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Validation of SCIAMACHY ozone profiles

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Aura Science Meeting

Outline

- Validation technique
- SCIAMACHY ozone profile products
  - ESA version 2.5
  - IFE version 1.62 (*Institute for Environmental Physics, U. Bremen*)
- Results
  - Potentials
  - Present shortcomings
- Conclusions

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Validation technique

- Correlative data: lidar
- Collocation criteria
  - Maximum distance: 800 km
  - Maximum time difference: 20 hours
- Investigate dependencies on
  - Profile-nr. within state
  - Geographical location (latitude)
  - Solar Zenith Angle
  - Solar Azimuth Angle
  - ……..

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SCIAMACHY ozone profile product: ESA v2.5

- ESA v2.5
  - December 7th, 2004 – onward (*till begin April 2005 shown here*)
  - *No* Averaging Kernels available
  - *No* tangent height correction
    - For validation: -1500 m shift applied

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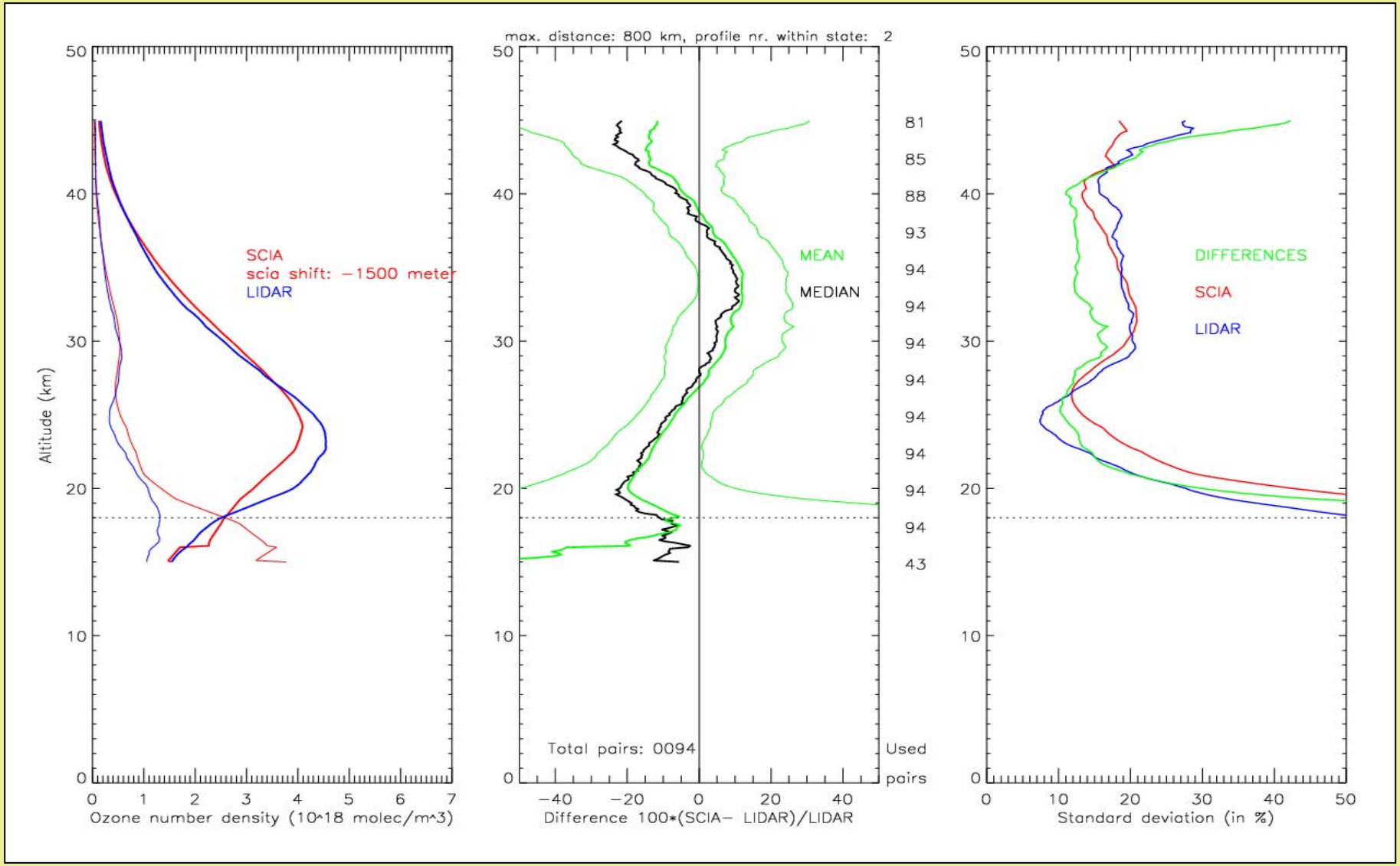
Validation example



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Results: ESA version 2.5

- **Profile-nr. within state**

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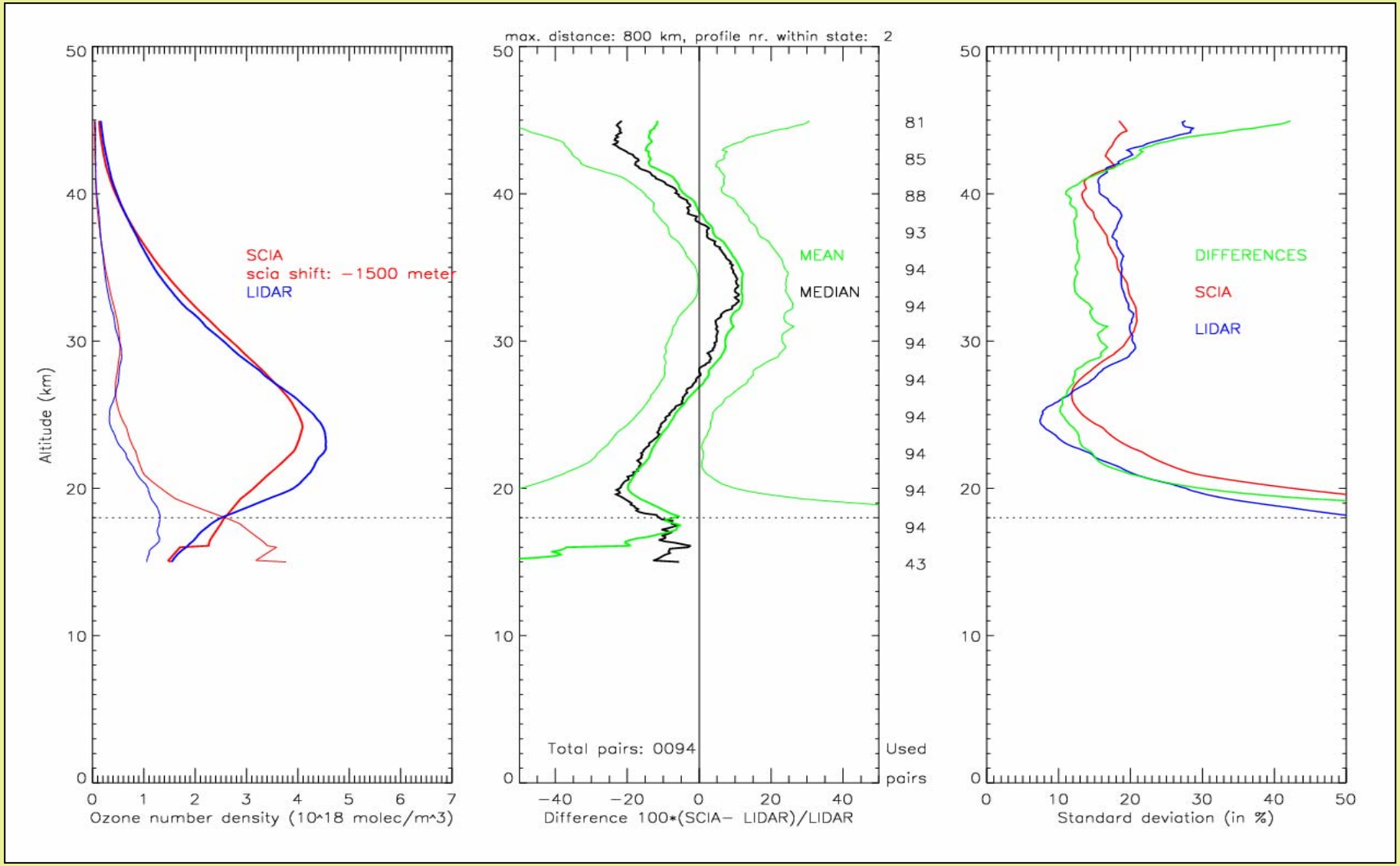
ESA version 2.5 – P1 shift: -1500 m



