

# Atmosphere parameters and Atmosphere Transmission at OHP in 2018 : application to Stardice analysis

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LAL

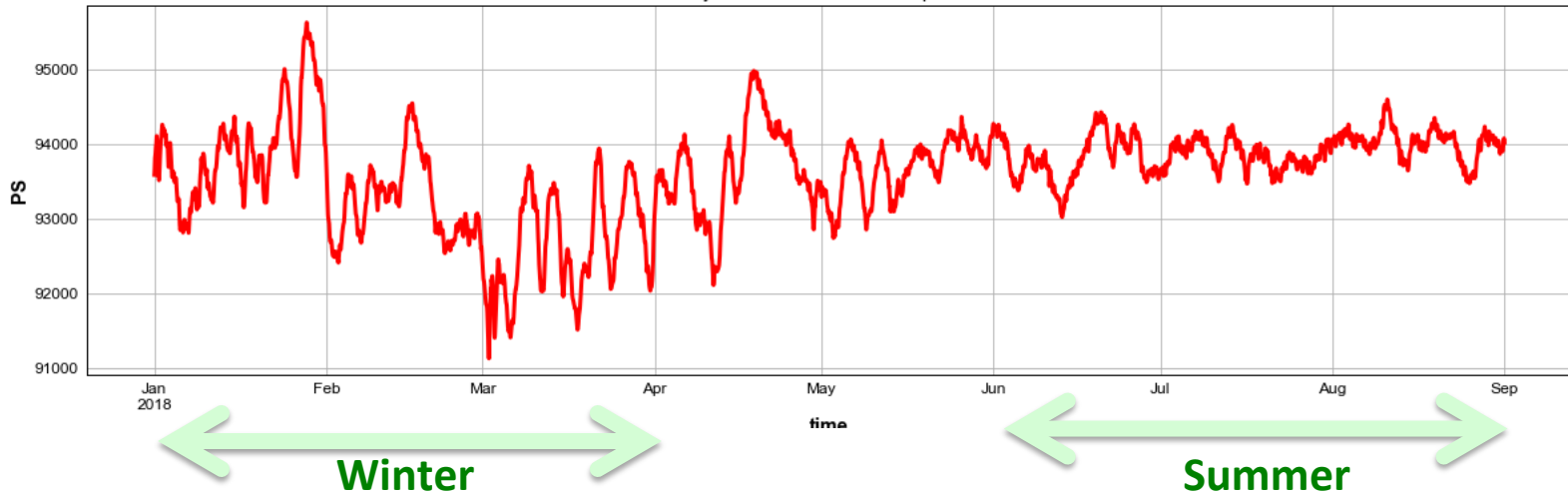
LSST-France, APC

# Goal

- **Provide typical OHP atmospheric transmission**
  - **Distinguish typical winter/summer**
- Need to collect relevant atmospheric parameters
- Use MERRA2 data in 2018 (January-August)

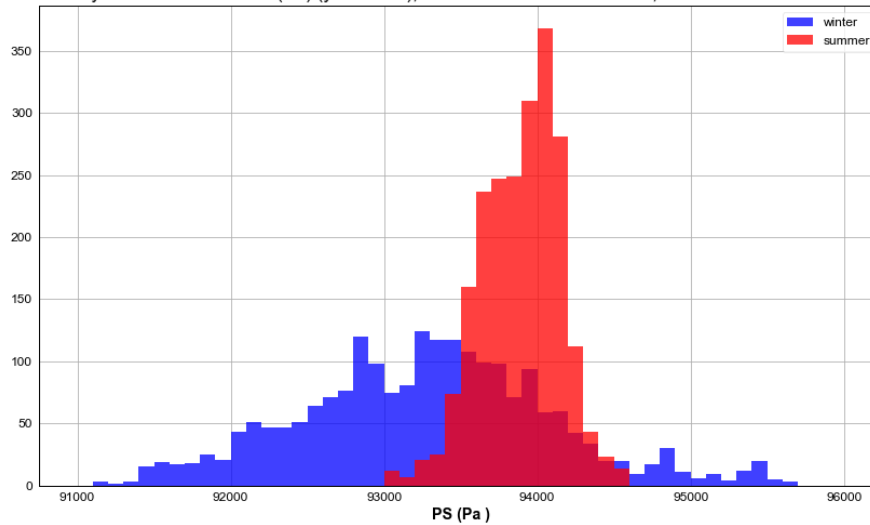
# Pressure

Hourly Surface Pressure at ohp in 2018



**Winter**  
P = 933 hPa

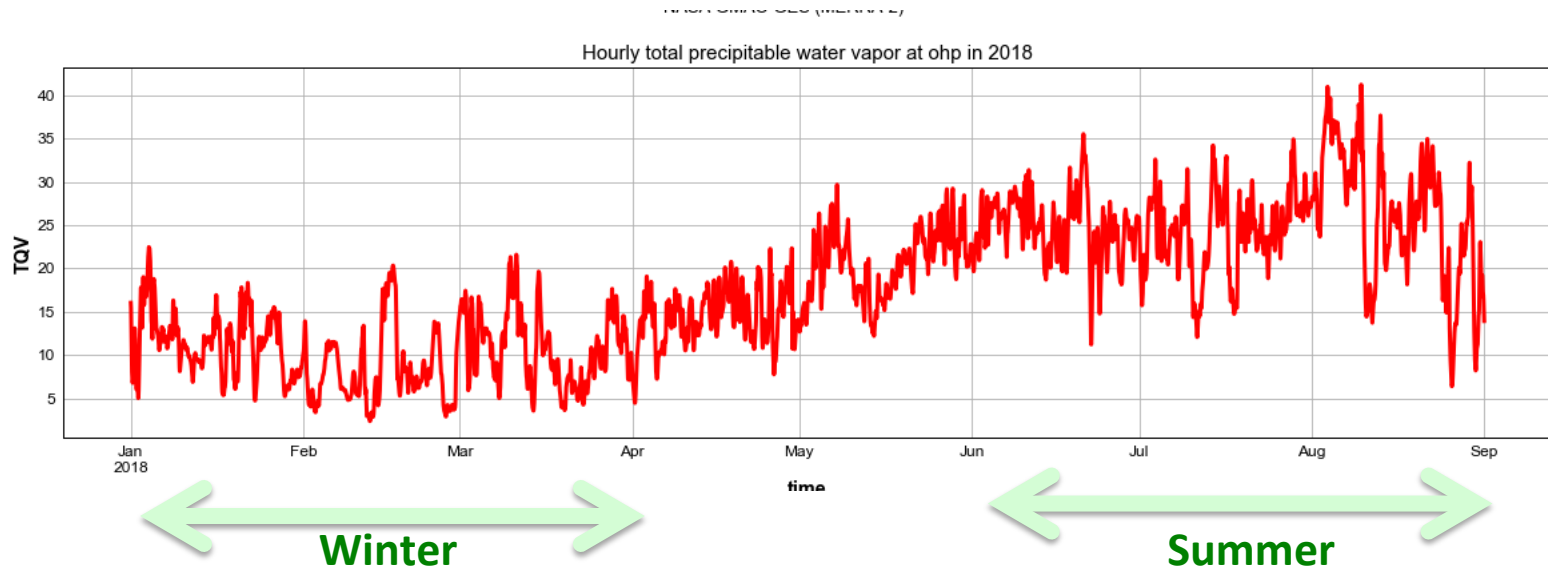
Yearly variation of Pressure(Pa) (year 2018), summer : 93891.0 +/- 257.0, winter : 93282.1 +/- 819.0



