

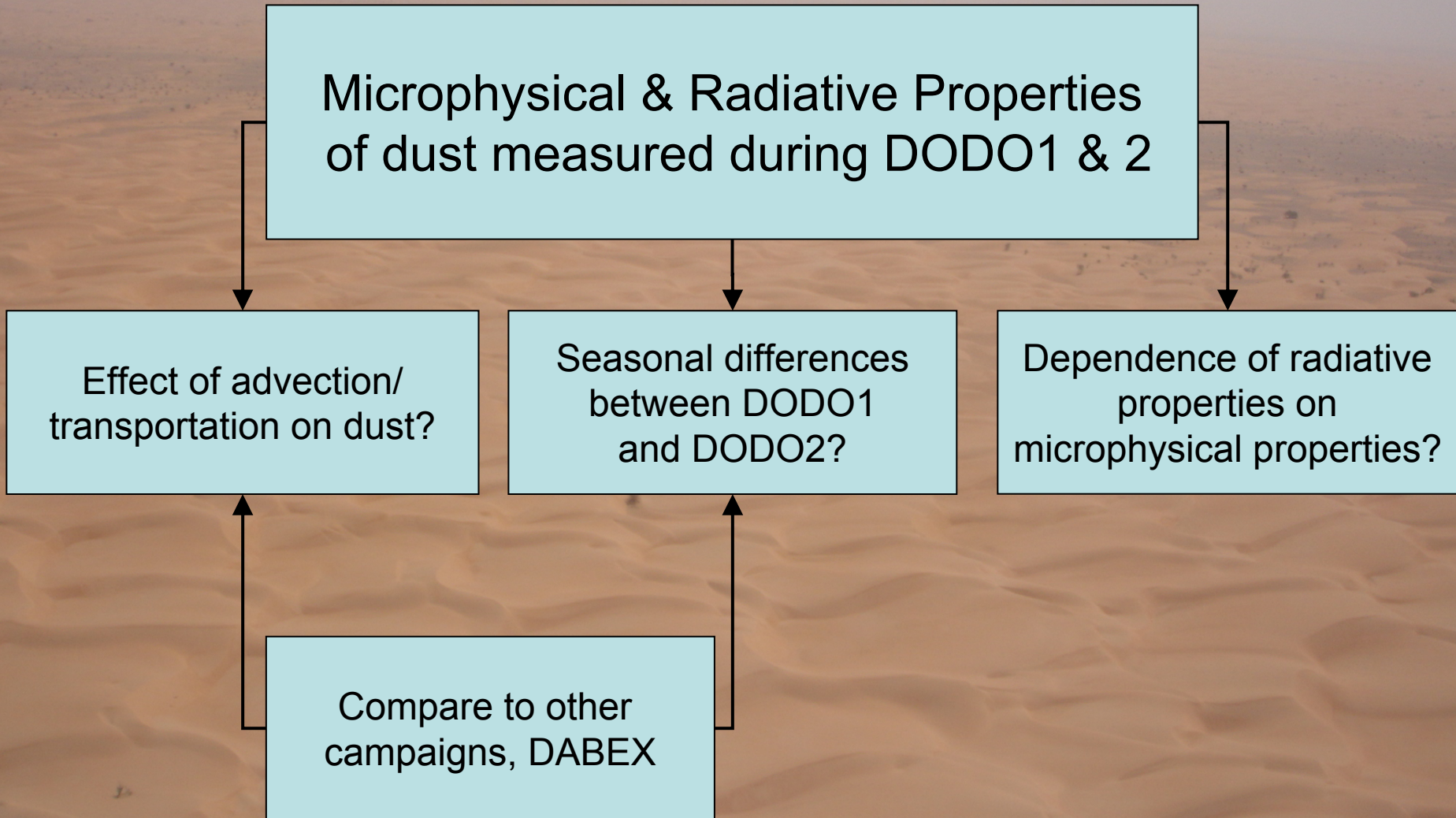
# DODO: Microphysical Properties of Dust