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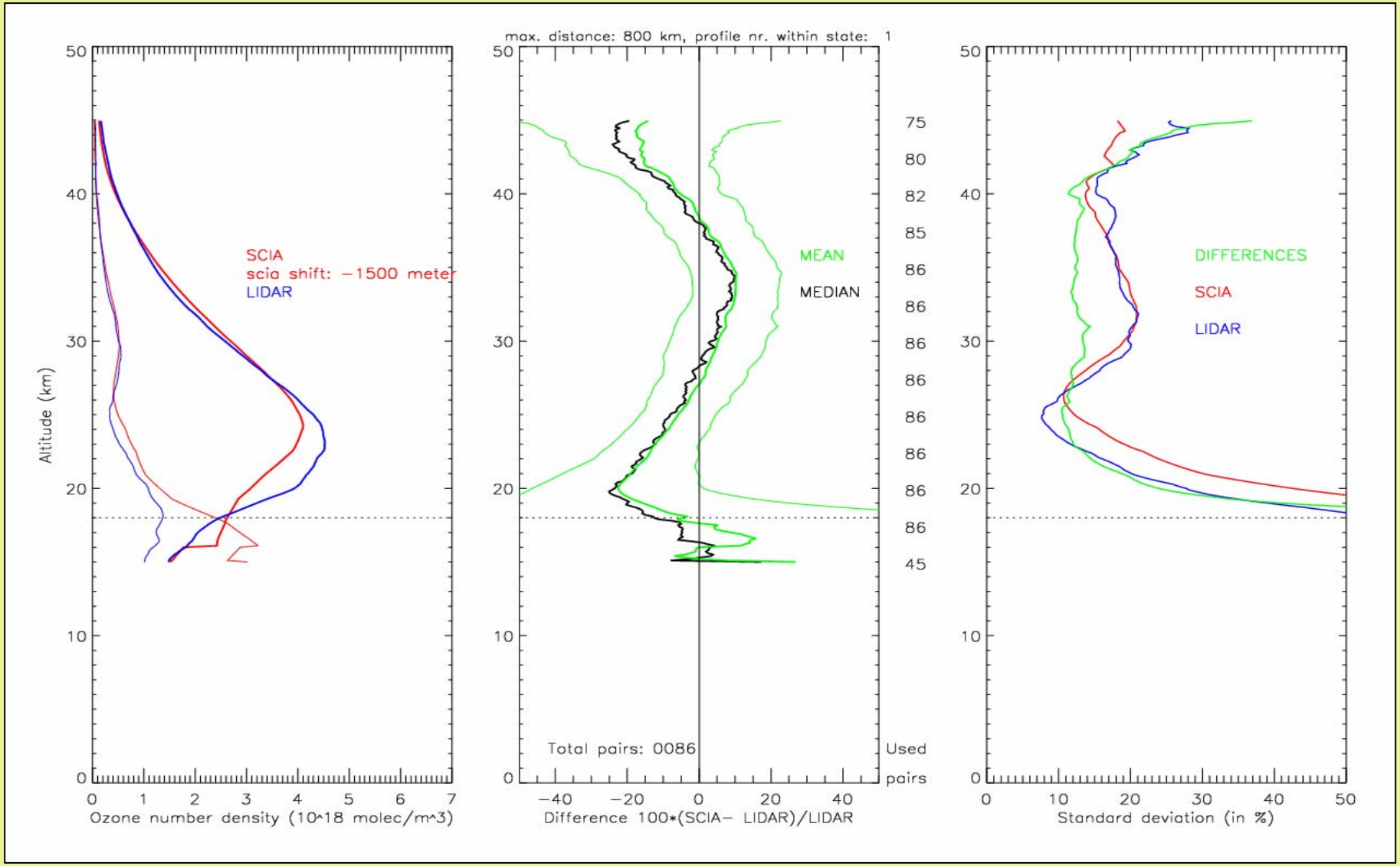
ESA version 2.5 – P2 shift: -1500 m



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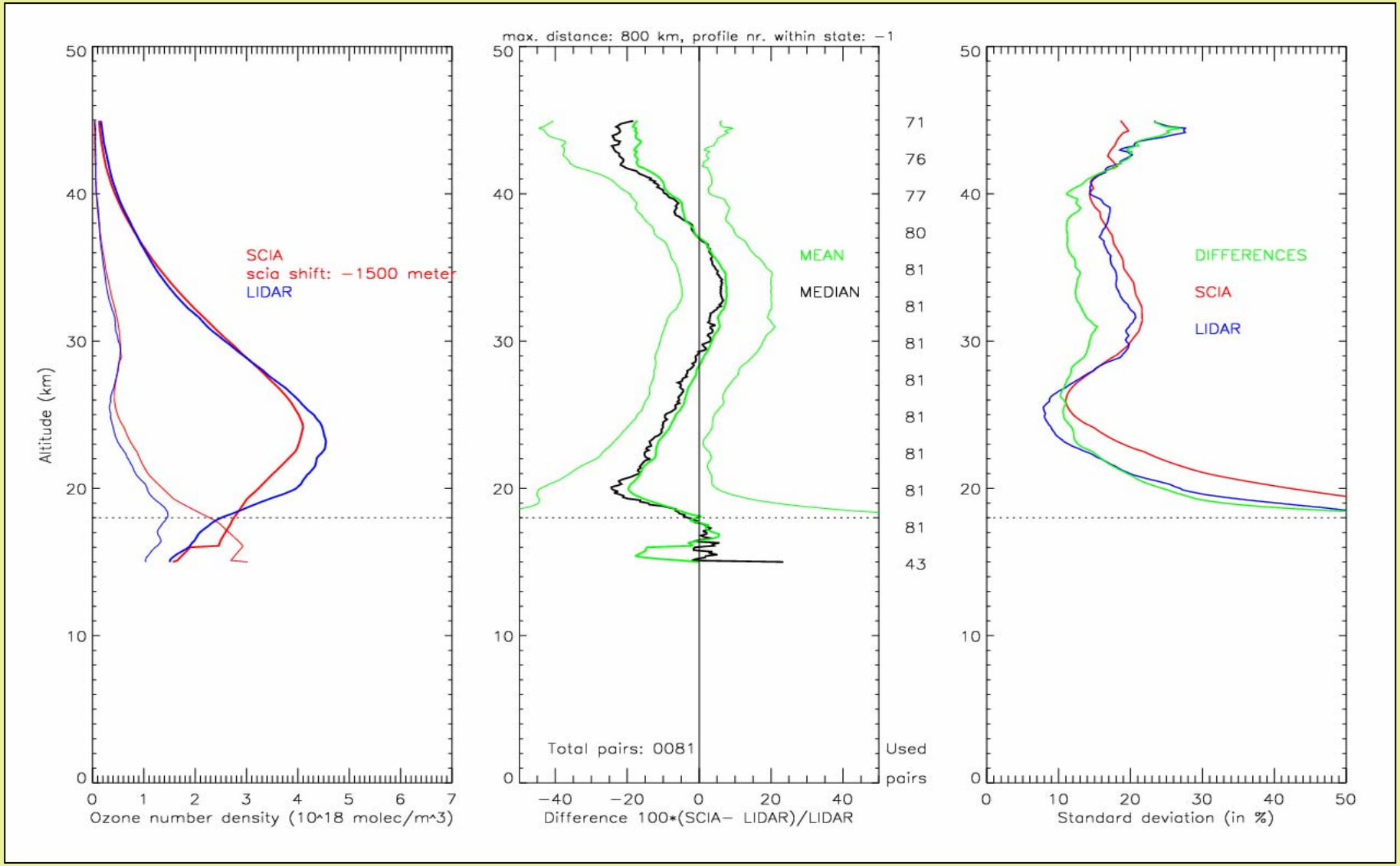
ESA version 2.5 – P3 shift: -1500 m



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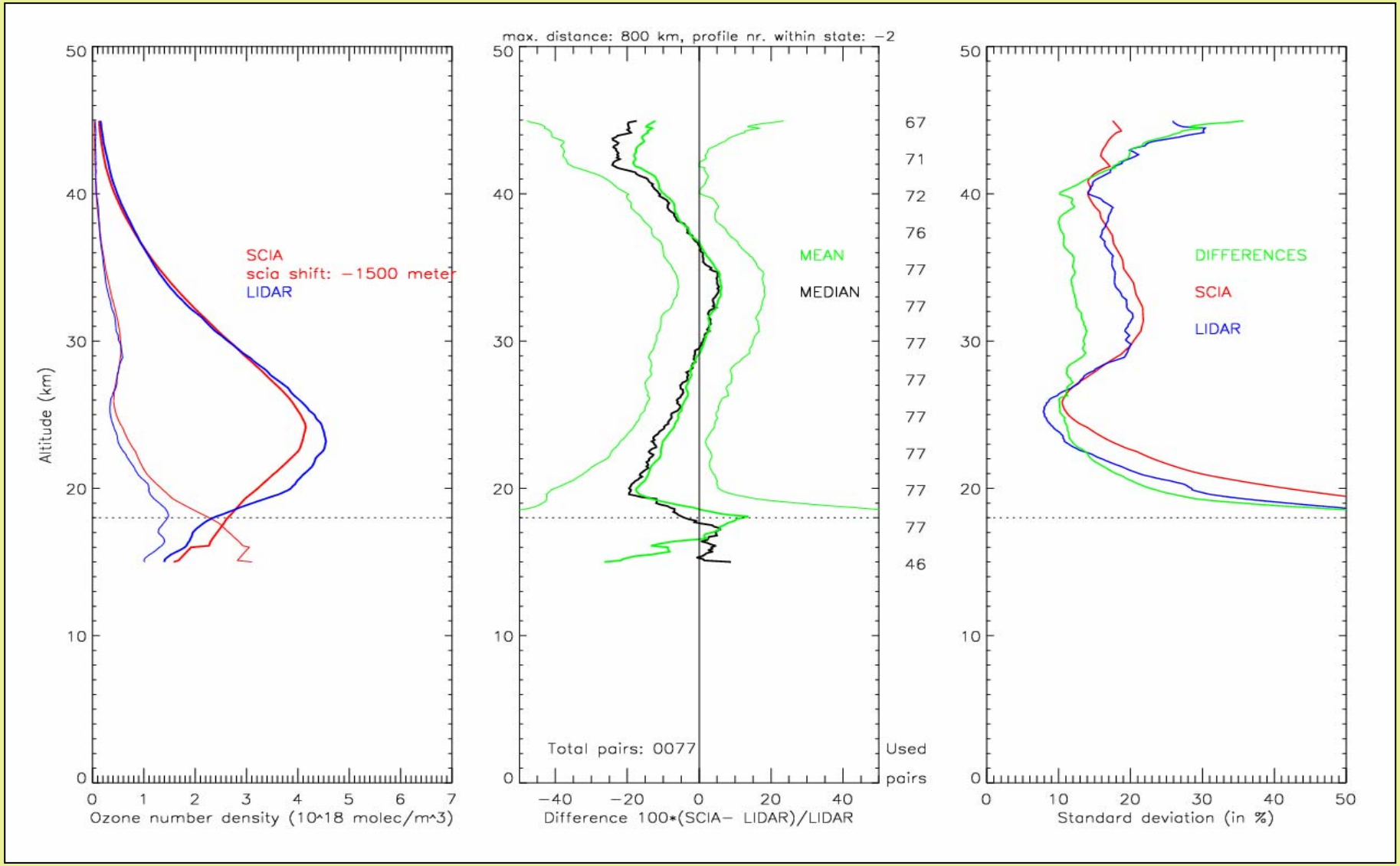
ESA version 2.5 – P4 shift: -1500 m