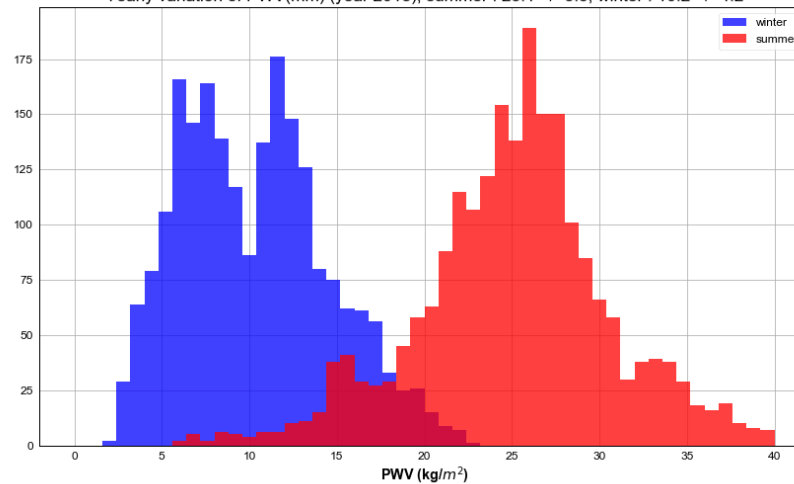
**Summer**  
P = 939 hPa

**Higher pressure  
In summer**

# Precipitable water vapor



Yearly variation of PWV(mm) (year 2018), summer : 25.1 +/- 5.5, winter : 10.2 +/- 4.2



Winter

PWV = 10mm

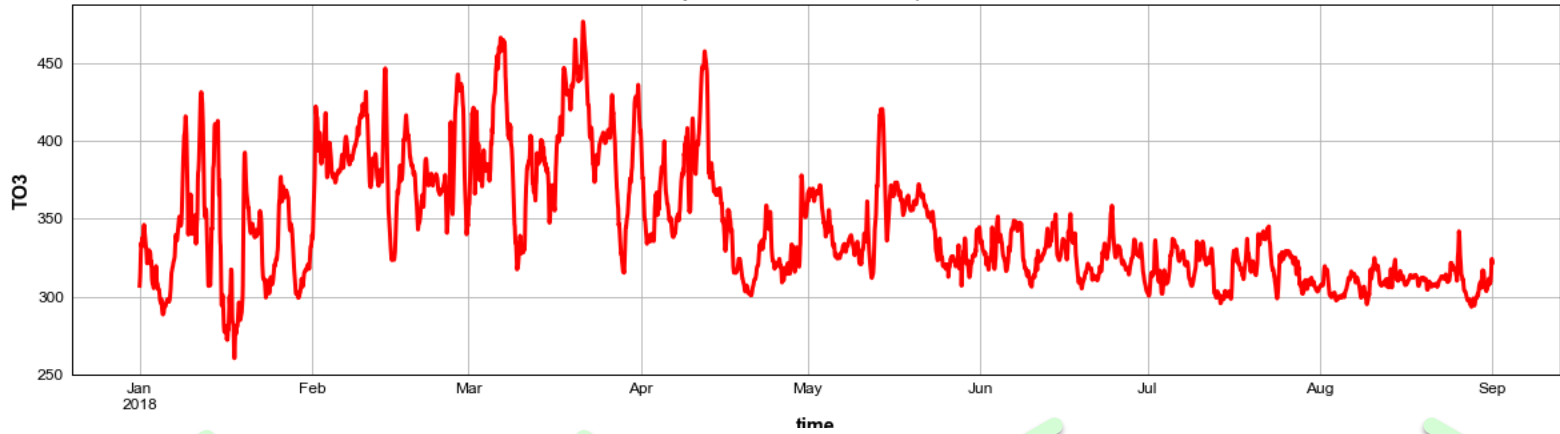
Summer

PWV = 25mm

Higher PWV  
in summer

# Ozone

Hourly total column ozone at ohp in 2018



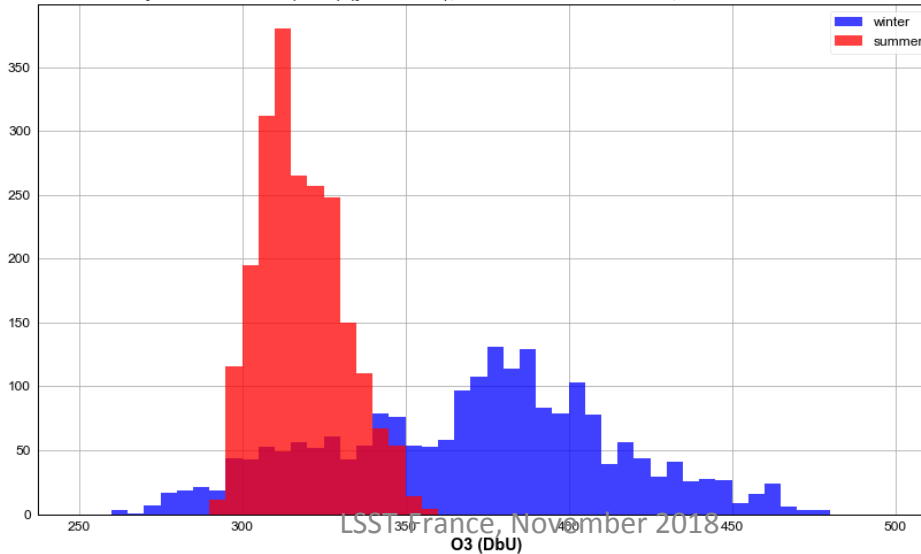
← Winter →

← Summer →

**Summer**

O3 = 318 DbU

Yearly variation of O3(DbU) (year 2018), summer : 318.1 +/- 12.7, winter : 370.1 +/- 43.1