Claire McConnell  
Ellie Highwood

DODO1: 3<sup>rd</sup> – 16<sup>th</sup> Feb 2006

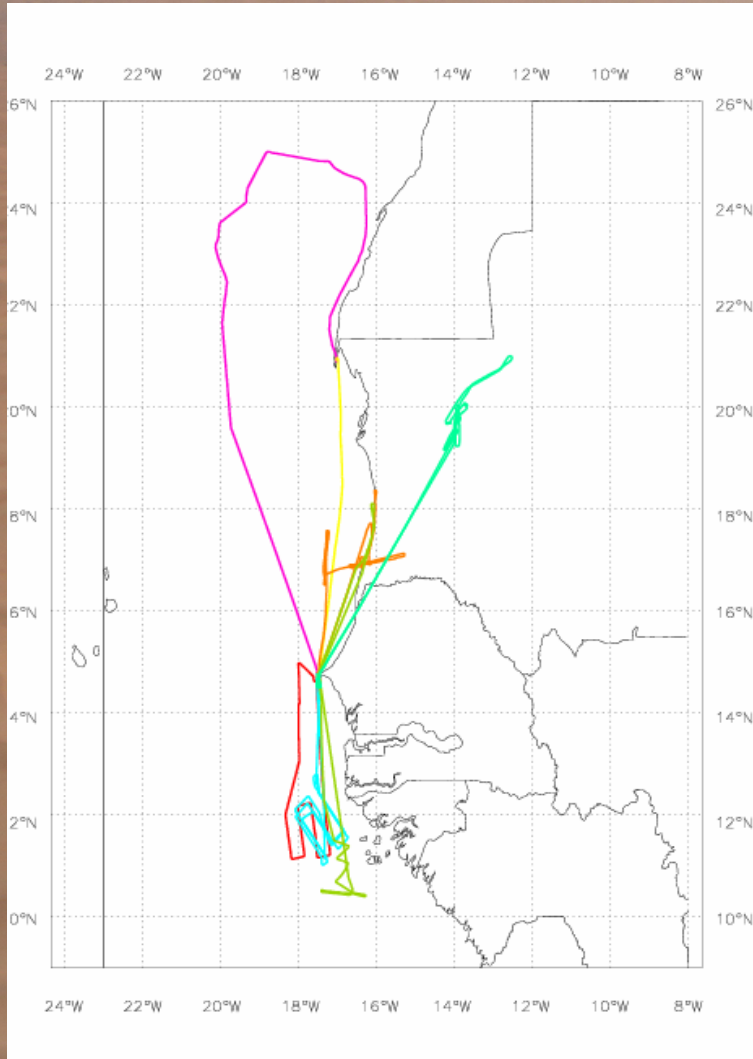
DODO2: 21<sup>st</sup> – 28<sup>th</sup> Aug 2006