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Results: ESA version 2.5

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Compares well to within 10% in range: 25-40 km
- **Geographical location (latitude)**

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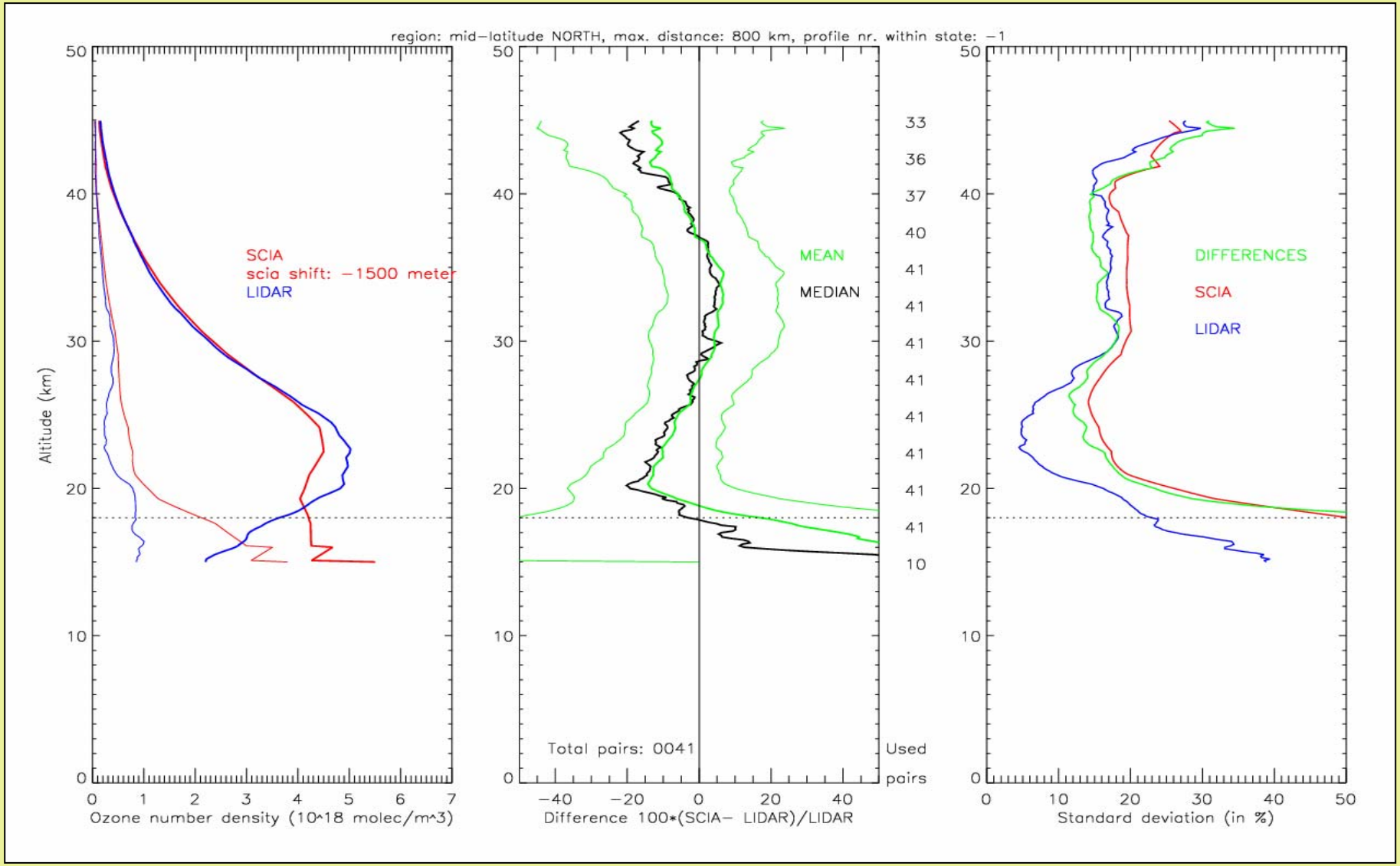
ESA v2.5 P3 – mid-latitudes NH shift: -1500 m



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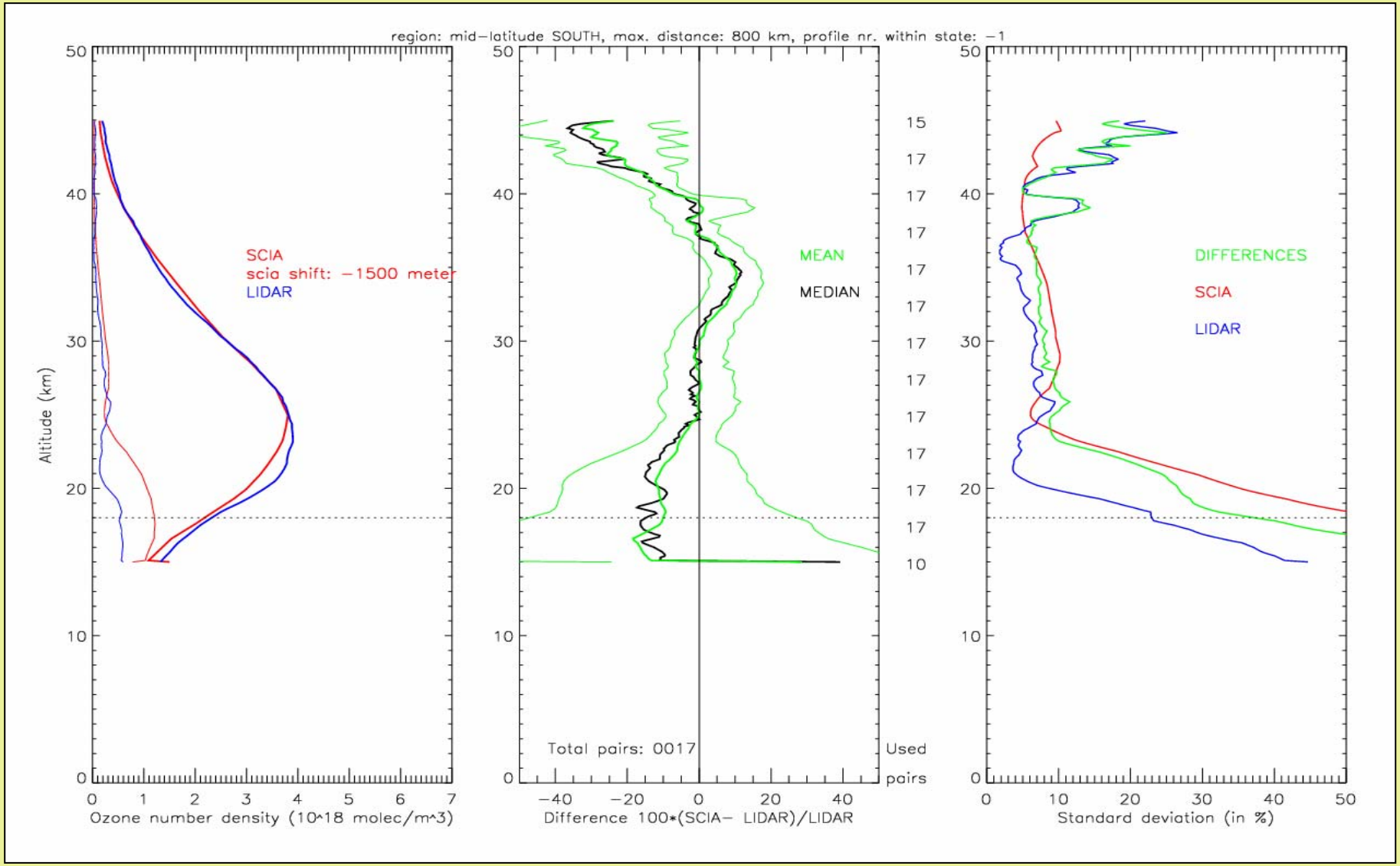
ESA v2.5 P3 – mid-latitudes SH shift: -1500 m



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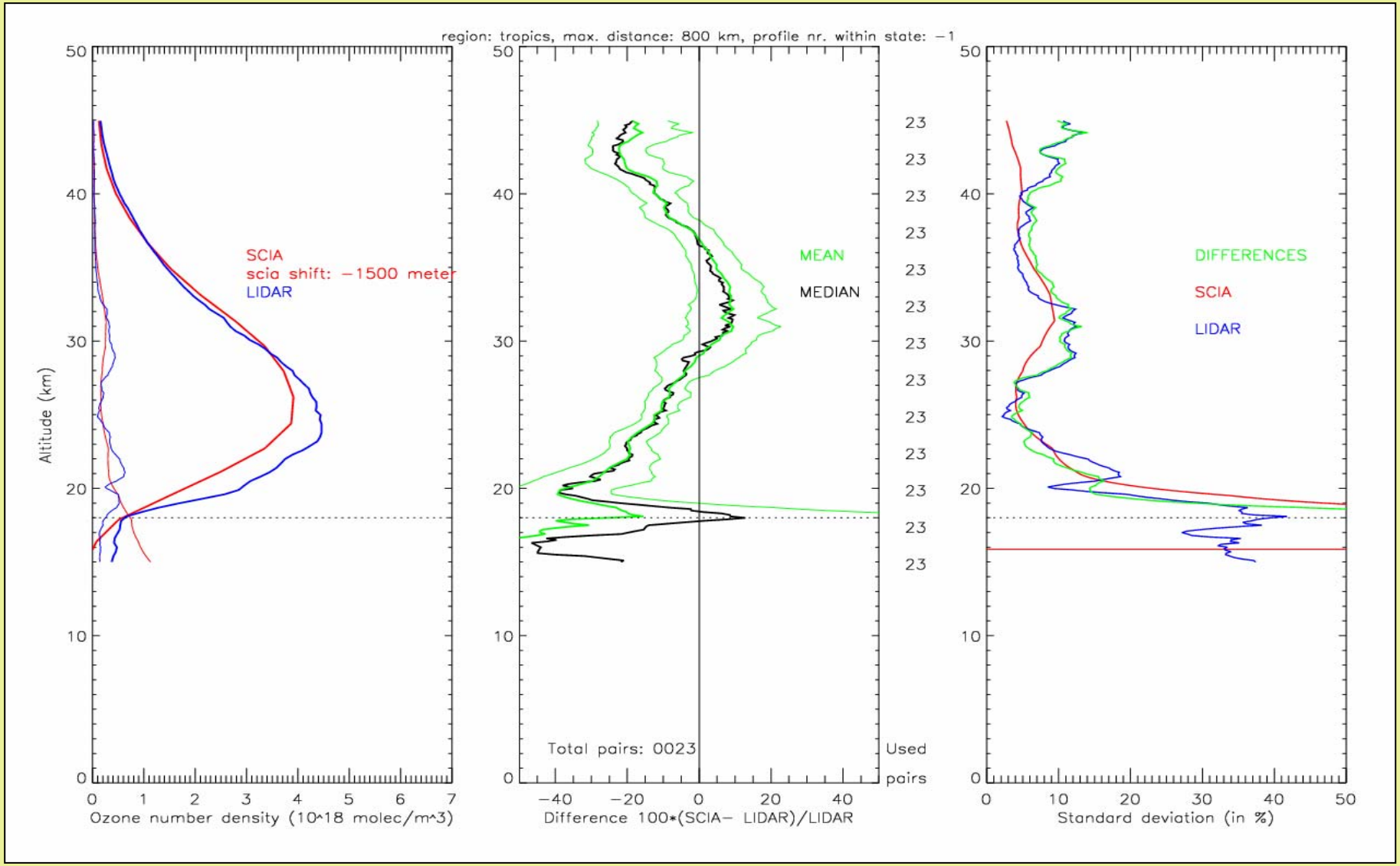
ESA v2.5 P3 – tropics shift: -1500 m