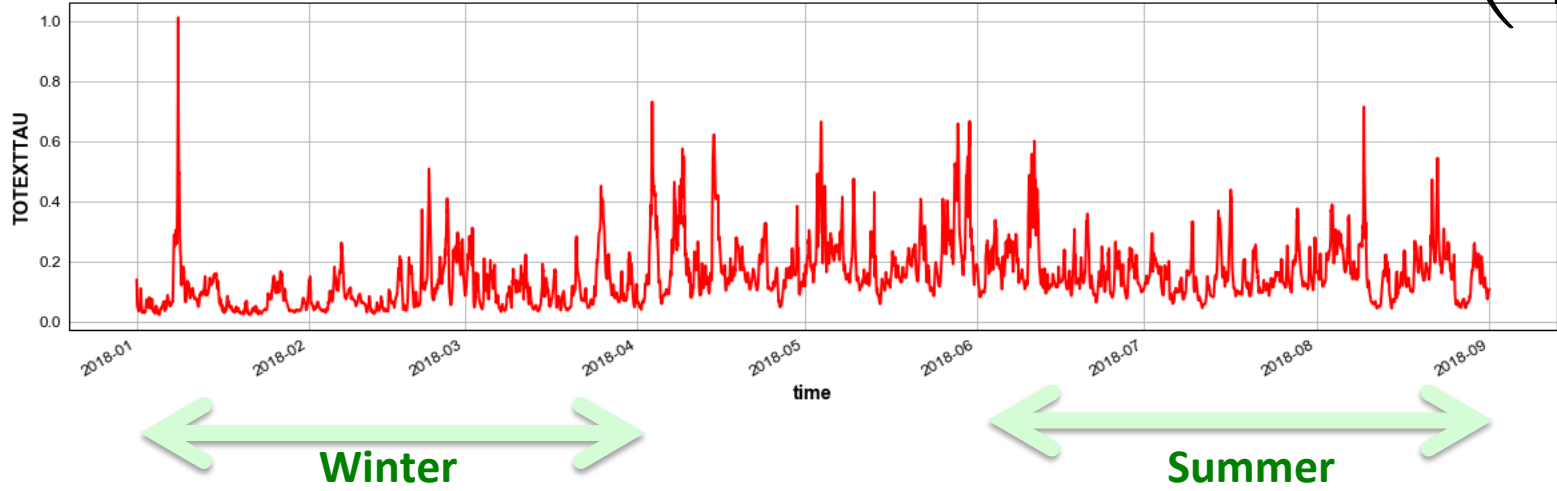
**Winter**

O3 = 370 DbU

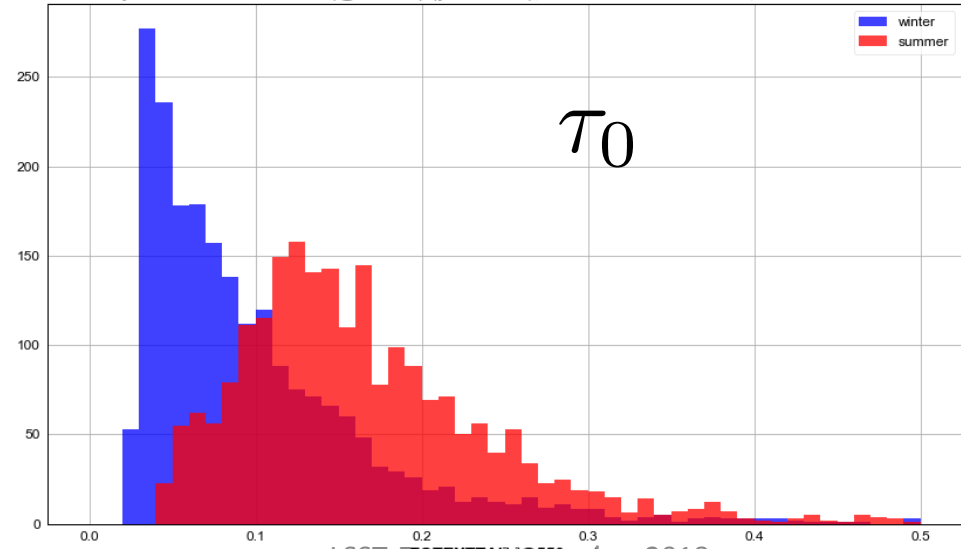
**Higher Ozone  
in winter**

# Aerosols optical depth $\tau(\lambda) = \tau_0 \times \left(\frac{\lambda_0}{\lambda}\right)^a$

Hourly Total Aerosol Extinction AOT 550 nm at ohp in 2018



Yearly variation of Extinction(@550nm) (year 2018), summer : 0.16 +/- 0.08, winter : 0.1 +/- 0.07



**Winter**  
 $\tau_0 = 0.10$

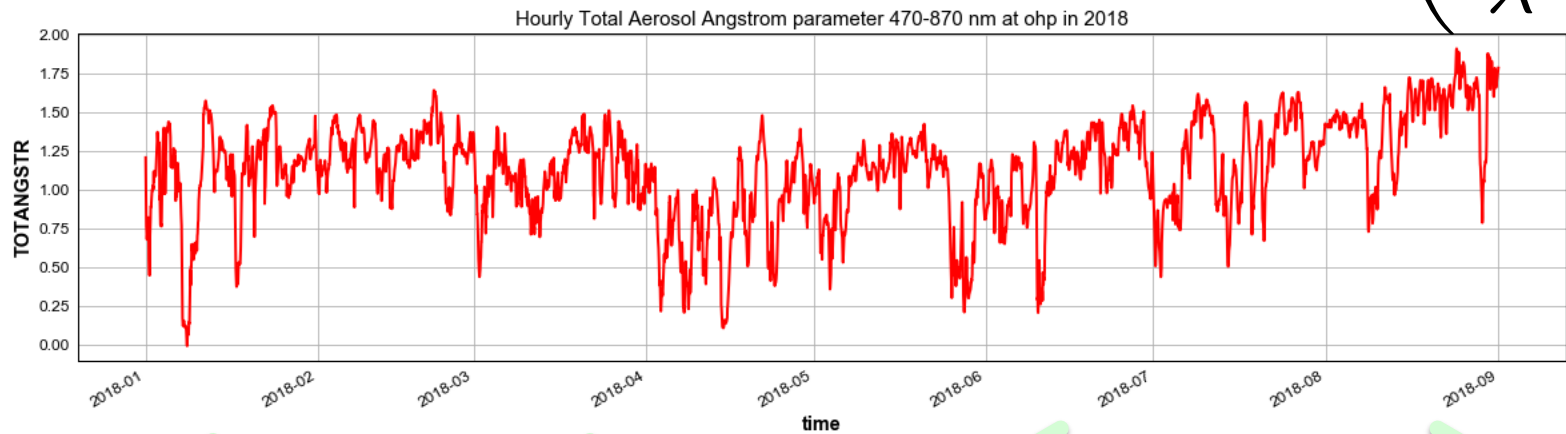
**Summer**  
 $\tau_0 = 0.16$

$\tau_0$  Higher in summer

*a*

# Angstrom coefficient

$$\tau(\lambda) = \tau_0 \times \left( \frac{\lambda_0}{\lambda} \right)^a$$

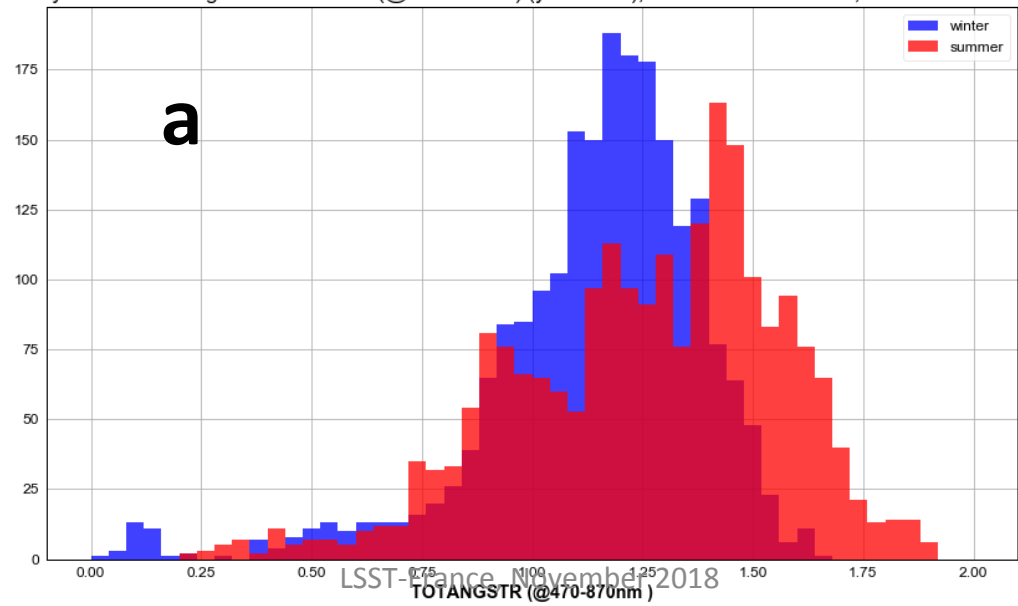


← Winter →

← Summer →

Yearly variation of Angstrom Parameter(@470-870nm) (year 2018), summer : 1.25 +/- 0.3, winter : 1.14 +/- 0.25