# My Research

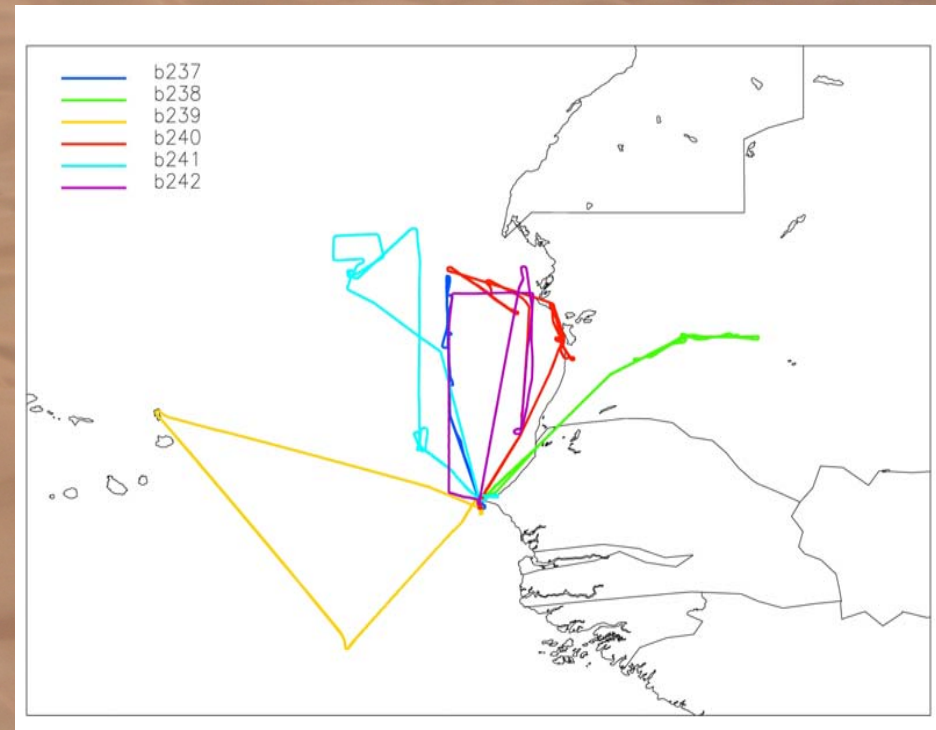


# DODO Campaigns

## DODO 1



## DODO 2



# Break down of Flights and Case Studies

## Microphysical Properties

B168

B173

B174

B175

B237

B238

B242

(B239)

(B240)

## Radiative Properties

B175

B237

B238

B242

## Effects of Transport

B173 v B174

B238 v B237 (but not sequential)

B240 v others (but low dust conditions)

## Seasonal Differences

General comparison of all flights in each campaign

Same areas:

- B175 v B238 (near source)

- B173 v B240 (low dust conditions)

# Single Scattering Albedo

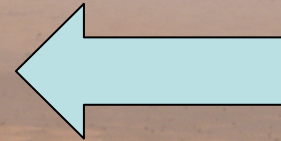
$$\omega_0^\lambda = \frac{Q_{sp}}{Q_{ext}} = \frac{\sigma_{sp}^\lambda}{\sigma_{sp}^\lambda + \sigma_{ap}^\lambda}$$

- The single scattering albedo is the fraction of light scattered to that extinguished by aerosol at a certain wavelength.
- Scattering,  $\sigma_{sp}$ , and absorption,  $\sigma_{ap}$ , coefficients are measured on BAe-146 by nephelometer and PSAP (Particle Soot Absorption Photometer).

# Corrections to Measurements

- PSAP Corrections:

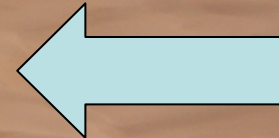
- Variations in spot size
- Inaccuracies in flow rate
- Scattering misinterpreted as absorption (related to nephelometer)
- Multiple scattering



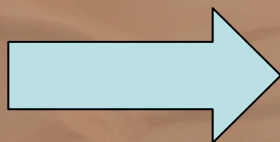
Act to decrease absorption

- Nephelometer Corrections:

- Missed forwards scattering (related to Å)

