



GOBIERNO  
DE ESPAÑA

MINISTERIO  
DE AGRICULTURA, ALIMENTACIÓN  
Y MEDIO AMBIENTE

**AEMet**  
Agencia Estatal de Meteorología

# Collocation: best practices and related uncertainties

Xavier Calbet (xcalbeta@aemet.es)  
Níobe Peinado-Galán

23 September 2016  
GEWEX G-VAP Workshop September 2016

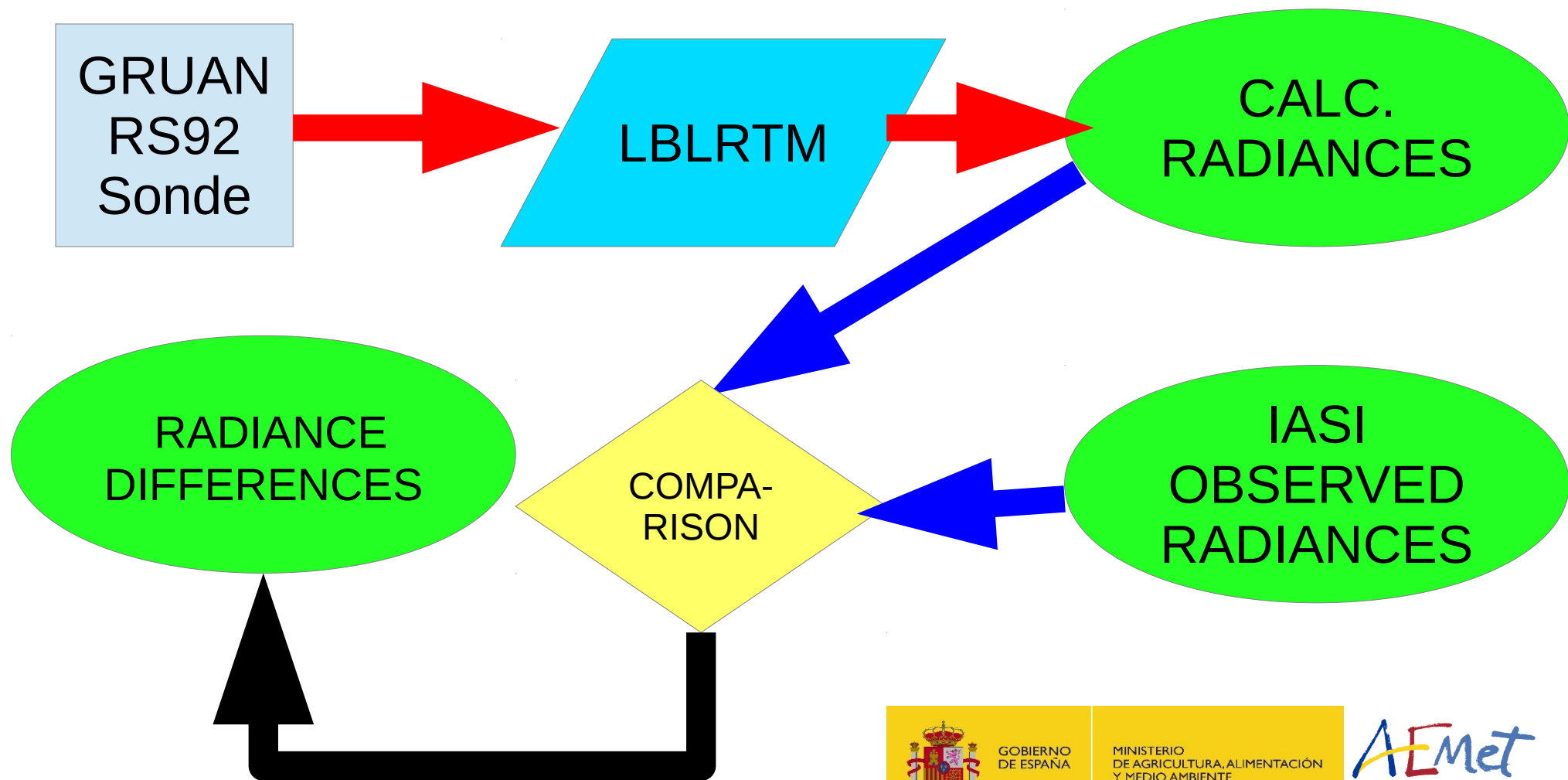
# CONTENTS

## 1. Atmospheric profiles on an individual basis

- a) Dual Sondes
- b) Single Sondes
- c) Single sondes and NWP

## 2. Statistical results

# Finding Consistency



# Why consistency?

1. Important for **climate**: transforming FCDR (e.g. Radiances) into CDR of ECV (T, WV, etc.) should measure the same
2. Important for **validation**: if GRUAN, LBLRTM and IASI are not consistent → collocation uncertainties too high to compare reasonably (Calbet, 2016, AMT)

# Consistency: Dual vs Single Sondes

## 1. Dual Sondes

- a) Time Interpolation possible to obtain SASBE (Site Atmospheric State Best Estimate)
- b) SASBEs calculated radiances match well with IASI measured radiances in a one to one basis (Calbet et al. 2011, AMT)