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Results: ESA version 2.5

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Compares well to within 10% in range: 25-40 km
- Geographical location (latitude)
  - *Best results for mid-latitudes NH (mid-latitudes SH, tropical regions)*
  - *No collocations for polar regions*
- **Solar Zenith Angle**

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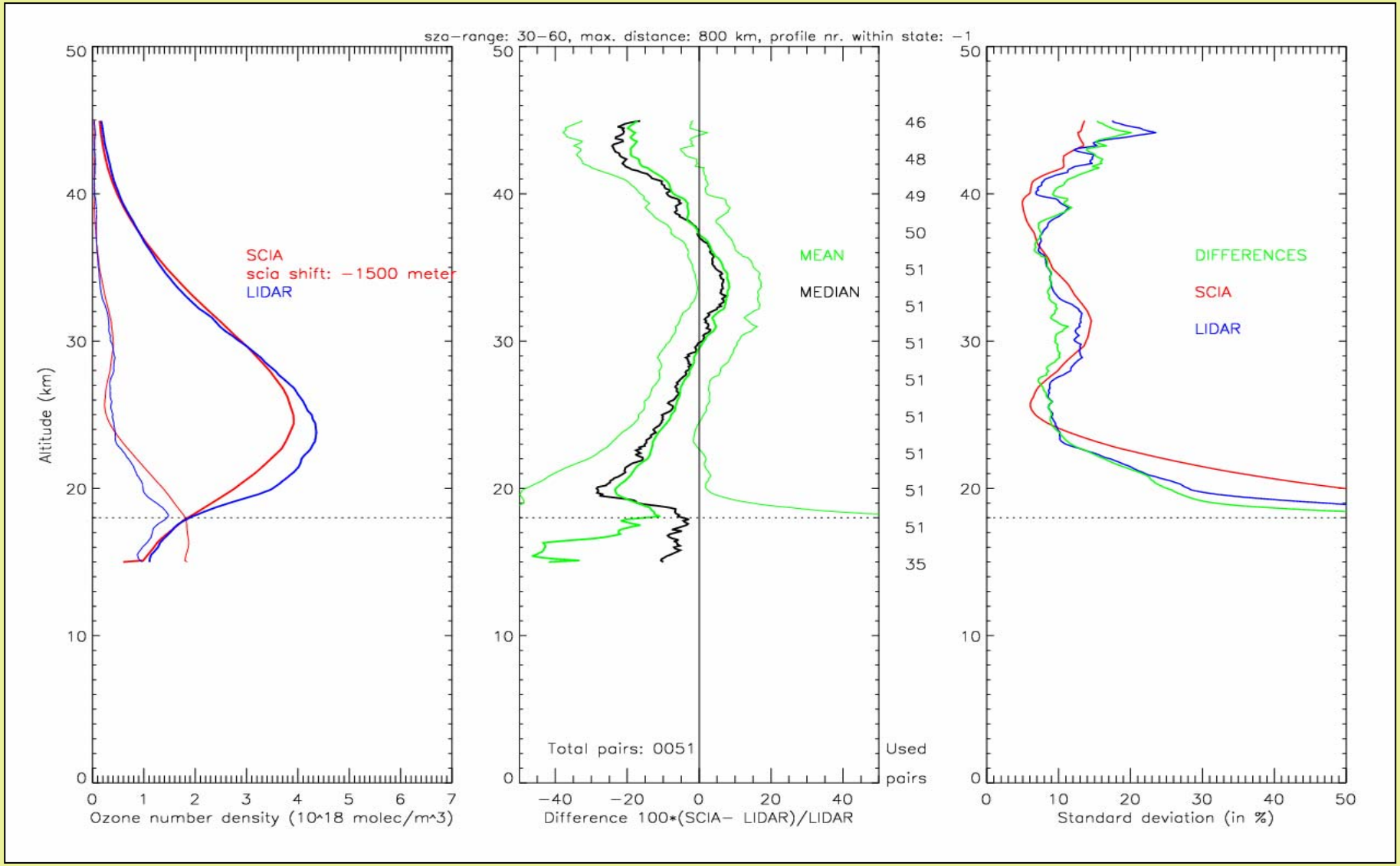
ESA v2.5 P3 – SZA range: 30-60 shift: -1500 m



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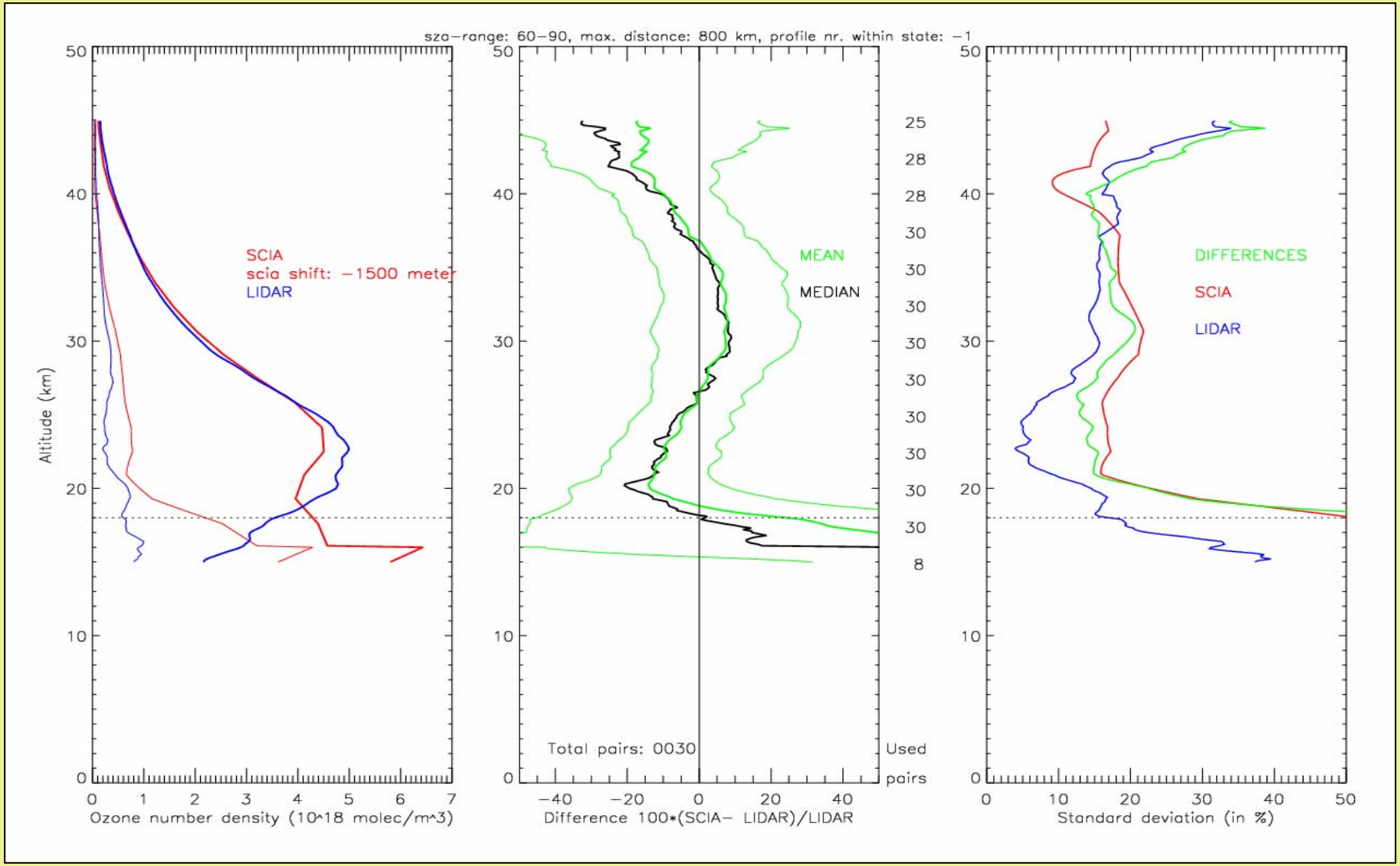
ESA v2.5 P3 – SZA range: 60-90 shift: -1500 m



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Restults: ESA version 2.5

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Compares well to within 10% in range: 25-40 km
- Geographical location (latitude)
  - *Best results for mid-latitudes NH (mid-latitudes SH, tropical regions)*
  - *No collocations for polar regions*
- Solar Zenith Angle
  - *Slightly better results for SZA-range: 60-90*
  - *No collocations SZA-range: 0-30*
- **Solar Azimuth Angle**