Winter  
 $a = 1.14$

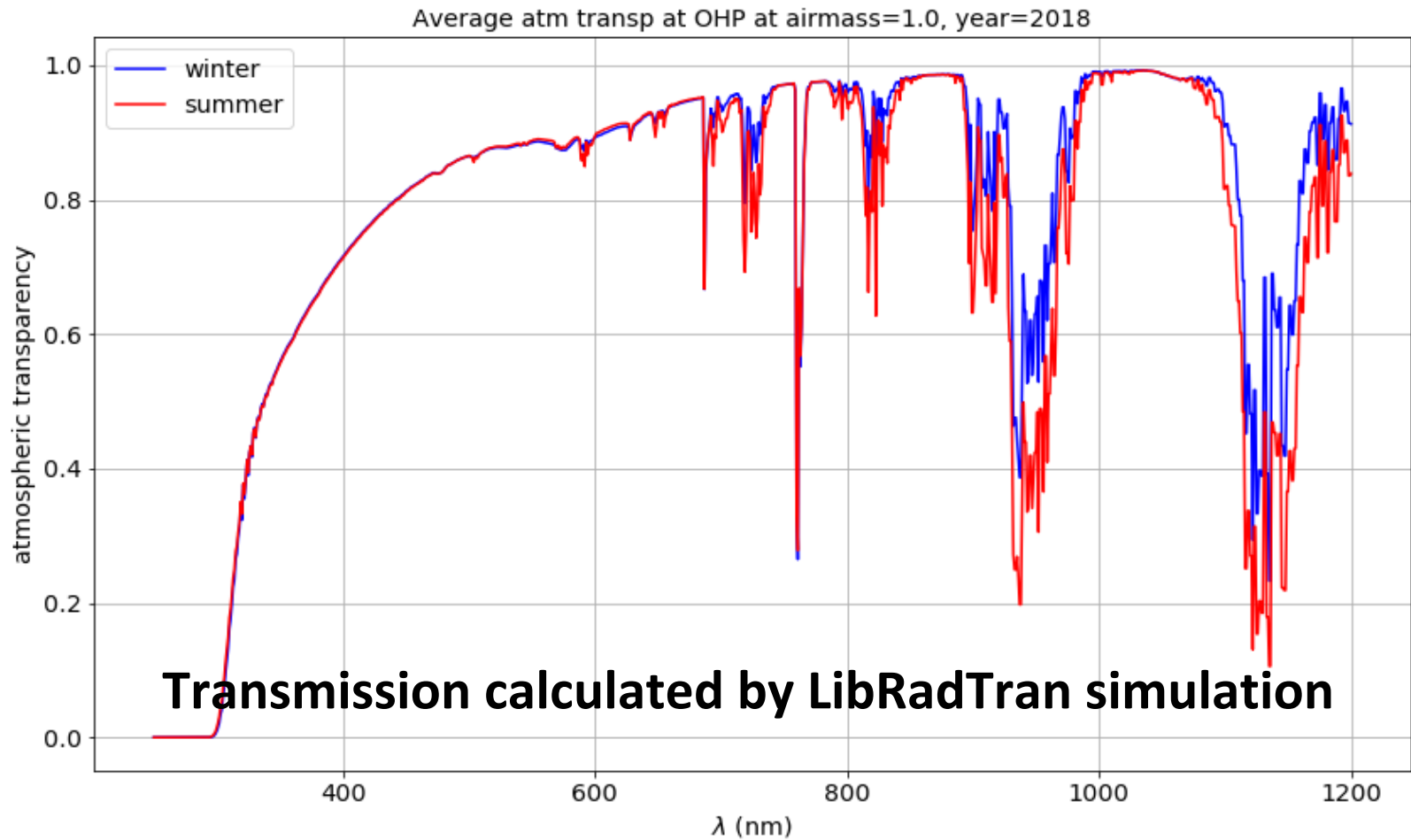


Summer  
 $a = 1.25$

Steeper  
Wavelength  
Attenuation  
in summer

# Average transmission Summer & Winter

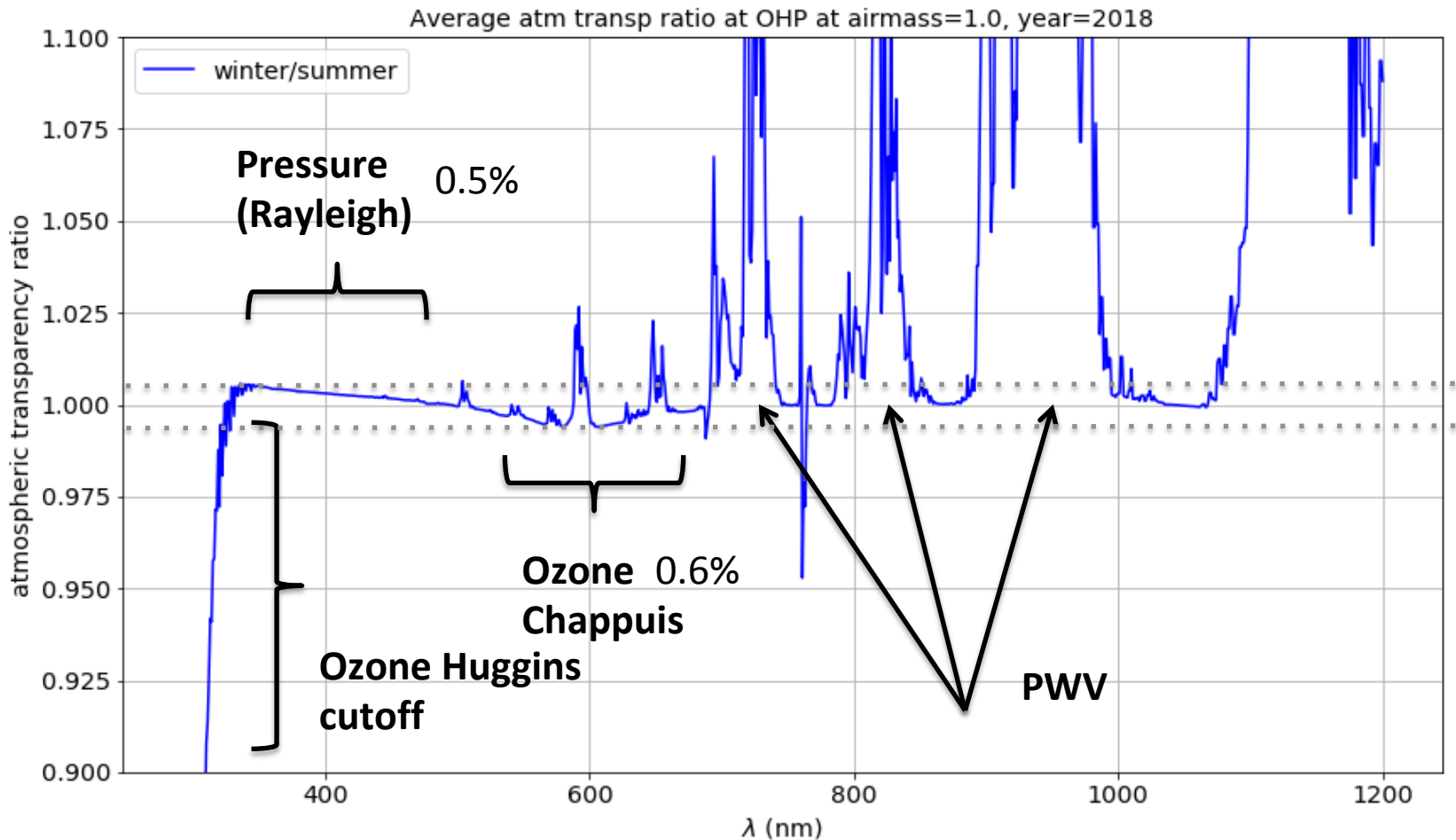