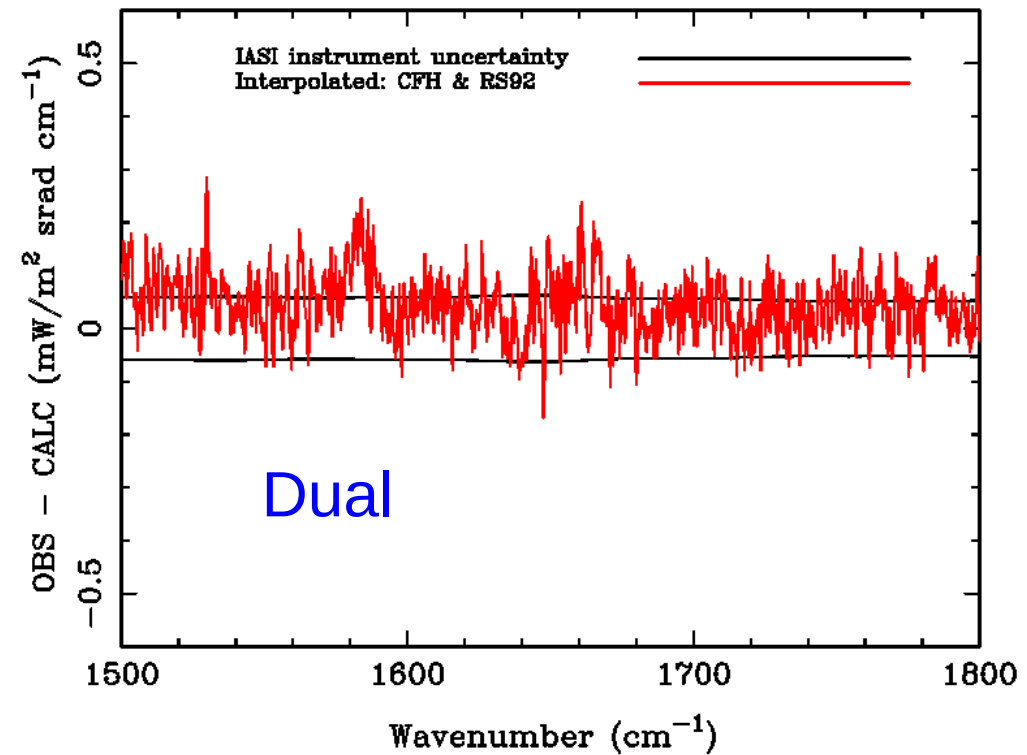
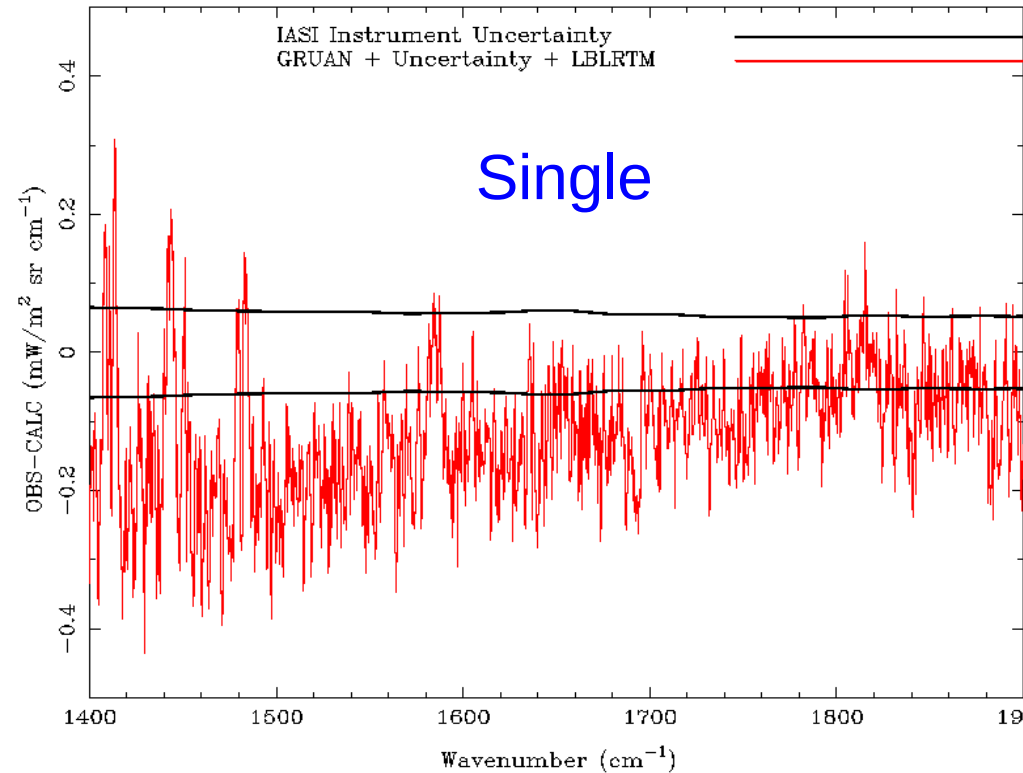
## 2. Single Sondes

- a) No SASBE possible, only direct sonde measurement
- b) Single sonde calculated radiances do not match well with IASI measured radiance in a one to one basis. They do on average (Calbet et al. 2016, to be submitted)