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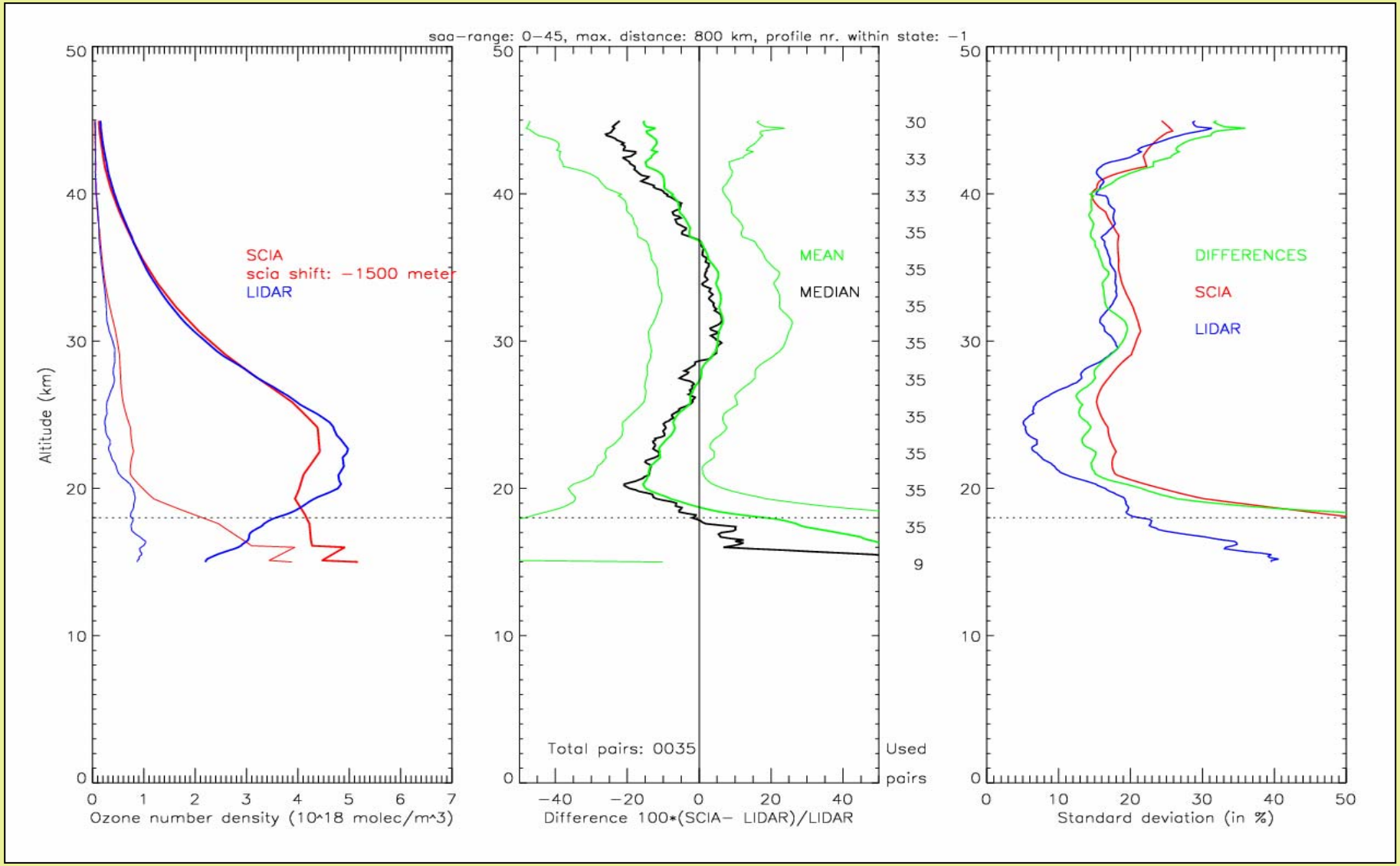
ESA v2.5 P3 – SAA range: 0-45 shift: -1500 m



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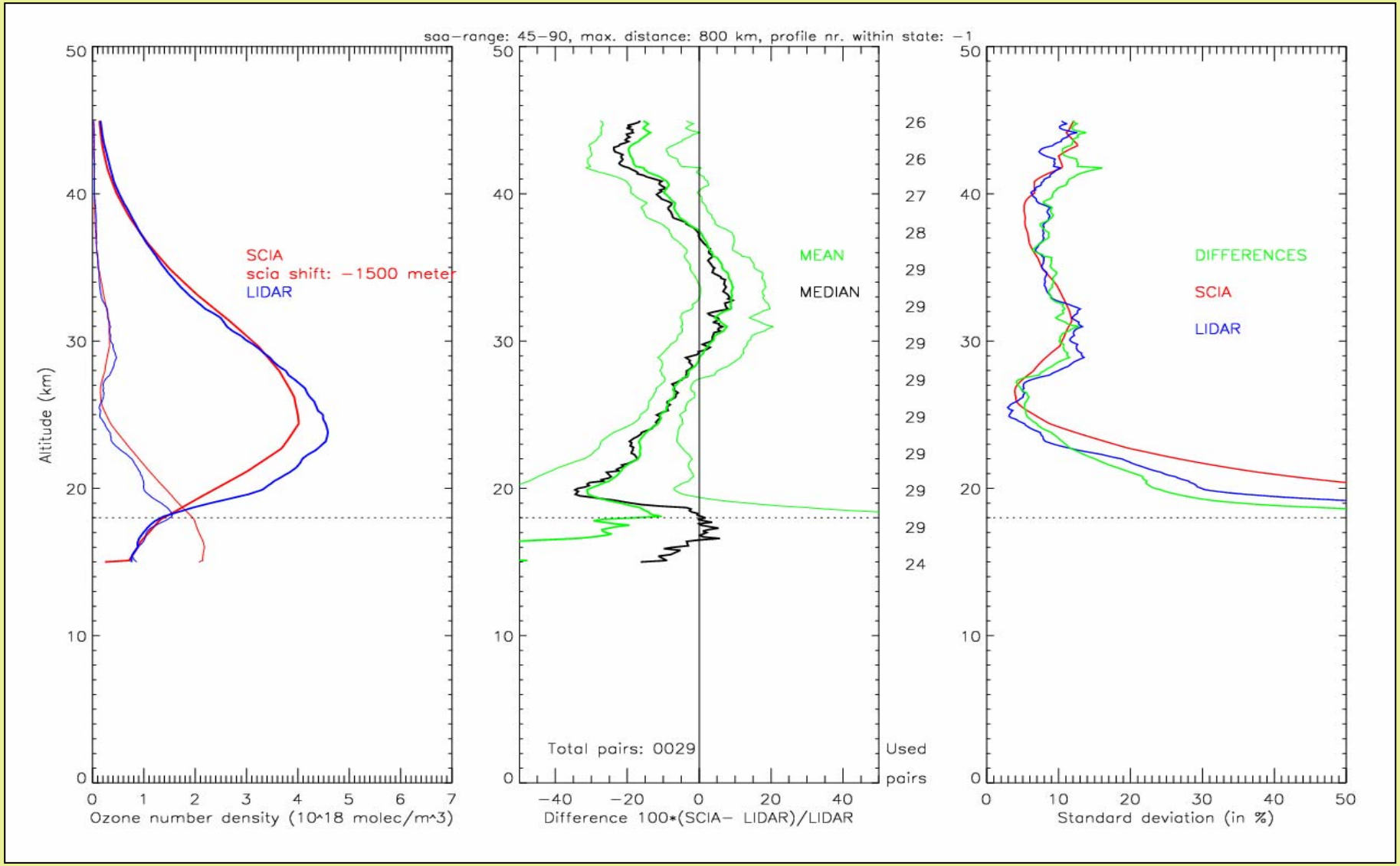
ESA v2.5 P3 – SAA range: 45-90 shift: -1500 m



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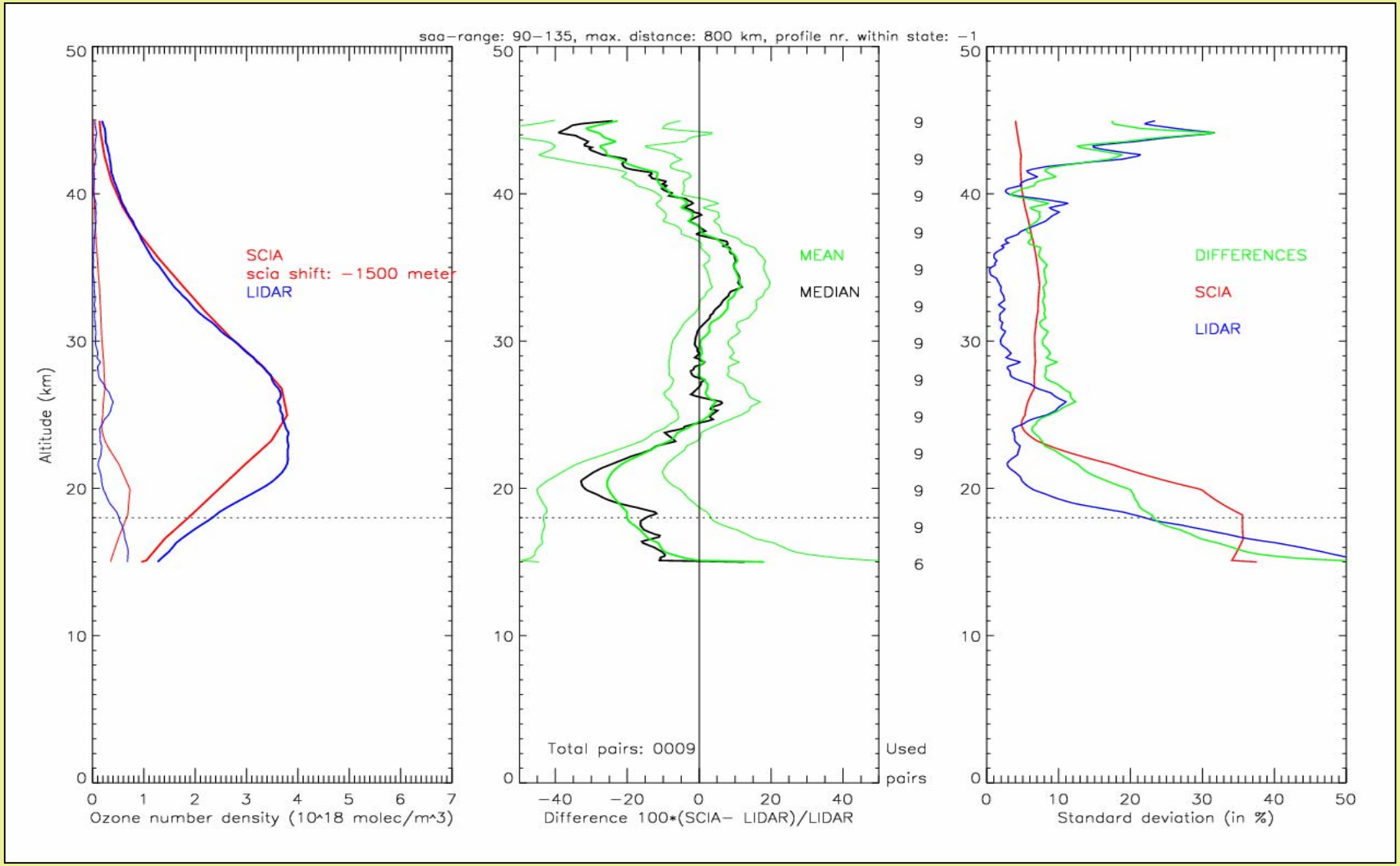
ESA v2.5 P3 – SAA range: 90-135 shift: -1500 m