Airmass = 1



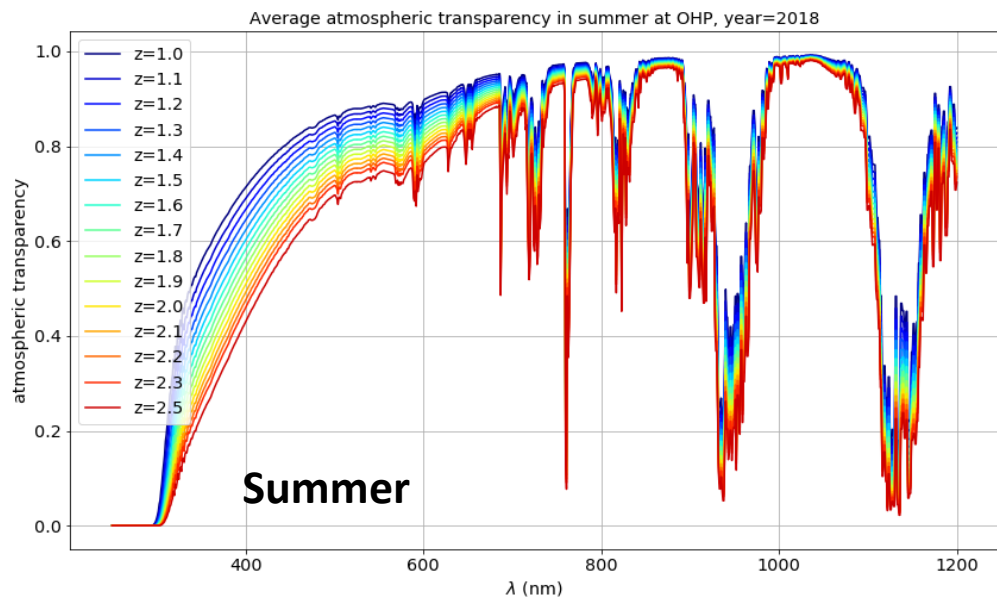


# Average Transmission Winter/Summer ratio

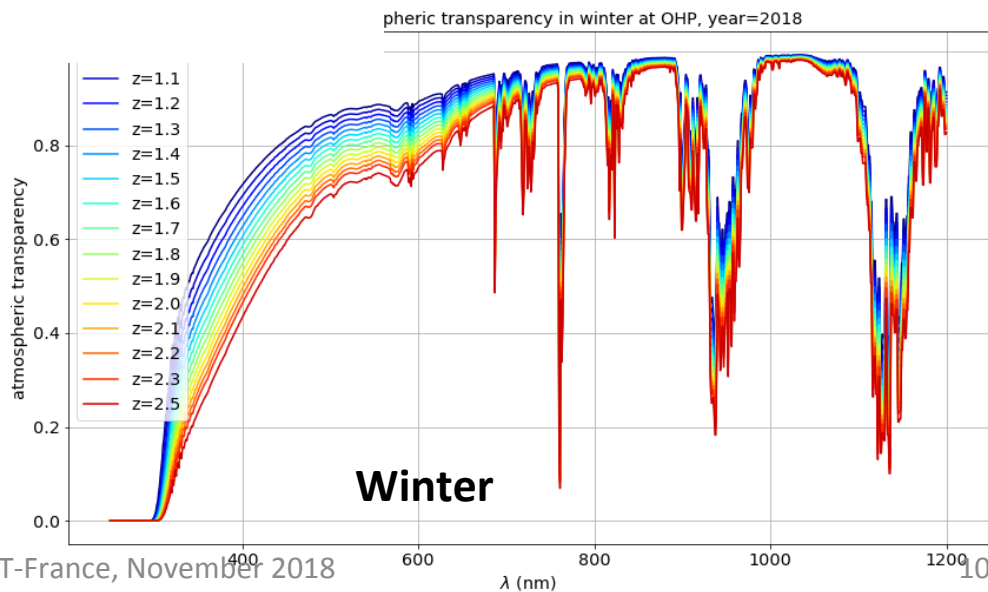
Airmass = 1



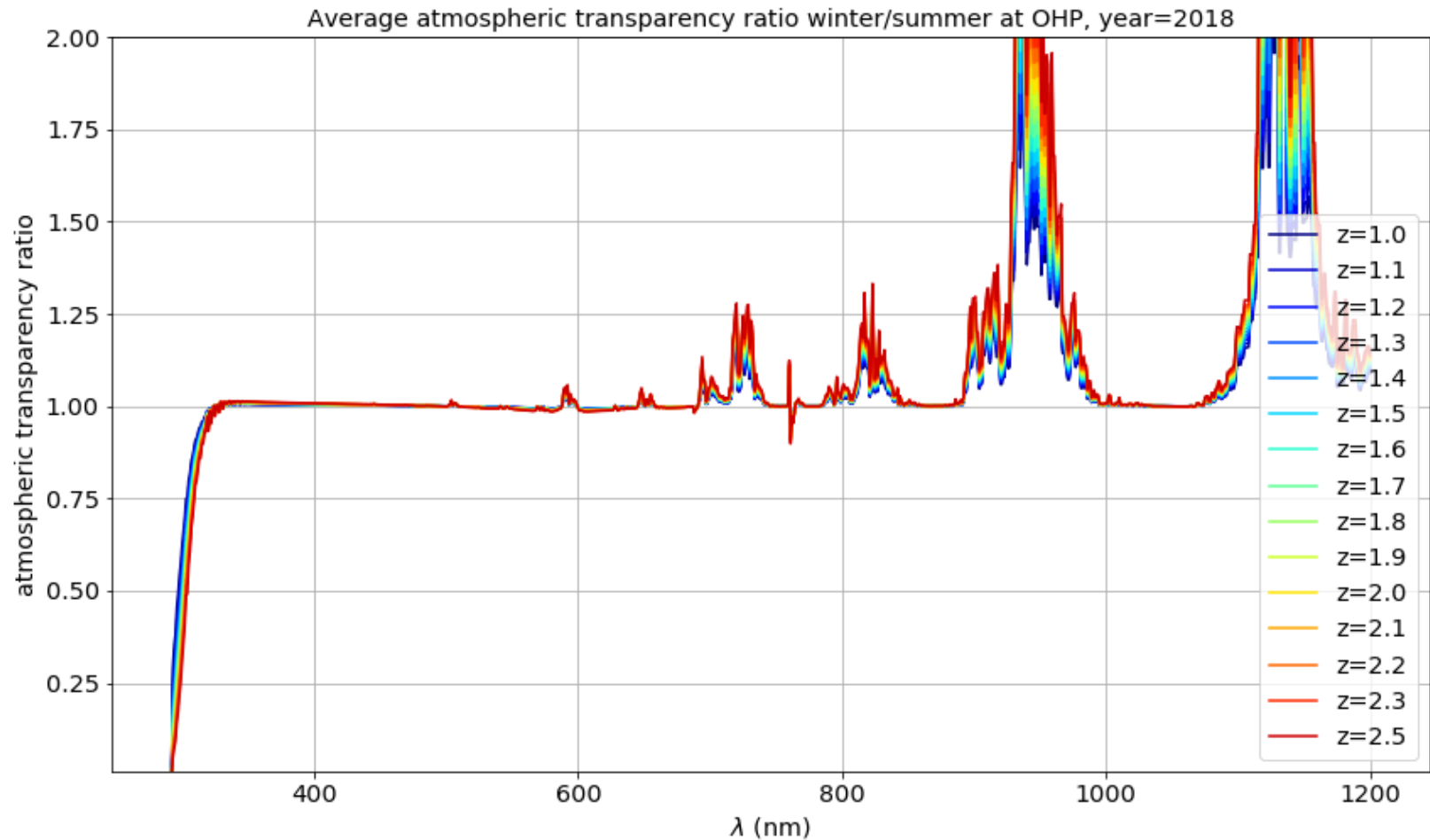