# Dual vs Single Sondes: Individually

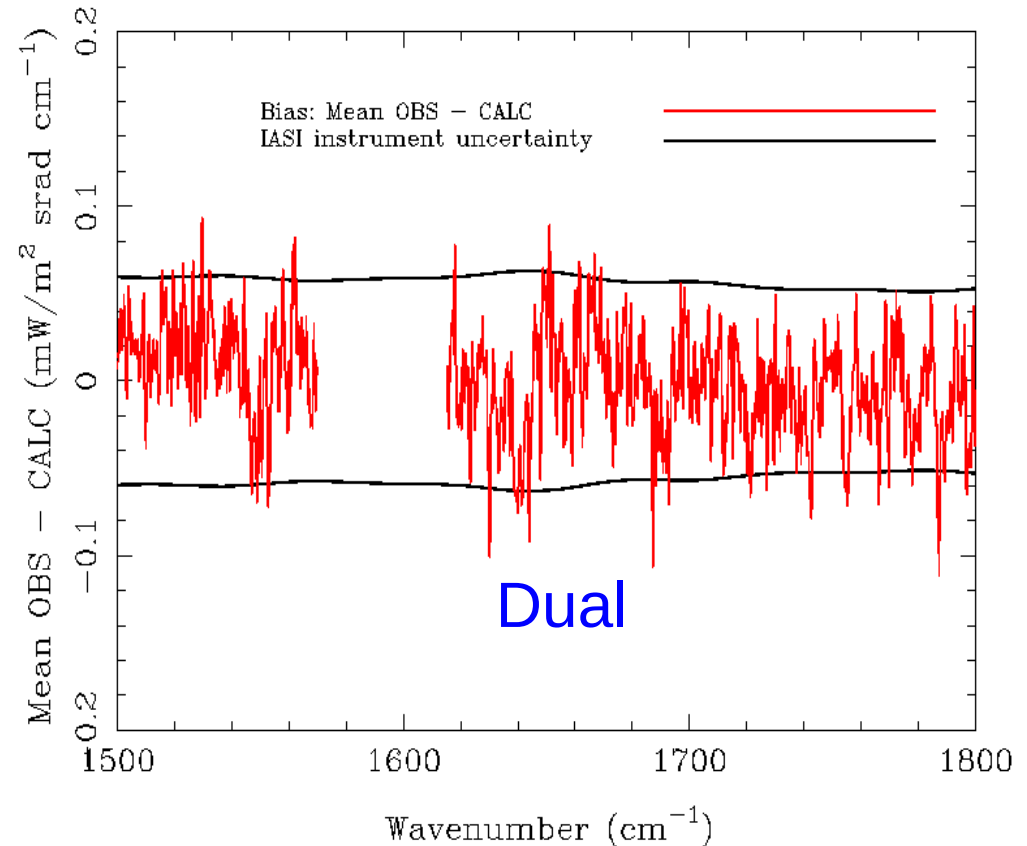
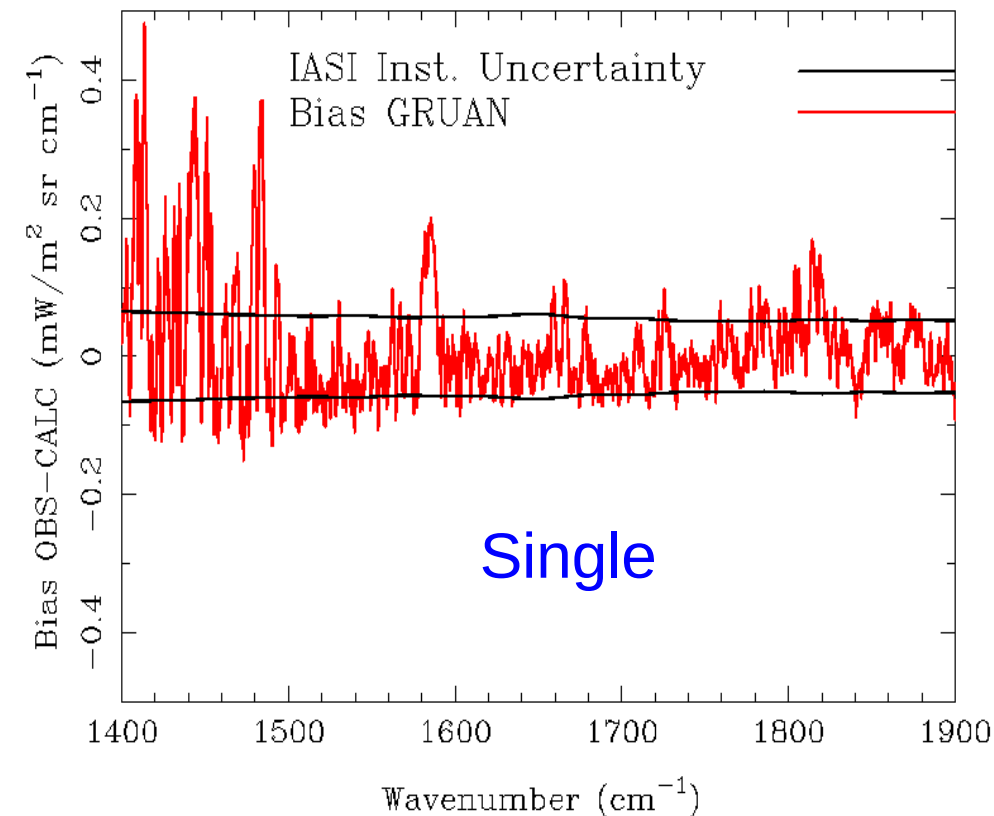
2011/10/15 11:17:05