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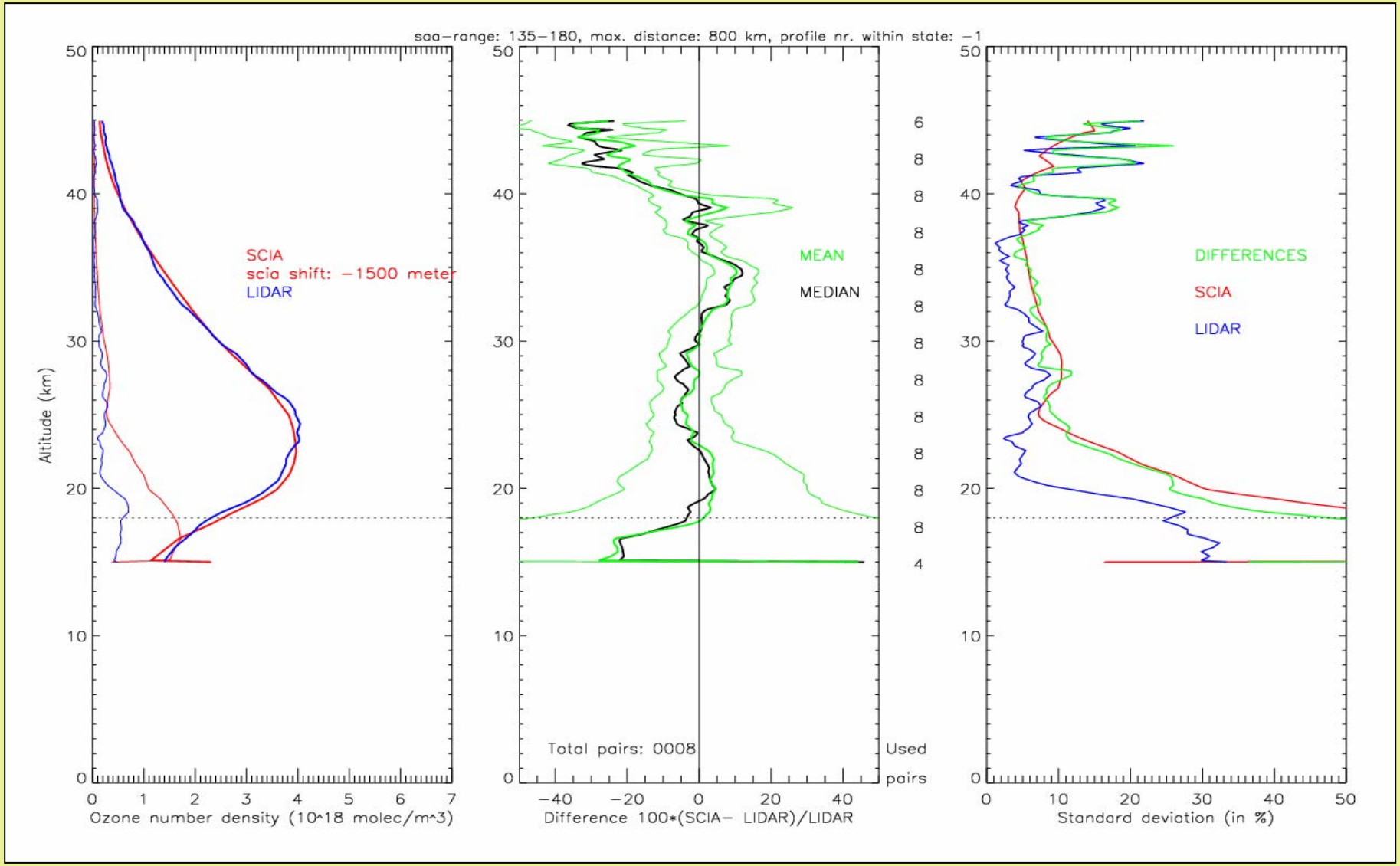
ESA v2.5 P3 – SAA range: 135-180 shift: -1500 m



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Results: ESA version 2.5

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Compares well to within 10% in range: 25-40 km
- Geographical location (latitude)
  - *Best results for mid-latitudes NH (mid-latitudes SH, tropical regions)*
  - *No collocations for polar regions*
- Solar Zenith Angle
  - *Slightly better results for SZA-range: 60-90*
  - *No collocations SZA-range: 0-30*
- Solar Azimuth Angle
  - *Best results for SAA-range: 0-45 <u>and</u> 135-180*

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SCIAMACHY ozone profile product: IFE v1.62

- ESA v2.5
  - December 7th, 2004 – onward (*till begin April 2005 shown here*)
  - *No* Averaging Kernels available
  - *No* tangent height correction
    - For validation: -1500 m shift applied
- IFE v1.62
  - Months September and October 2004
  - Averaging Kernels *are* available
  - Altitude range: 15-40 km
  - TRUE-shift applied (*Tangent height Retrieval by UV-B Exploitation, Kaiser et al., 2004**)
    - Average TRUE-shift: -800 m
    - For validation: -700 m shift applied

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*Kaiser, J.W., C. von Savigny, K.-U. Eichmann, S. Noël, H. Bovensmann, and J.P. Burrows, Satellite Pointing Retrieval from Atmospheric Limb Scattering of Solar UV-B Radiation, *Can. J. Phys.*, *82*, 1041-1052, 2004.

Results: IFE version 1.62

- **Profile-nr. within state**

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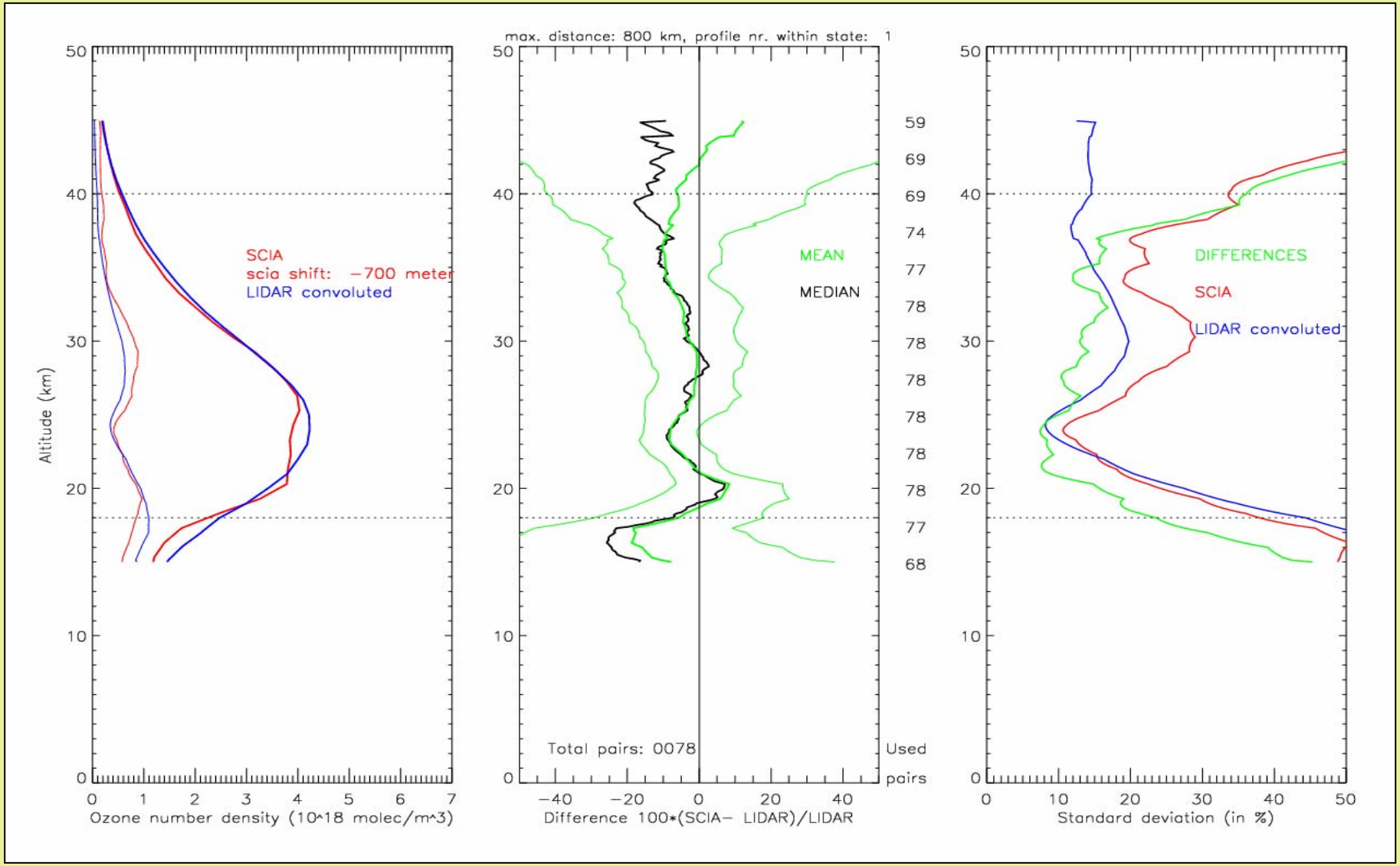
IFE version 1.62 – P1 shift: -700 m