# Winter/Summer Libradtran Profiles generated for Stardice analysis at several airmass



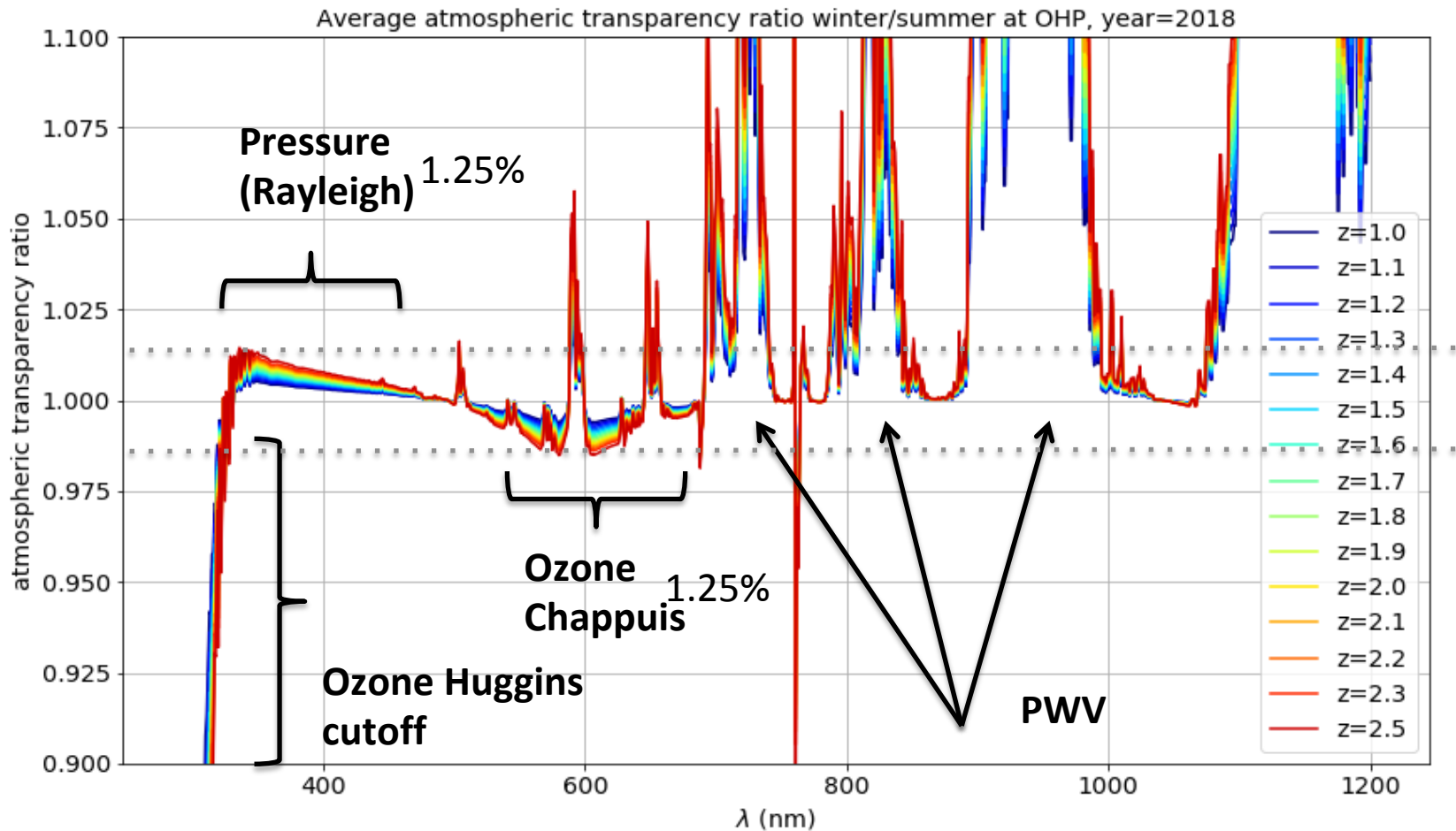
Simulations  
Required for  
Data analysis



