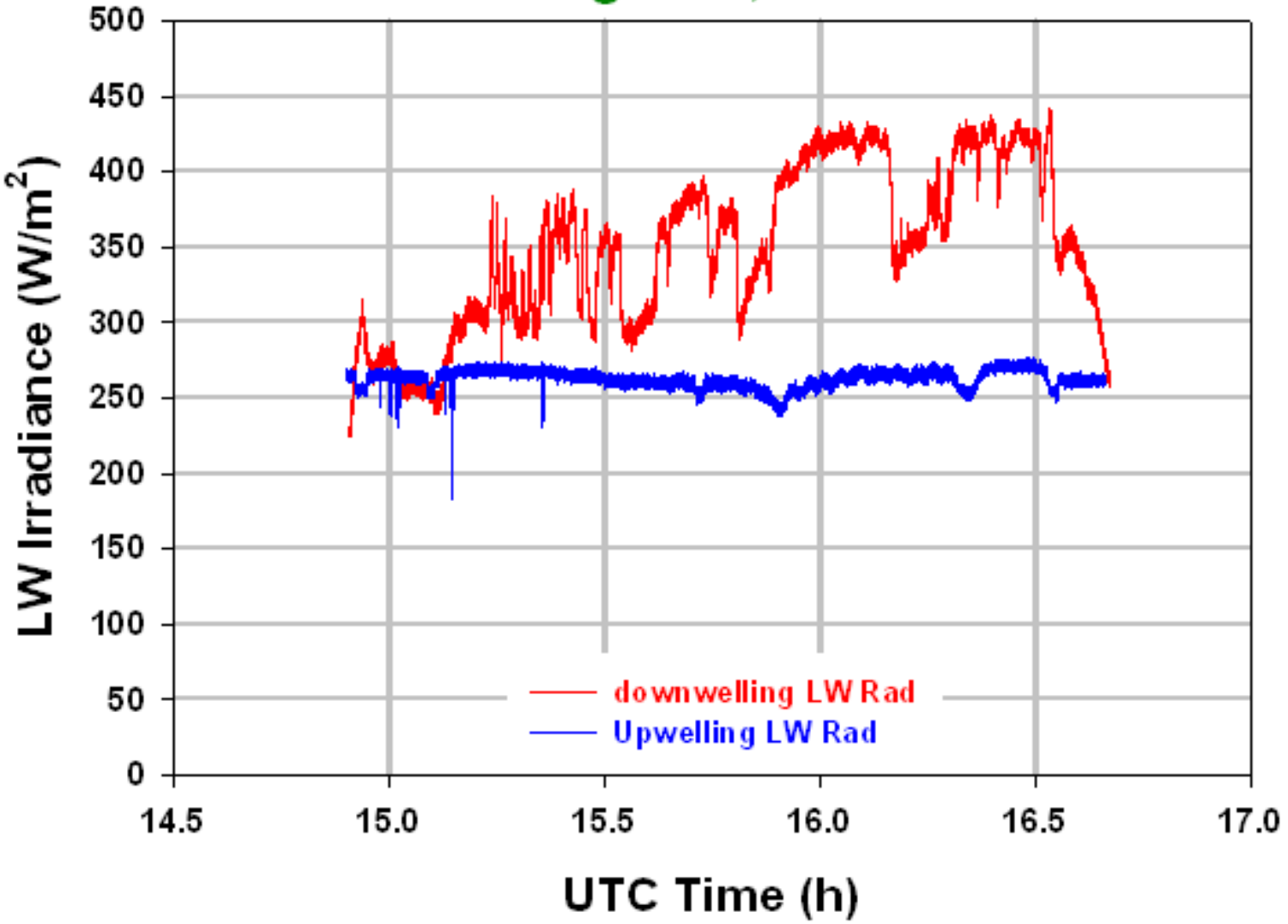


- As is shown, the OLR measured above the cirrus layer (*blue curve*) is lesser than the OLR measured below the cirrus layer (*red curve*).
- Hence, the cirrus layer has a net absorption of OLR and thus, has a net warming effect on *upper troposphere*. Indirectly it has a warming effect on surface.
- Between 15 and 16.5 hours (*UTC time*) both aircrafts encountered a thin aged cirrus layer. So, the net warming effect increases.