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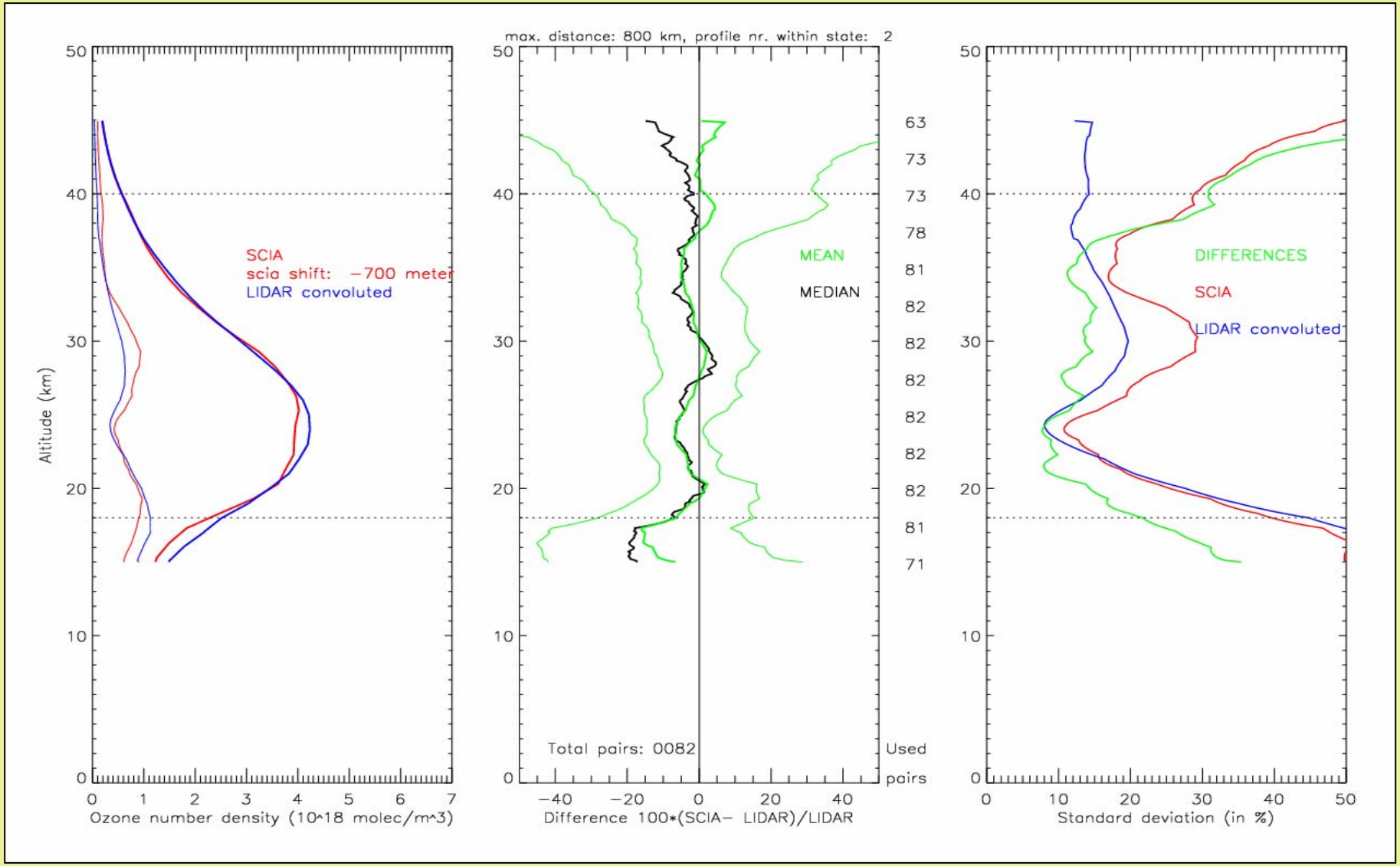
IFE version 1.62 – P2 shift: -700 m



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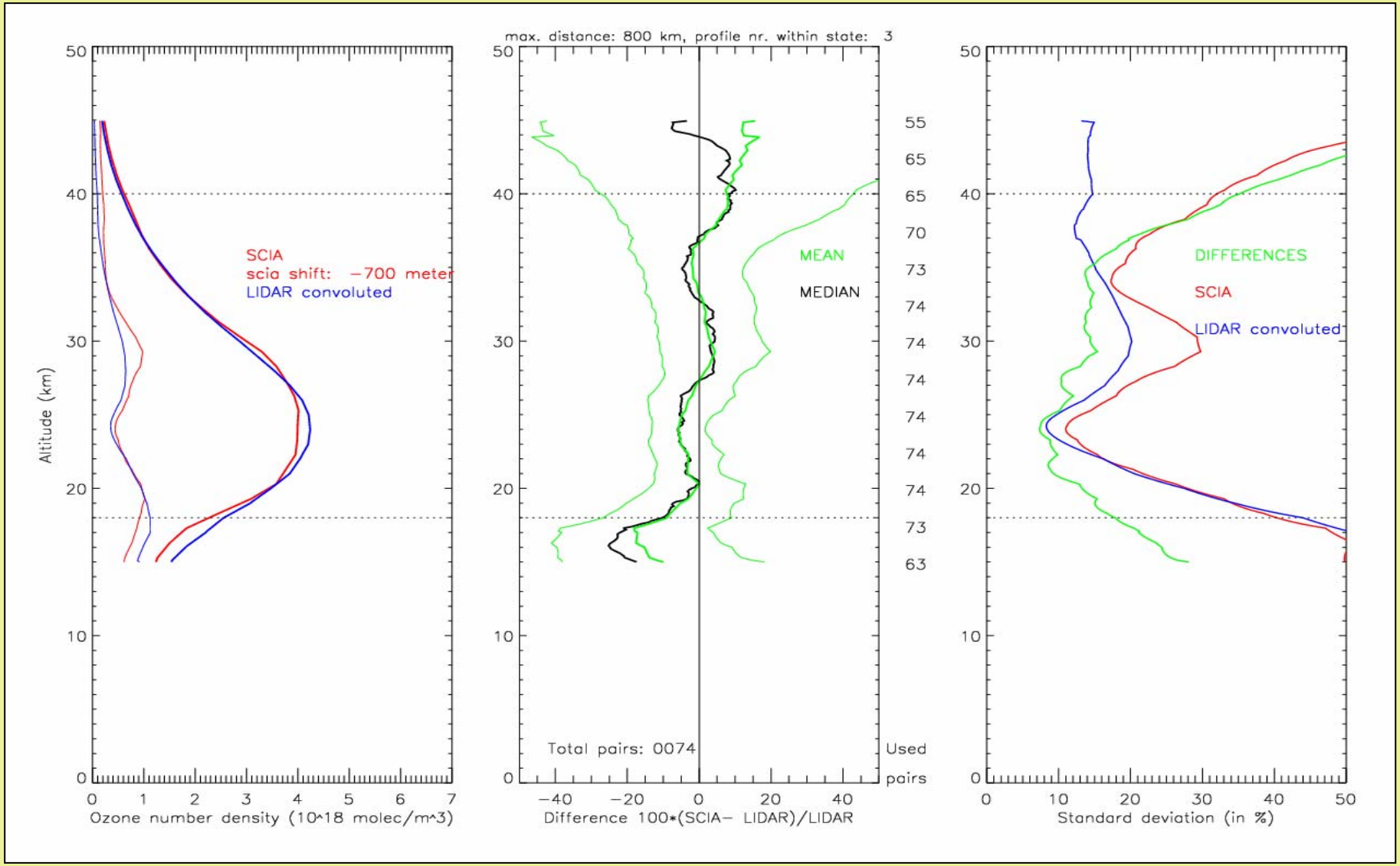
IFE version 1.62 – P3 shift: -700 m