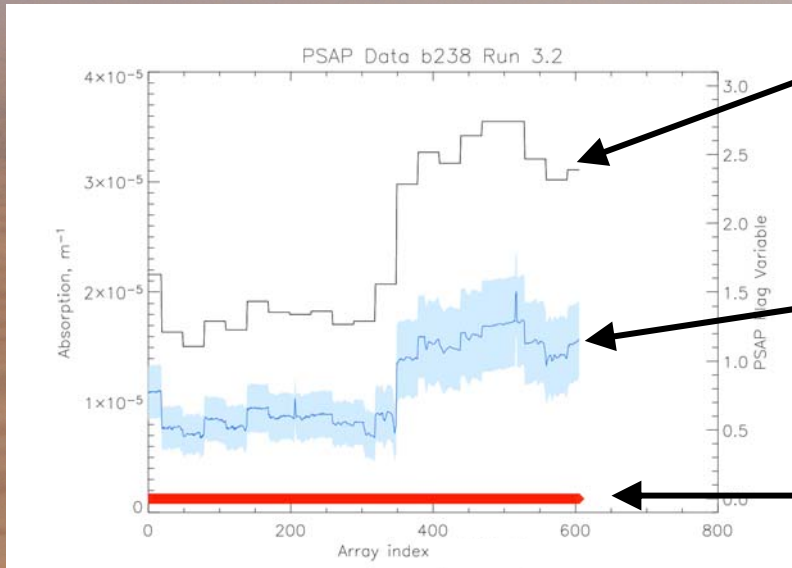


Act to increase scattering



Together the corrections act to increase  $\omega_0$

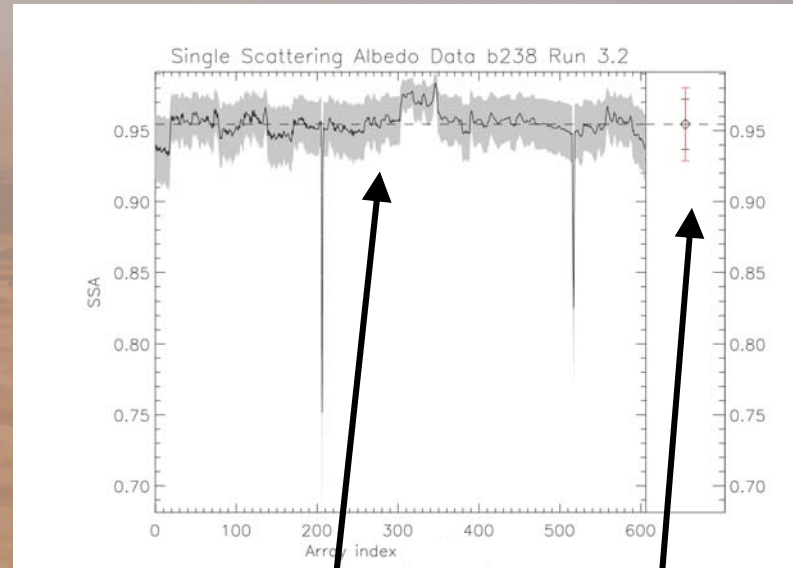
# Example Run



Raw PSAP data

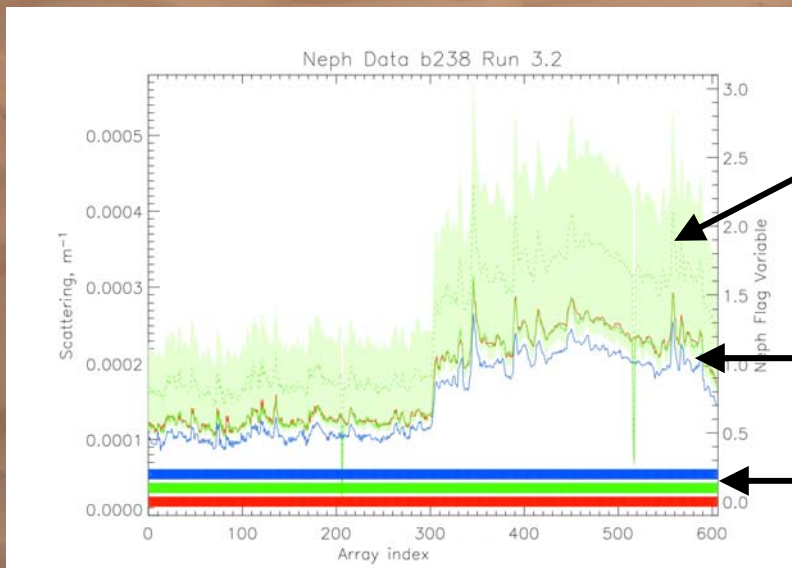
Corrected absorption & instrumental error

Quality Flag



$\omega_0$  & instrumental error over run

Mean  $\omega_0$ , instrumental error (black) & atmospheric variability (red)