# Winter/Summer Libradtran transmission ratio generated for Stardice analysis at several airmass

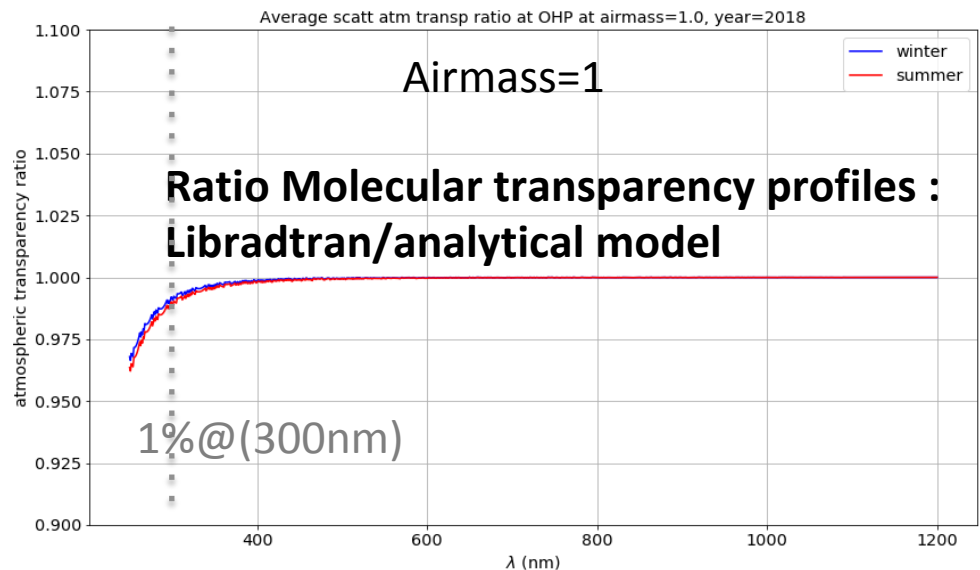
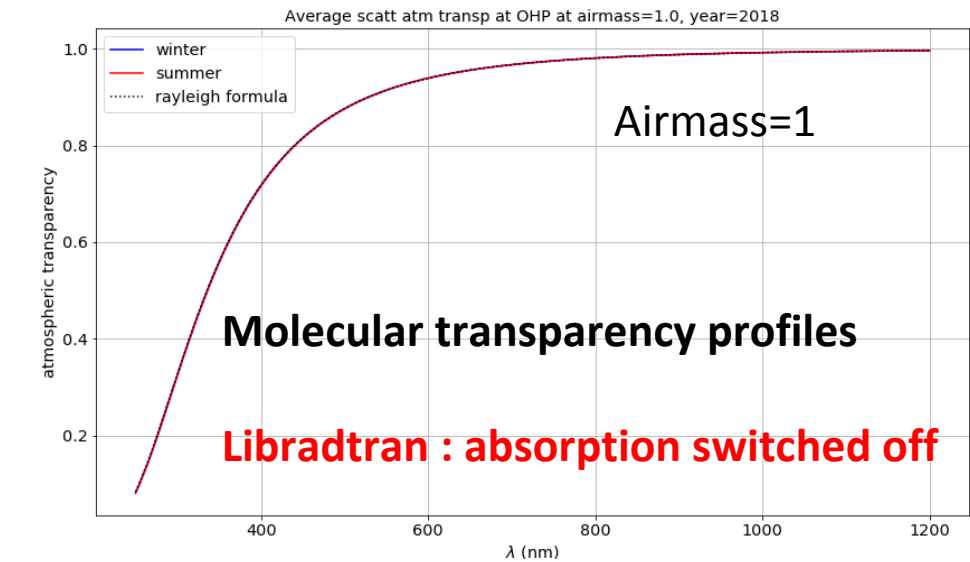
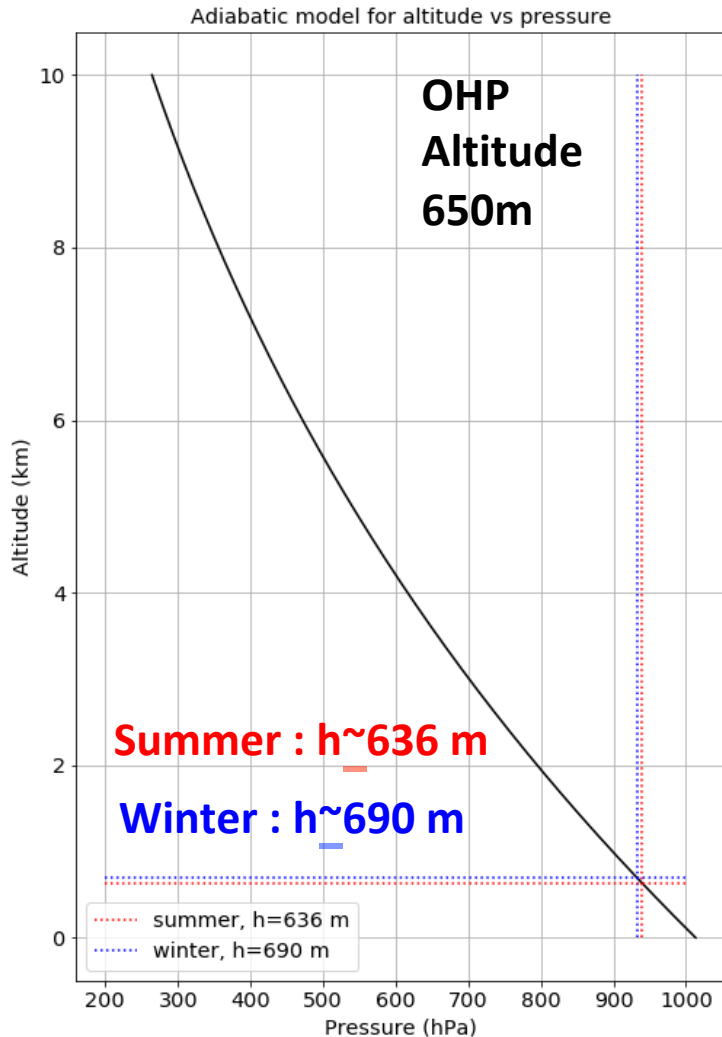


# Zoom on Winter/Summer Profiles ratio generated for Stardice analysis at several airmass

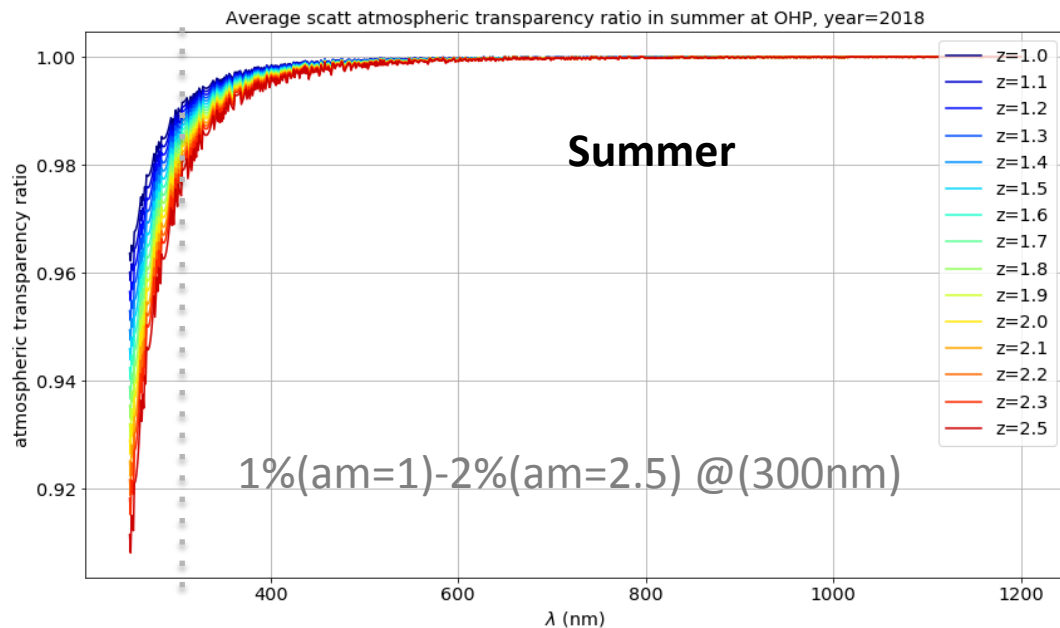
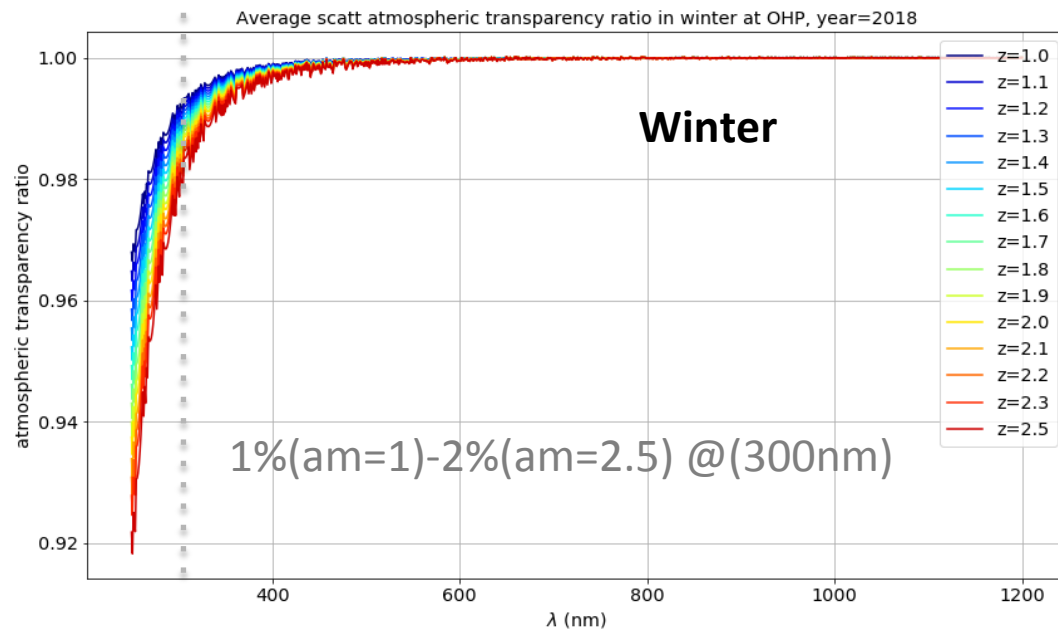