20070717. LBLRTM 11.6



# Dual vs Single Sondes: Bias Statistics

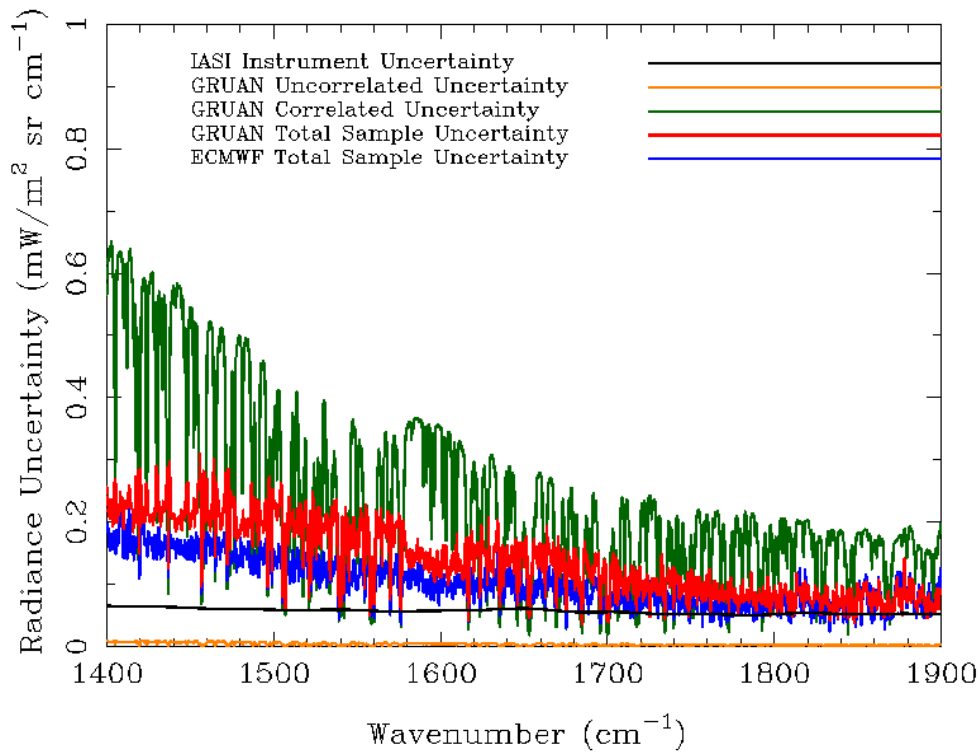
OBS-CALC Bias



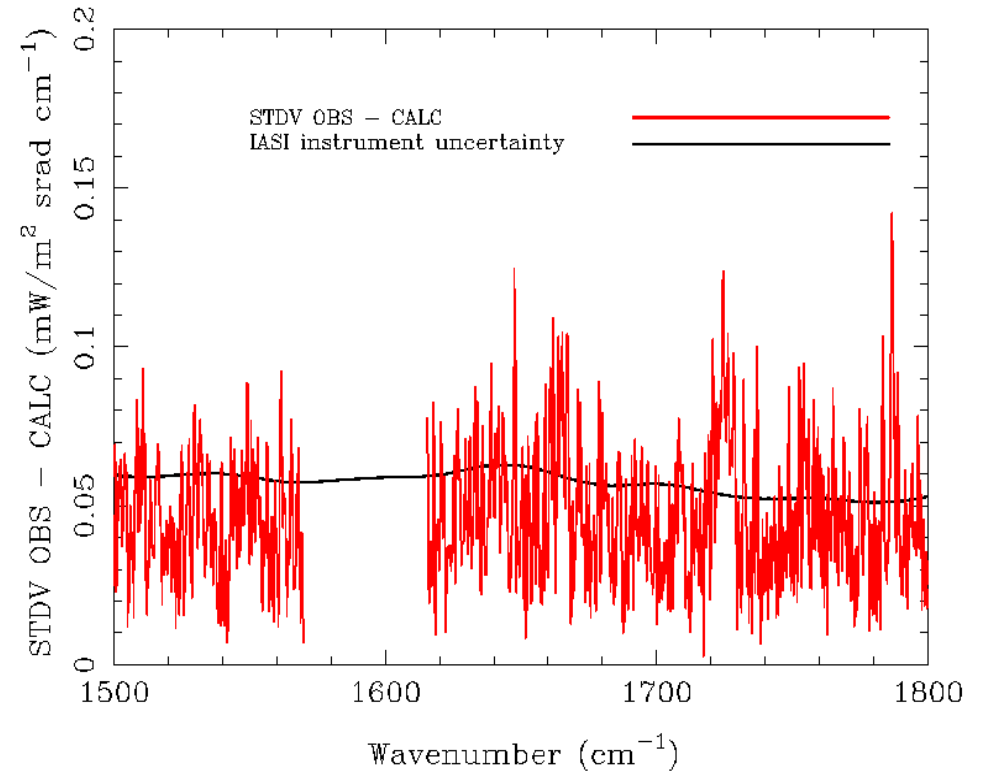
# Dual vs Single Sondes: STDV Statistics

Single

2011/01/21 11:41:31



Dual

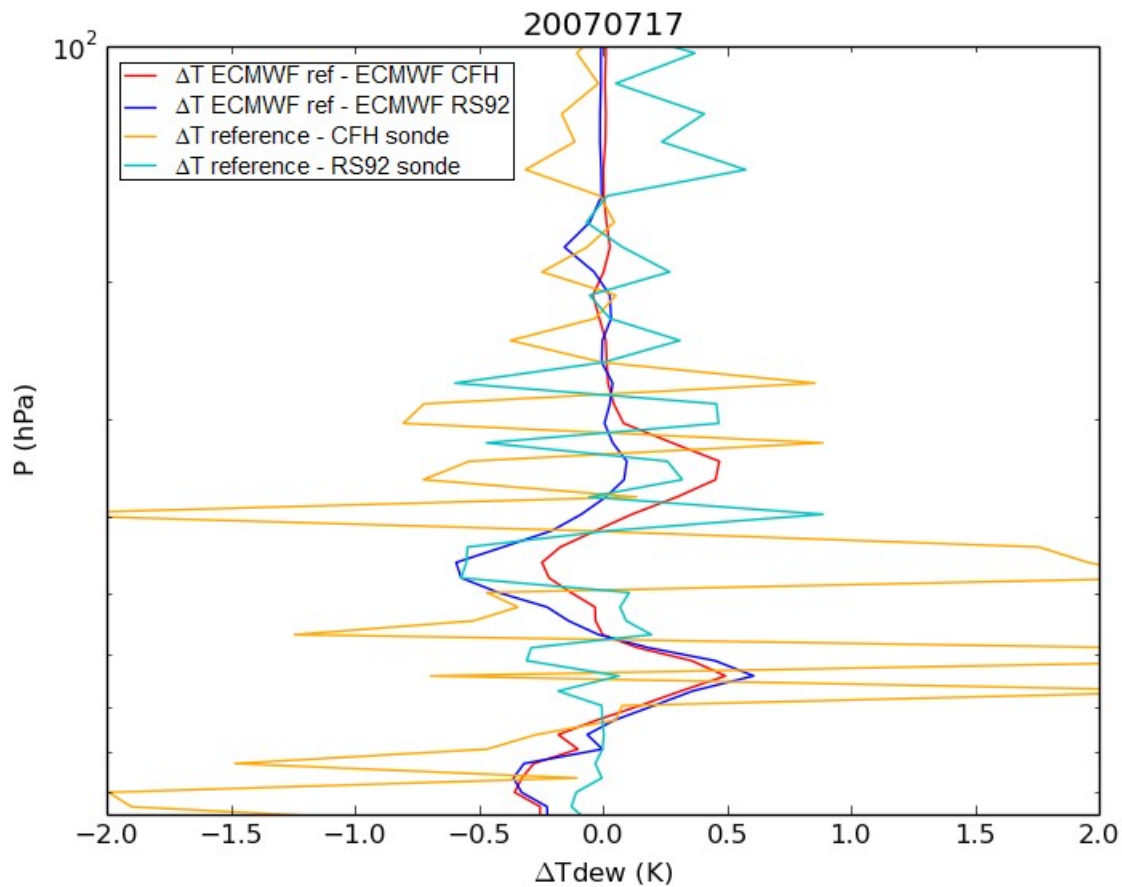




# Dual vs Single Sondes: Conclusions

1. If we want negligible collocation uncertainty, we need Dual Sondes (or similar: LIDAR, etc.)
2. Can we complement a Single Sonde with NWP? Can we estimate a SASBE using a single sonde and NWP? Can we estimate on an individual basis the collocation uncertainty of one sonde with NWP?