LW Radiation Balance - Aircrafts DC-8/ER-2

LW Irradiance vs UTC Time

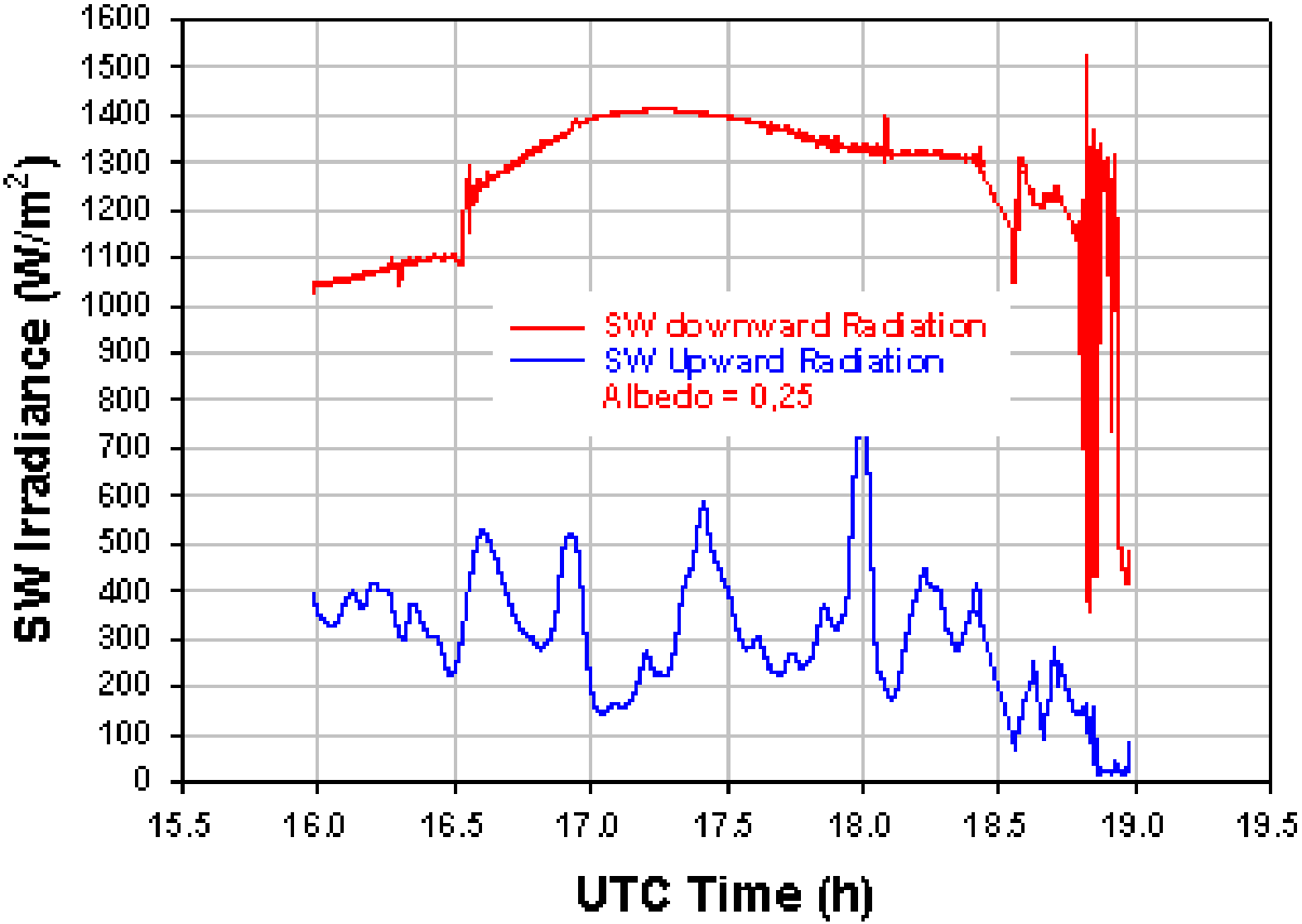
August 6, 2007



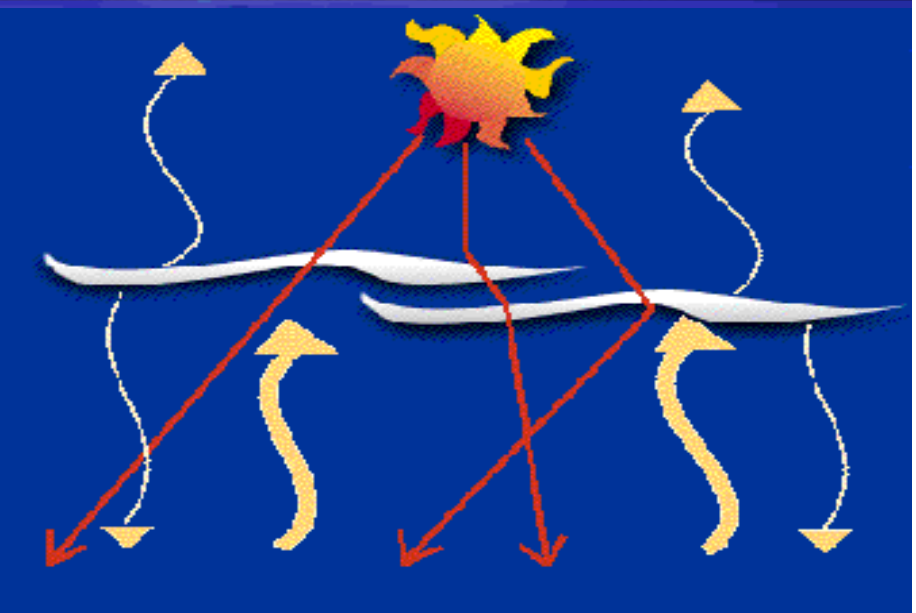
SW Radiation Budget - ER2

SW Irradiance vs UTC Time

August 6, 2007



RADIATIVE FORCING OF TROPICAL CIRRUS



- ***Thin cirrus*** (optical thickness < 1) are relatively **transparent** to Short Wave Radiation (albedo ~ 0,25)
- ***Thin tropical cirrus*** have a stronger longwave warming effect than a shortwave cooling effect.
- Hence, this behavior could cause a net warming effect on the climate.
- ***Thick cirrus***, are highly reflective to Short Wave Radiation (albedo ~ 0,42) and have a net cooling effect on the climate.

CONCLUSIONS

- The relative humidity profiles give reliable information about the presence of tropical deep convection and about the presence of subsequent layers of anvil cirrus generated from convective turrets.
- Thin aged anvil cirrus with no convective system below, have a net radiation warming effect at TTL.
- The infrared greenhouse effect of thin maritime anvil cirrus ***outweighs*** their solar albedo. Thus, the "cloud radiative forcing" (CRF) for this type of clouds is positive.
- The effect of these clouds on an additional increment in SST depends on the frequency of convective processes over the ocean, on the extension of cirrus detached from their convective source, on the cloud optical thickness (linked to age of cirrus) and on the ice crystal shapes and size. Larger crystals (>100 μm) contribute to a net positive Cloud Radiative Forcing.

ACKNOWLEDEGMENT

THANKS TO NASA DUE TO THE FACT THAT THE TC-4 PROJECT WILL ALLOW US TO HAVE A BETTER VIEW AND UNDERSTANDING OF THE PHYSICOCHEMICAL PROCESSES AT THE TROPICAL TROPOPAUSE LAYER.

ALSO THE TC-4 PROJECT HAS PERMITTED TO GET A BETTER ASSESSMENT OF THE EVOLUTION OF CLIMATE CHANGE AT CENTRAL AMERICA AND PANAMA.