Corrected green scattering & instrumental error

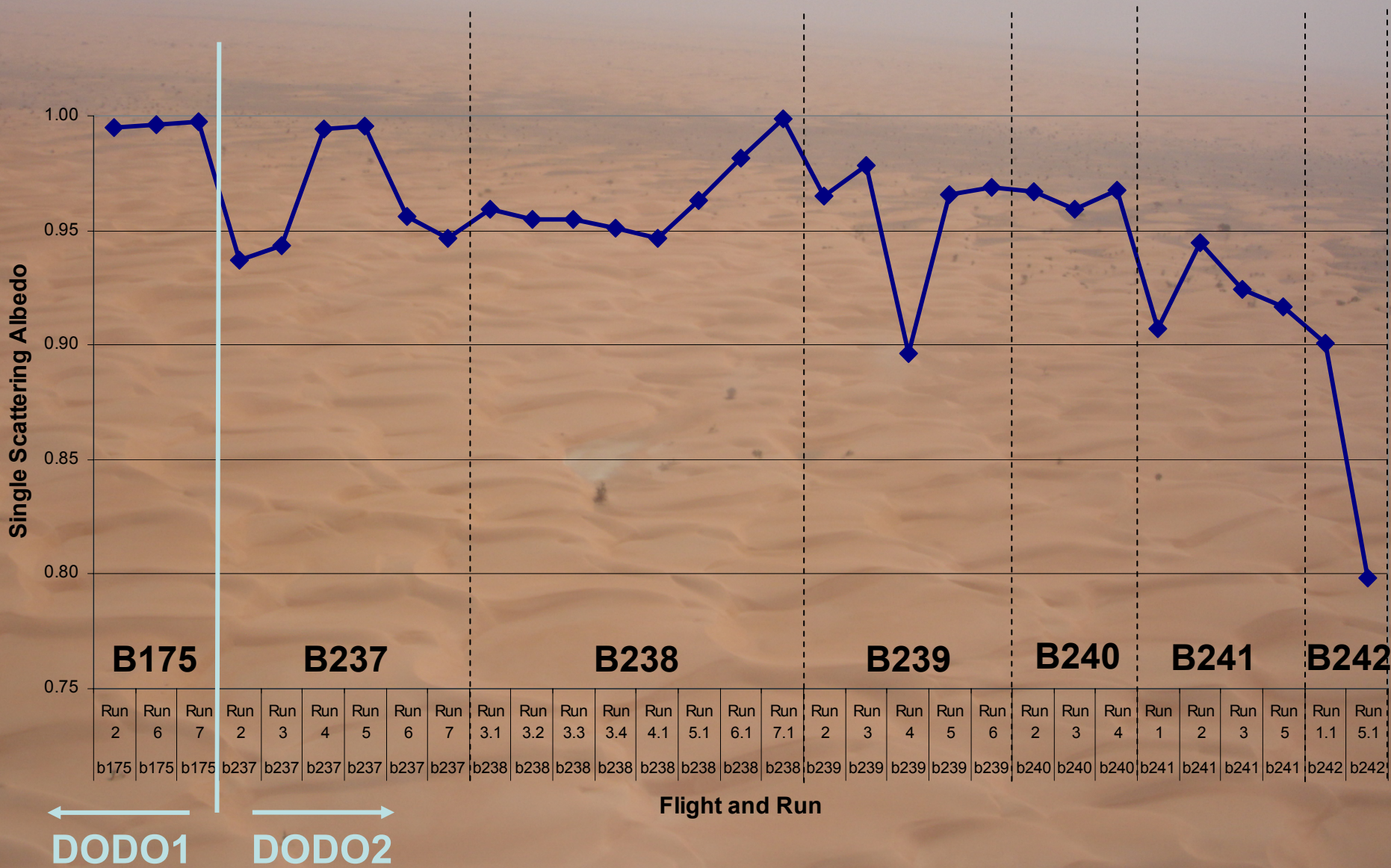
Raw neph data

Quality Flags

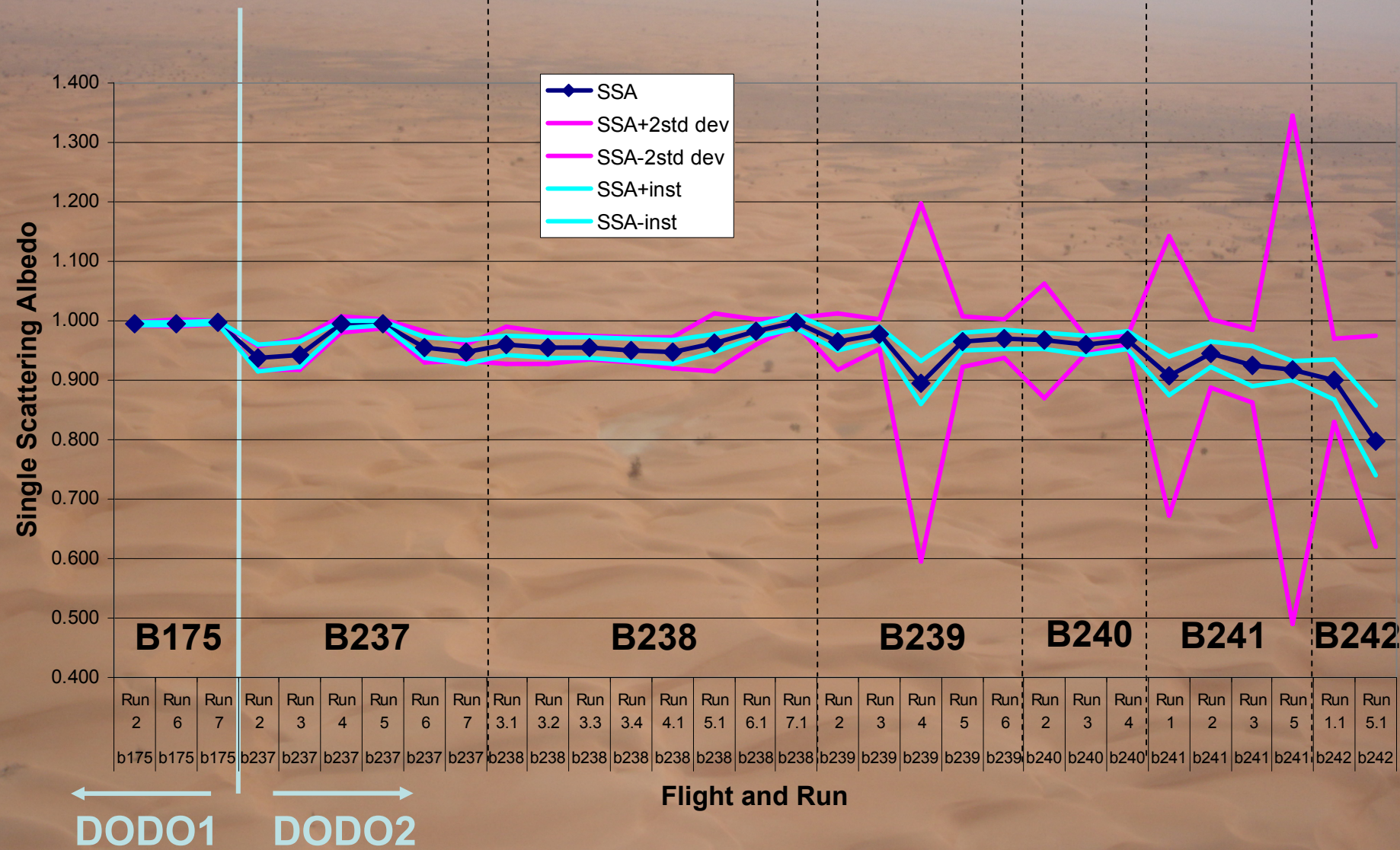
# Single Scattering Albedos

DODO1  $\bar{\omega}_0 = 0.996$

DODO2  $\bar{\omega}_0 = 0.948$



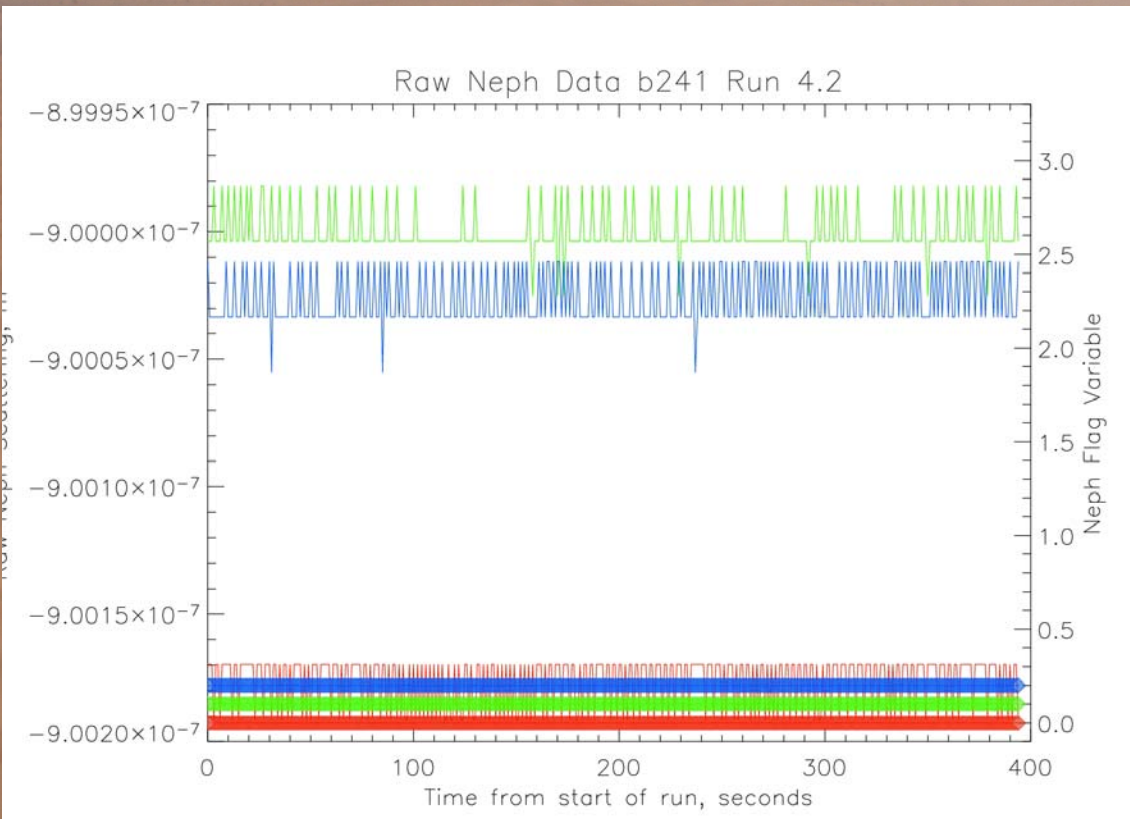