# Analytical model for Molecular scattering

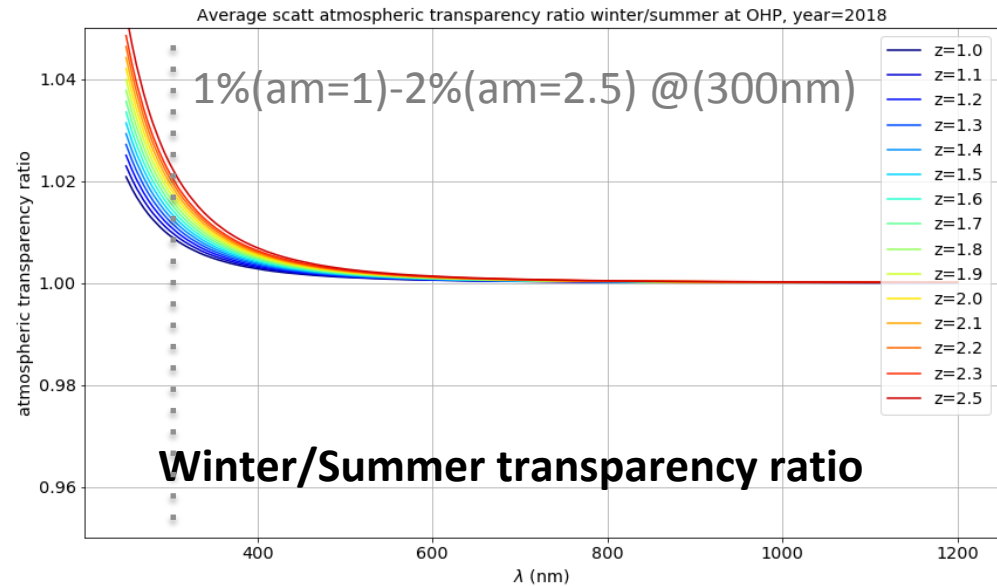
Analytic model : altitude vs pressure :



Libradtran/  
analytical-formula  
transparency ratio  
at all airmass

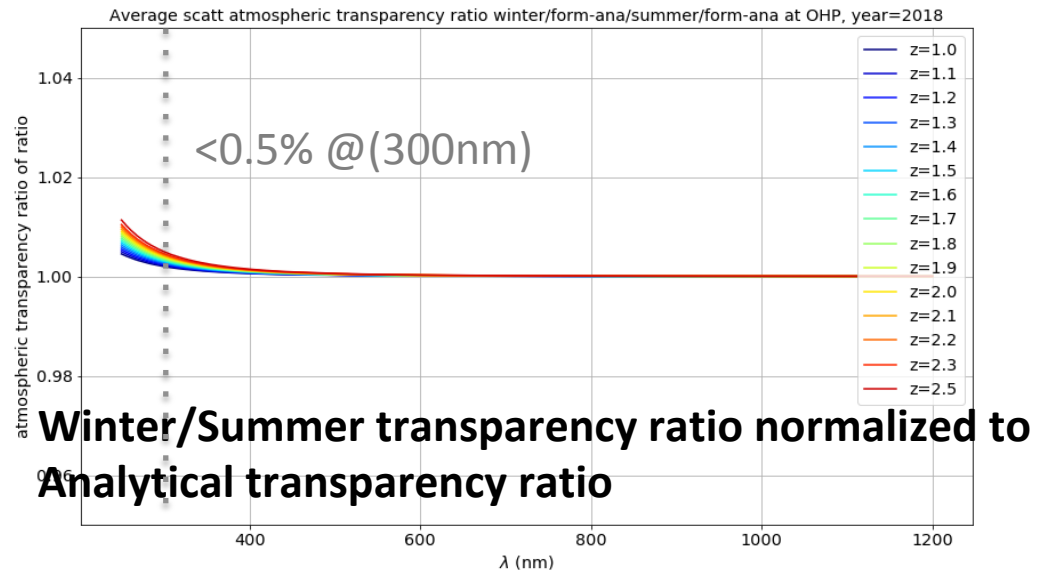


Winter/Summer  
transparency ratio  
at all airmass



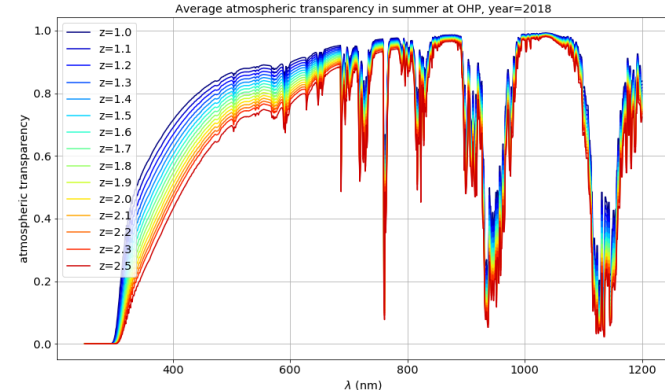
**Conclusion:**

Better use analytical  
formula to  
correct profile for  
Pressure variation



# Take home message

- Typical winter/summer atmospheric profiles at various airmass are provided for Stardice.
  - Average pressure, precipitable water vapor, ozone.
  - Simulated transparency data



- A numerical-analytical formula for atmospheric transparency to correct for daily pressure variation (auxiliary data) lead to an accuracy better than 0.5% for  $\lambda > 300$  nm