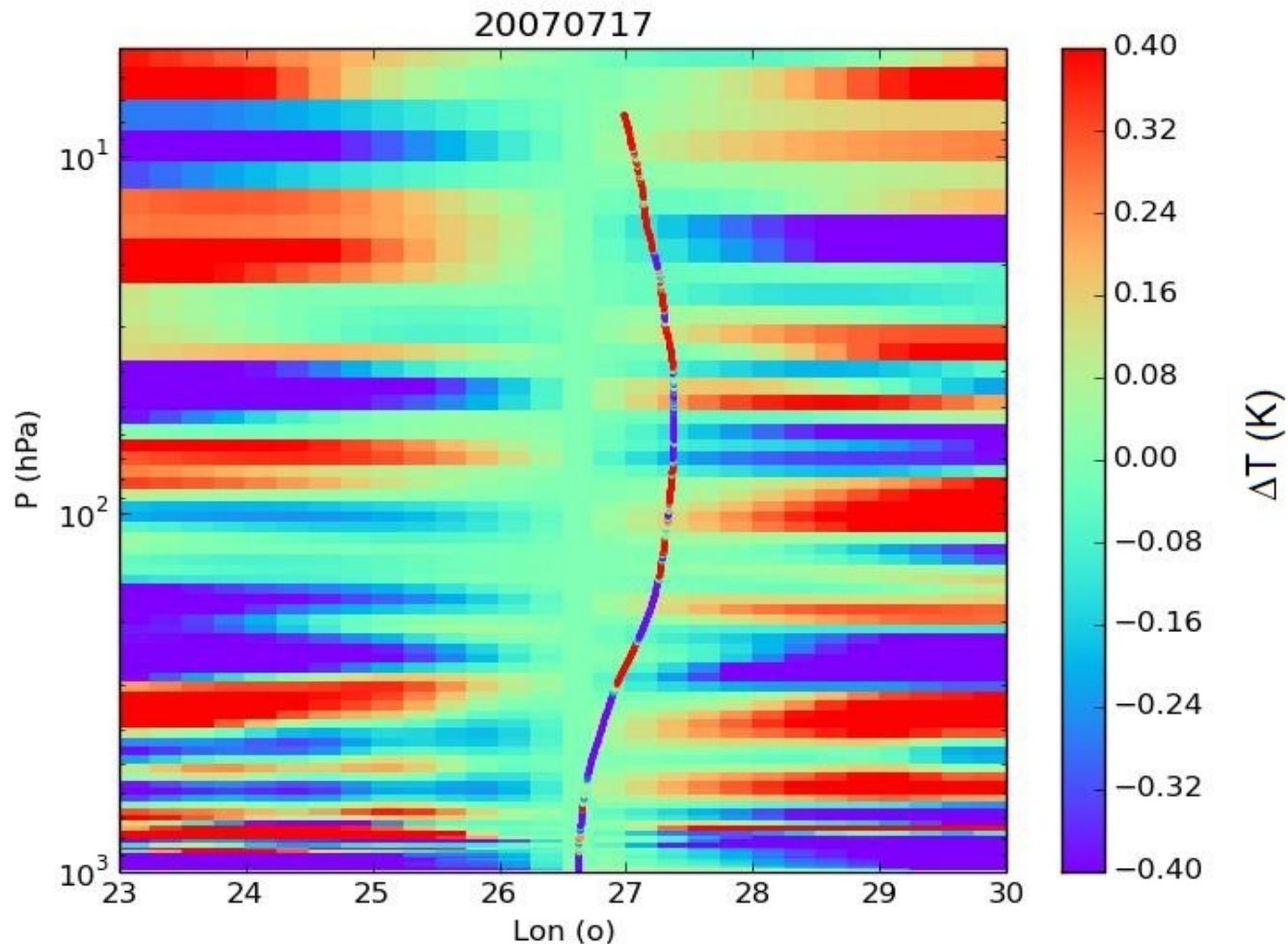
# Single Sonde and NWP uncertainties estimations



Red and Blue:  
NWP differences for two profiles

Cyan and Orange:  
Sonde differences for two profiles

# Sonde versus NWP comparison

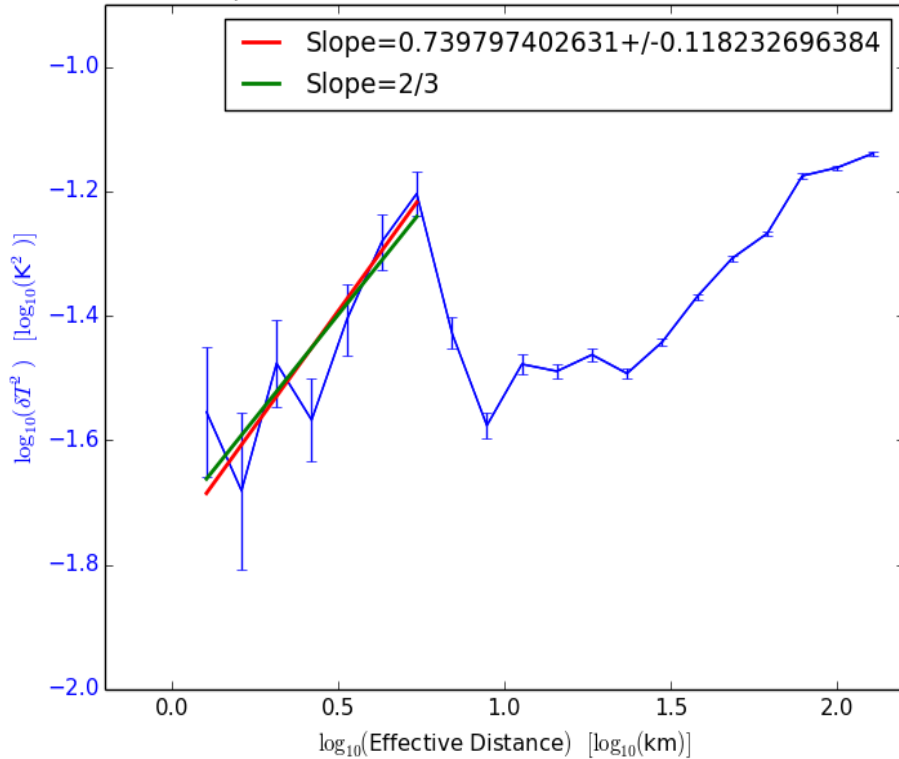


**Complete Field:**  
NWP Field relative to  
NWP Vertical over  
Observatory

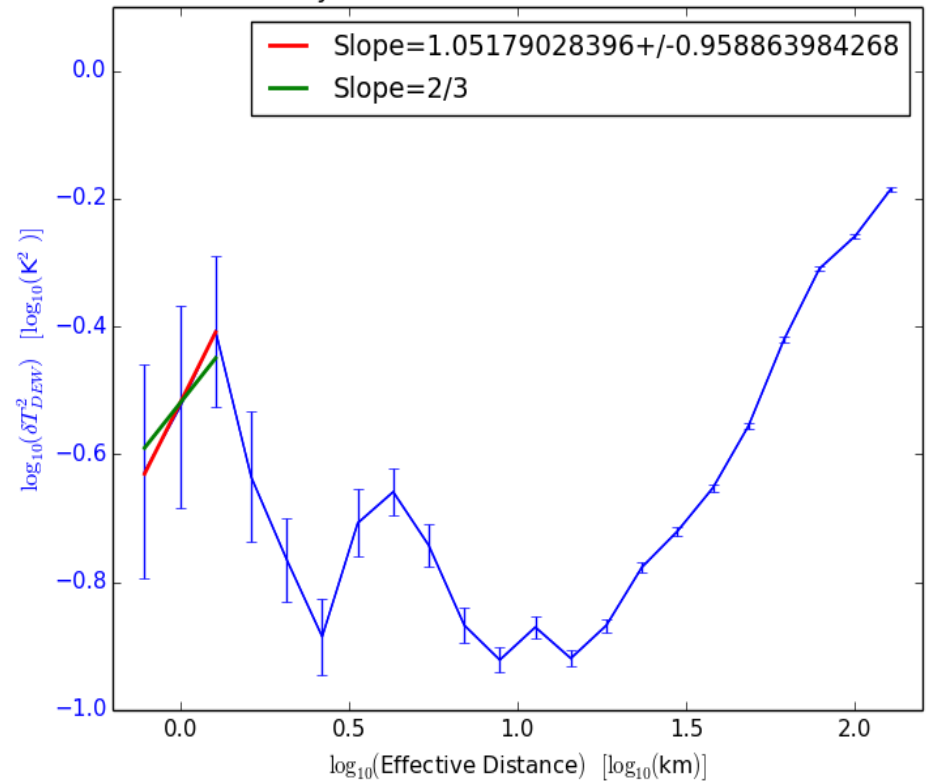
**Dots at Center:**  
Radiosonde relative to  
NWP Vertical over  
Observatory