# Single Scattering Albedos with Errors



# Issues to Consider

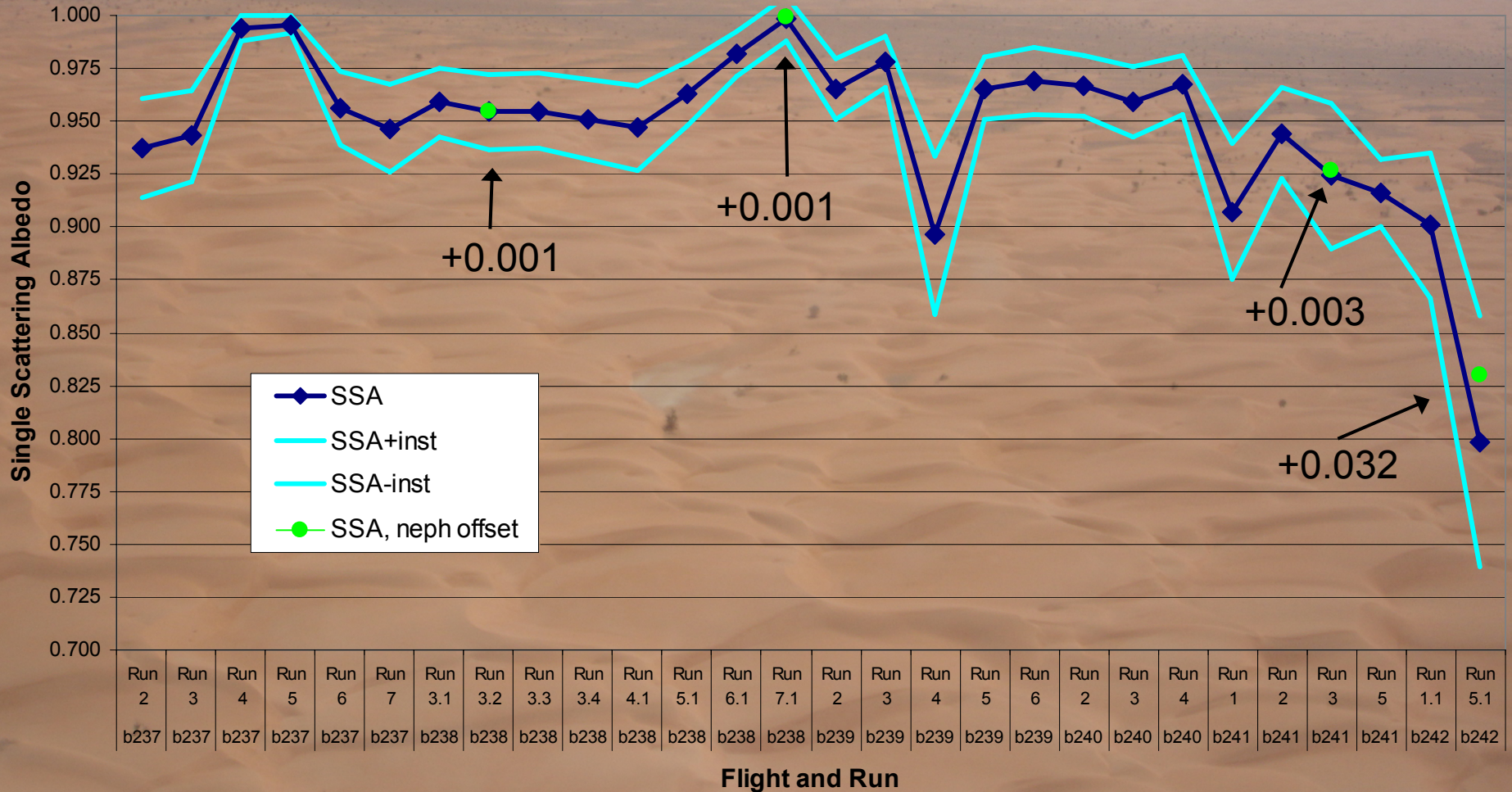
- Nephelometer has been calibrated, needs to be back calibrated for DODO2 (maybe DODO1 too) and applied to data
- Nephelometer appears to have a negative offset
- PSAP averages over 30s time intervals, neph data at 1Hz, so lags are possible in variable dust conditions → artificial changes in  $\omega_0$ . Solution: average raw data over run – need to test

# Nephelometer Offset



- B241 R4.2 at ~6.5km, above dust
- Should read zero, but appears to have a negative offset
- Test: add offset to raw data & calculate  $\omega_0$ .

# Nephelometer Offset Test



# Future Work

- Finish  $\omega_0$  work, and repeat for remaining DODO1 flights
- Apply calibrations to nephelometer data
- Use Mie code on PCASP data to calculate single scattering albedos and compare to neph/PSAP results (B175  $\rightarrow \omega_0 \sim 0.98$ )
- Radiation work – from radiometers and radiation code
- Analyse variation in dust characteristics with:
  - Transport
  - Season