# Turbulence as seen by Dual Sondes

Temperature Structure Function from Dual Sondes



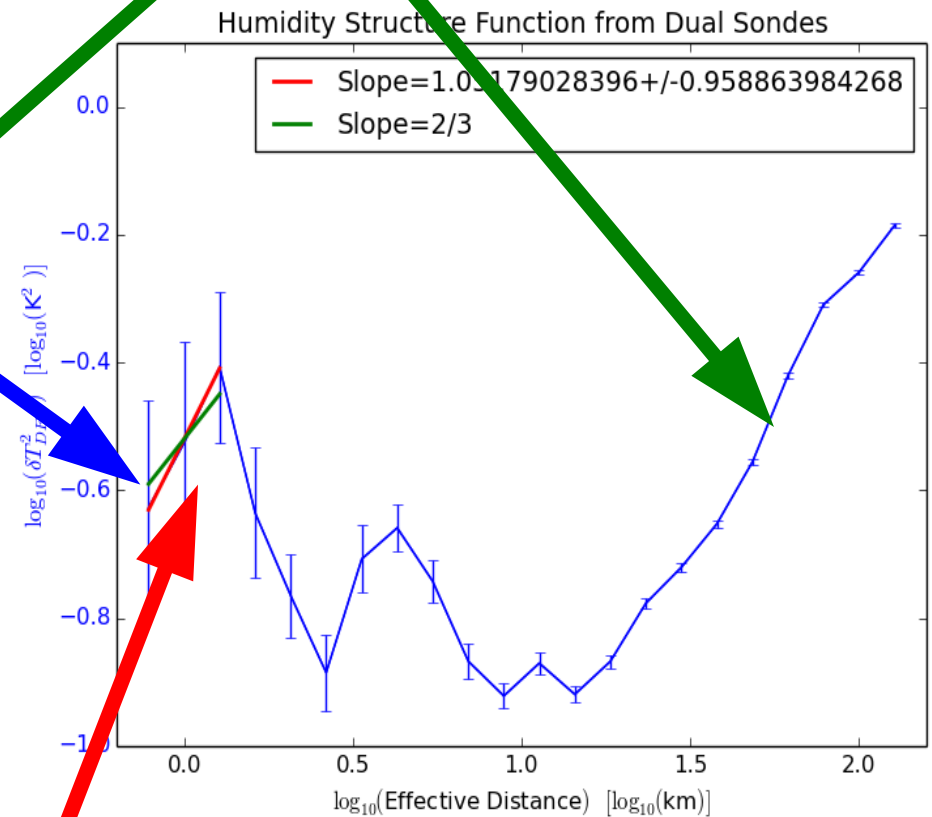
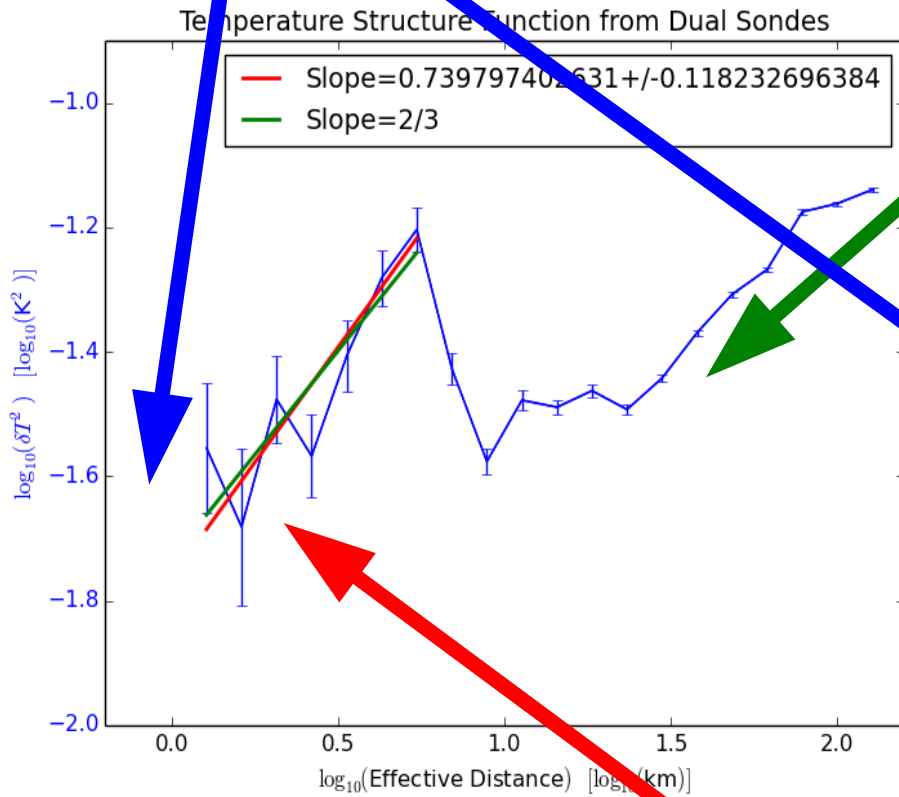
Humidity Structure Function from Dual Sondes



# Turbulence as seen by Dual Sondes

Dissipation Range

Energy Injection Range



Inertial Range



GOBIERNO DE ESPAÑA

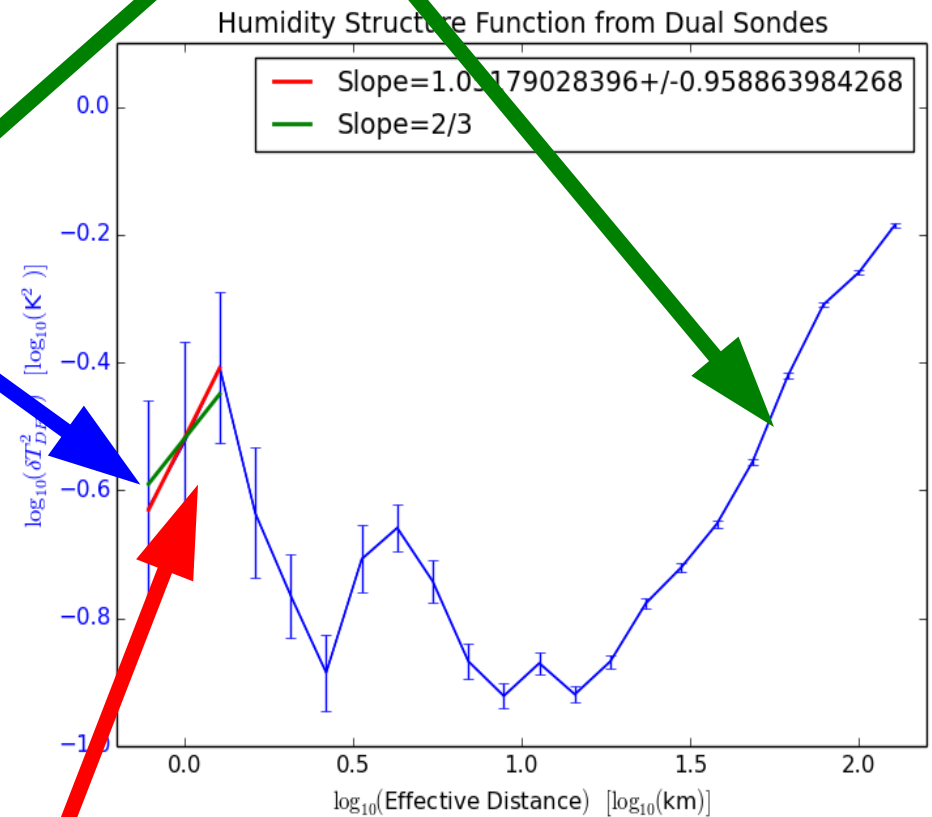
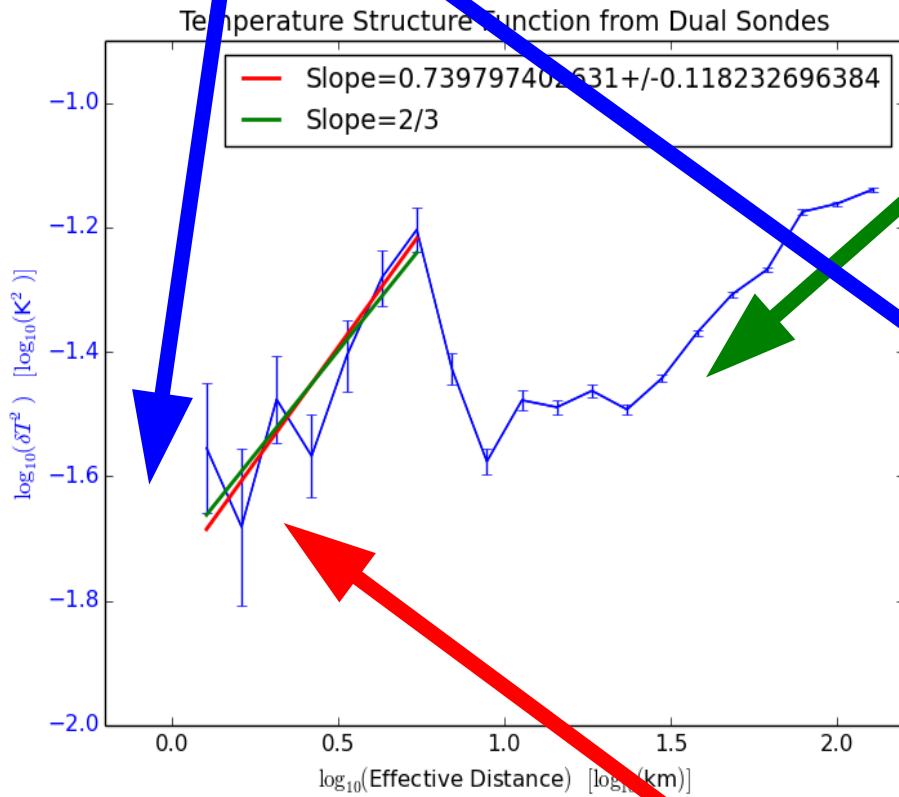
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE



# Turbulence as seen by Dual Sondes

Dissipation Range

Energy Injection Range



Inertial Range

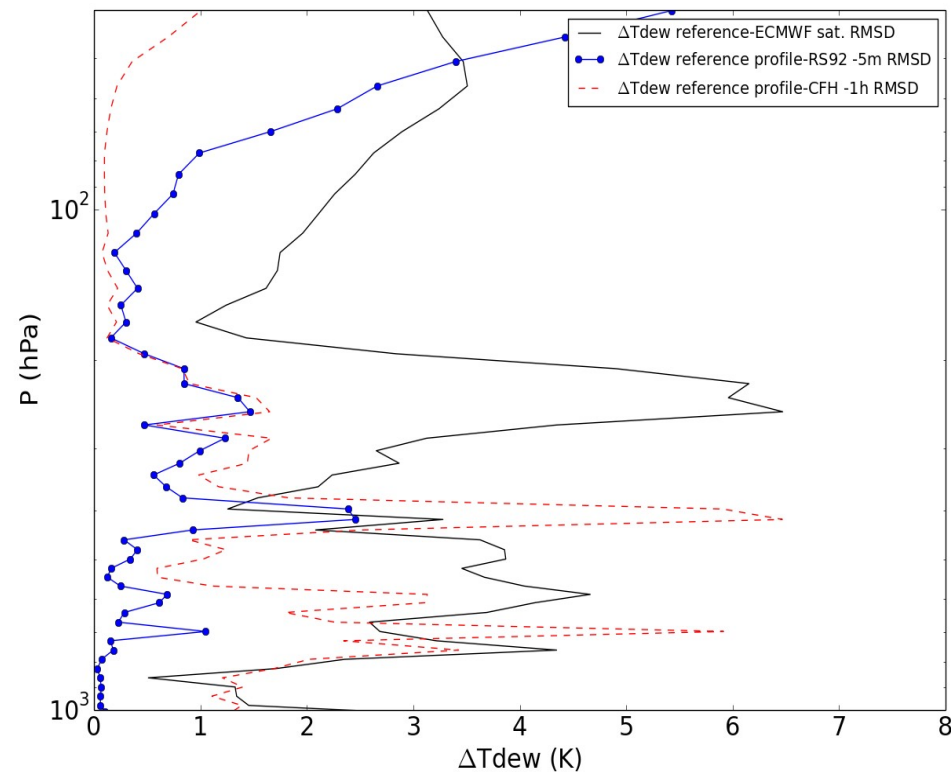
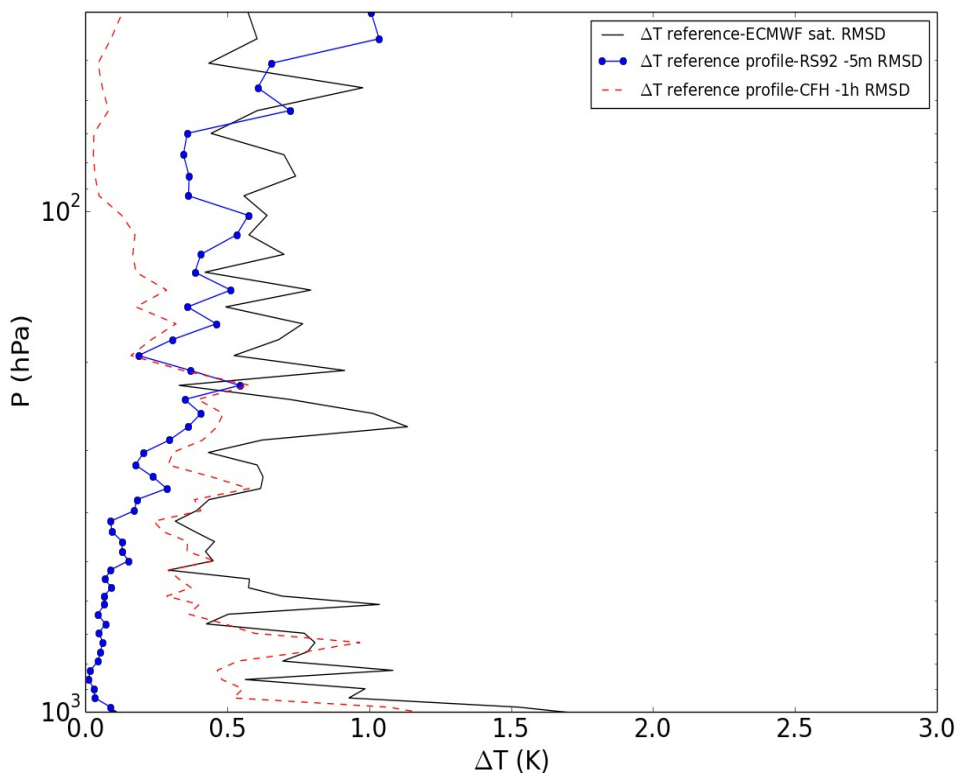


# Sonde and NWP versus SASBE RMS comparison

**Black Line:**  
RMS of NWP profiles  
versus SASBEs

**Blue Line:**  
RMS of Radiosondes -5 m  
Versus SASBEs

**Red Line:**  
RMS of Radiosondes -1 hour  
Versus SASBEs



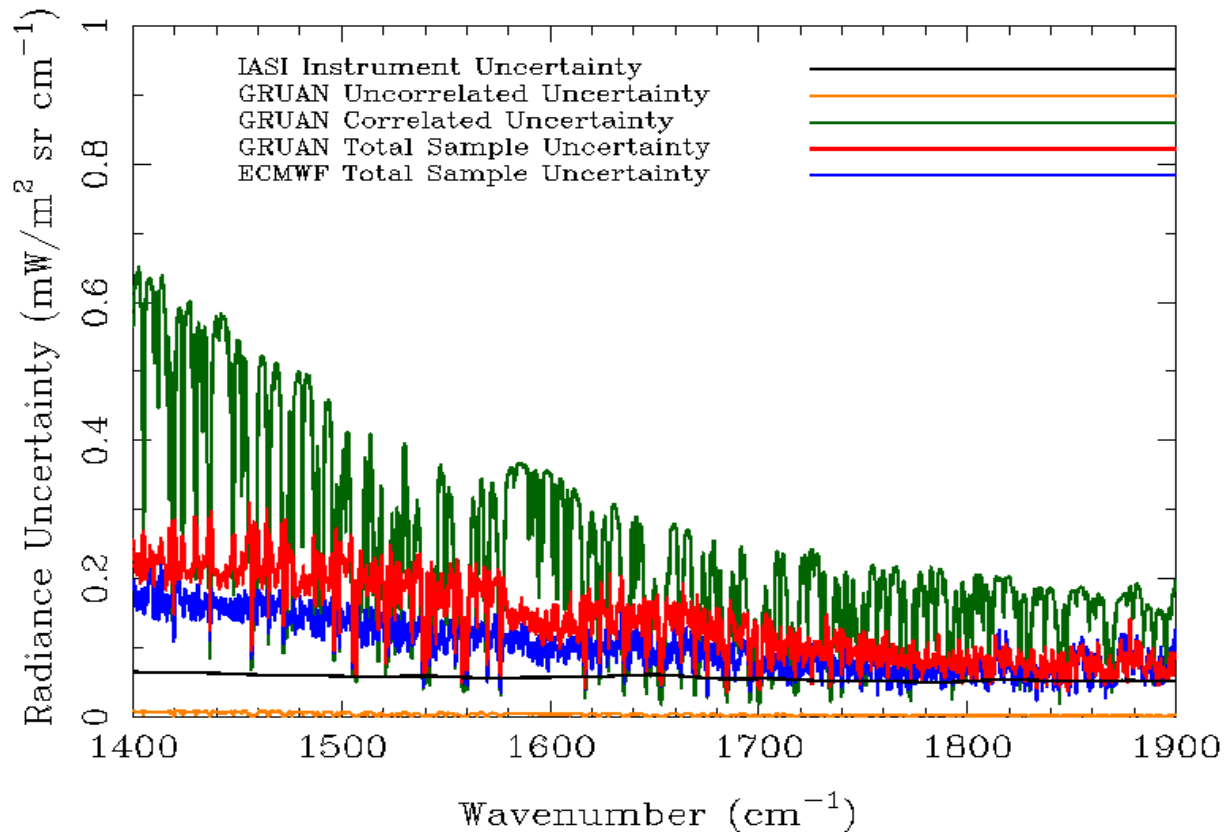
# Conclusions

1. If we want **negligible collocation** uncertainty, we need **Dual Sondes** (or similar: LIDAR, etc.)
2. Can we complement a Single Sonde with NWP? Can we estimate a SASBE using a single sonde and NWP? Can we estimate on an individual basis the collocation uncertainty of one sonde with NWP? **Answer: NO, we can only work statistically, not on an individual basis!!**



# GRUAN Single Individual Sonde: Uncertainties

2011/01/21 11:41:31



Single