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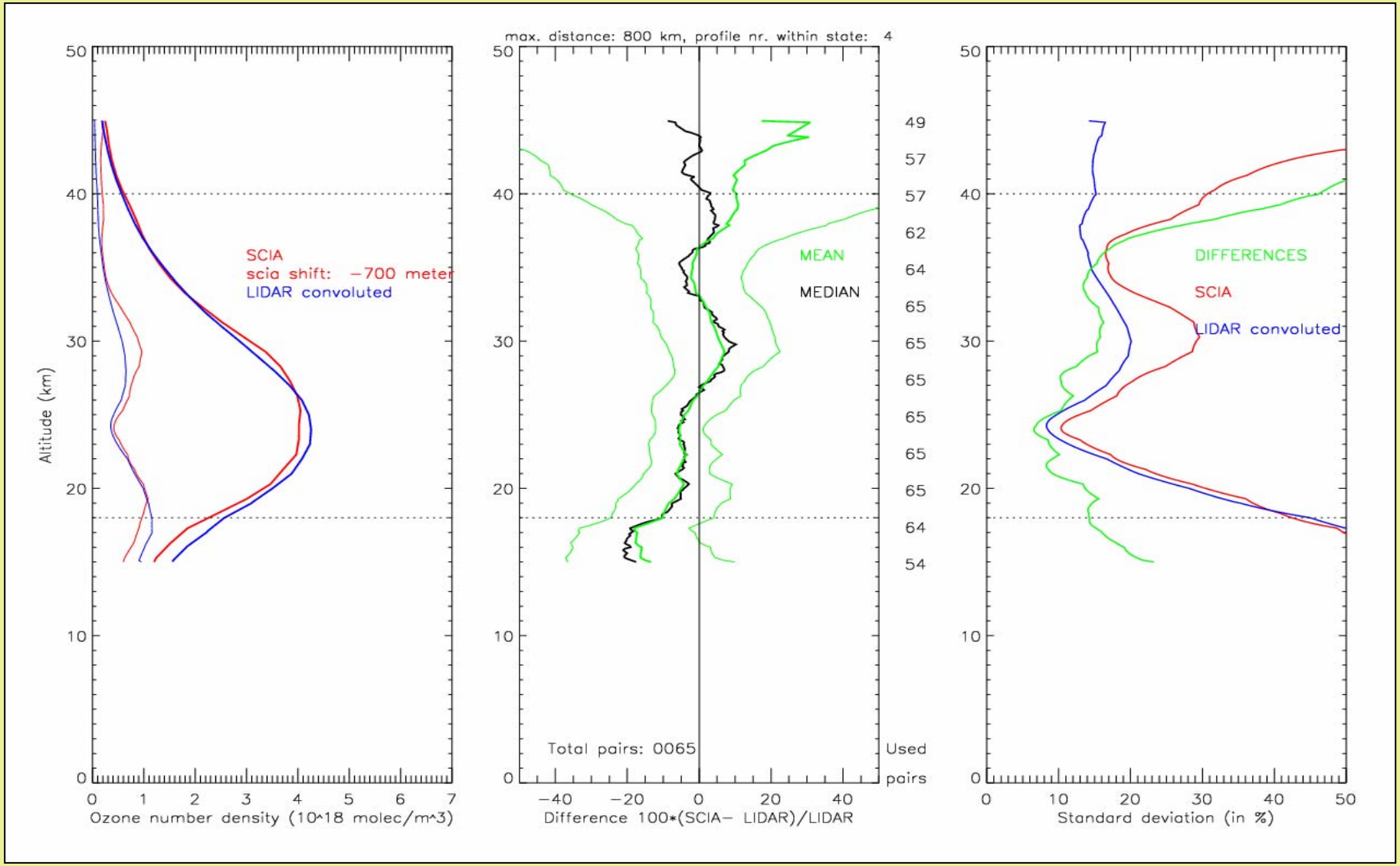
IFE version 1.62 – P4 shift: -700 m



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Results: IFE version 1.62

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Within range 18-40 km: -2% ± 10% compared to lidar
  - This strongly depends on the profile-nr. within state!
- **Geographical location (latitude)**

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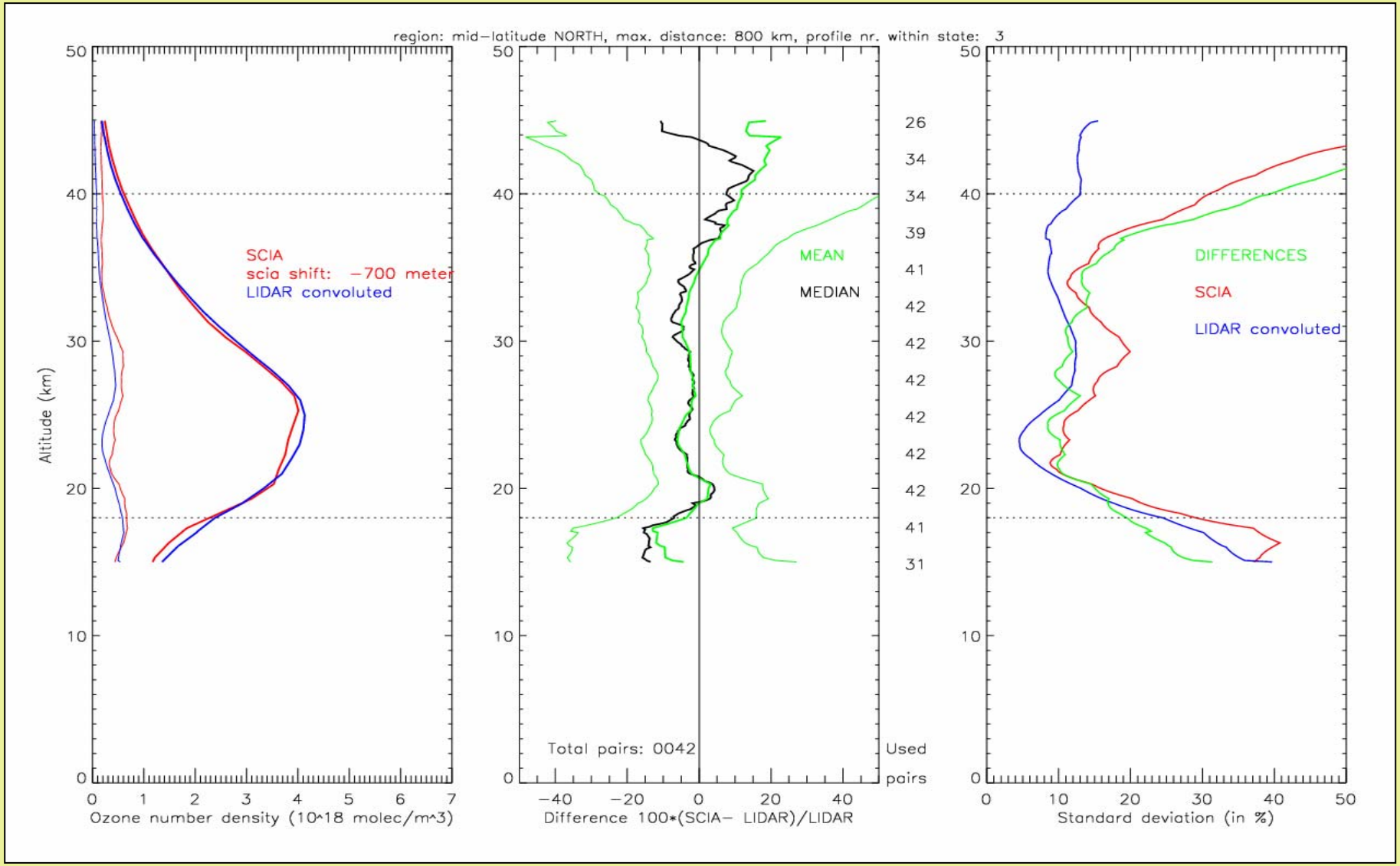
IFE v1.62 P3 – mid-latitudes NH shift: -700 m



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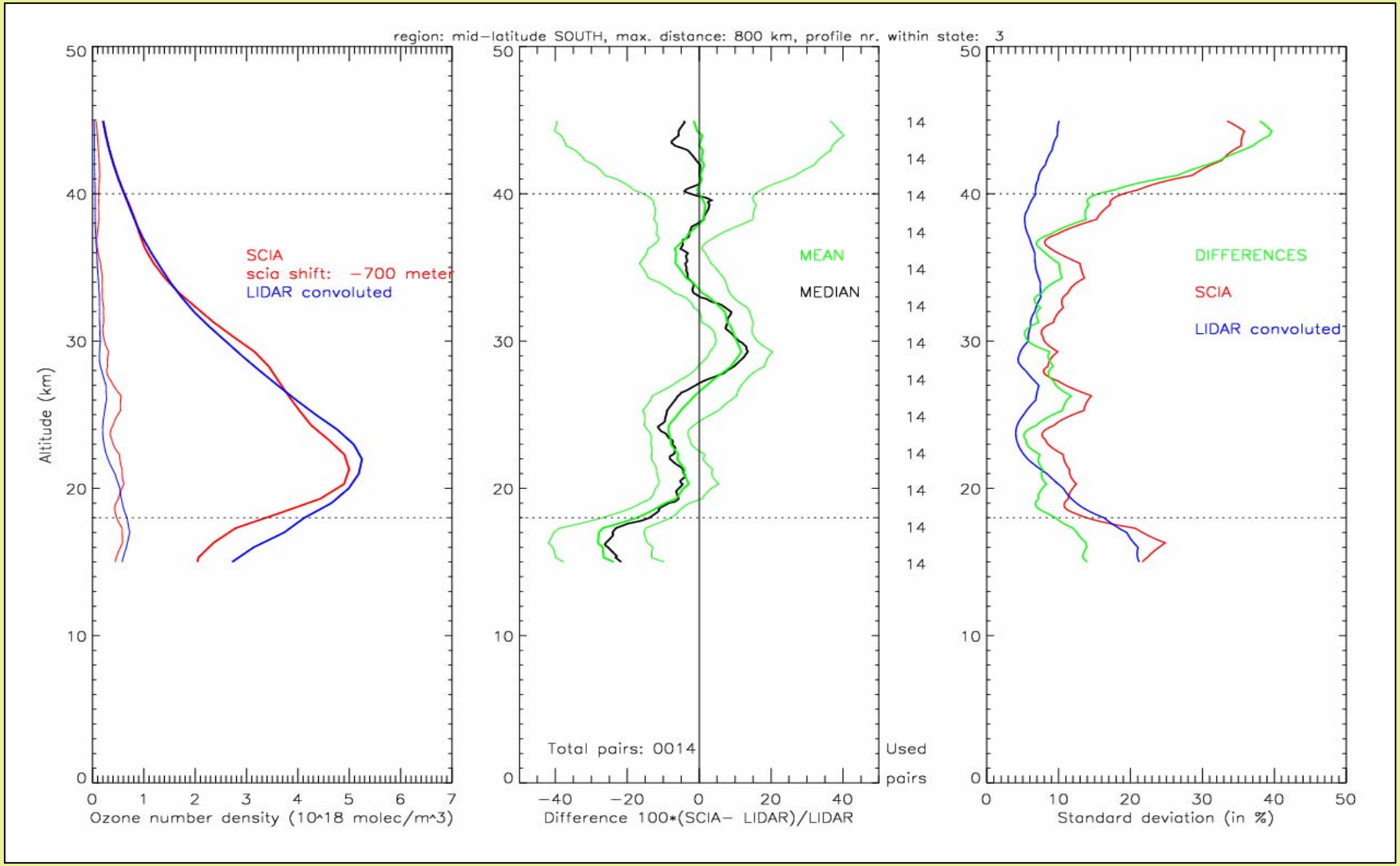
IFE v1.62 P3 – mid-latitudes SH shift: -700 m



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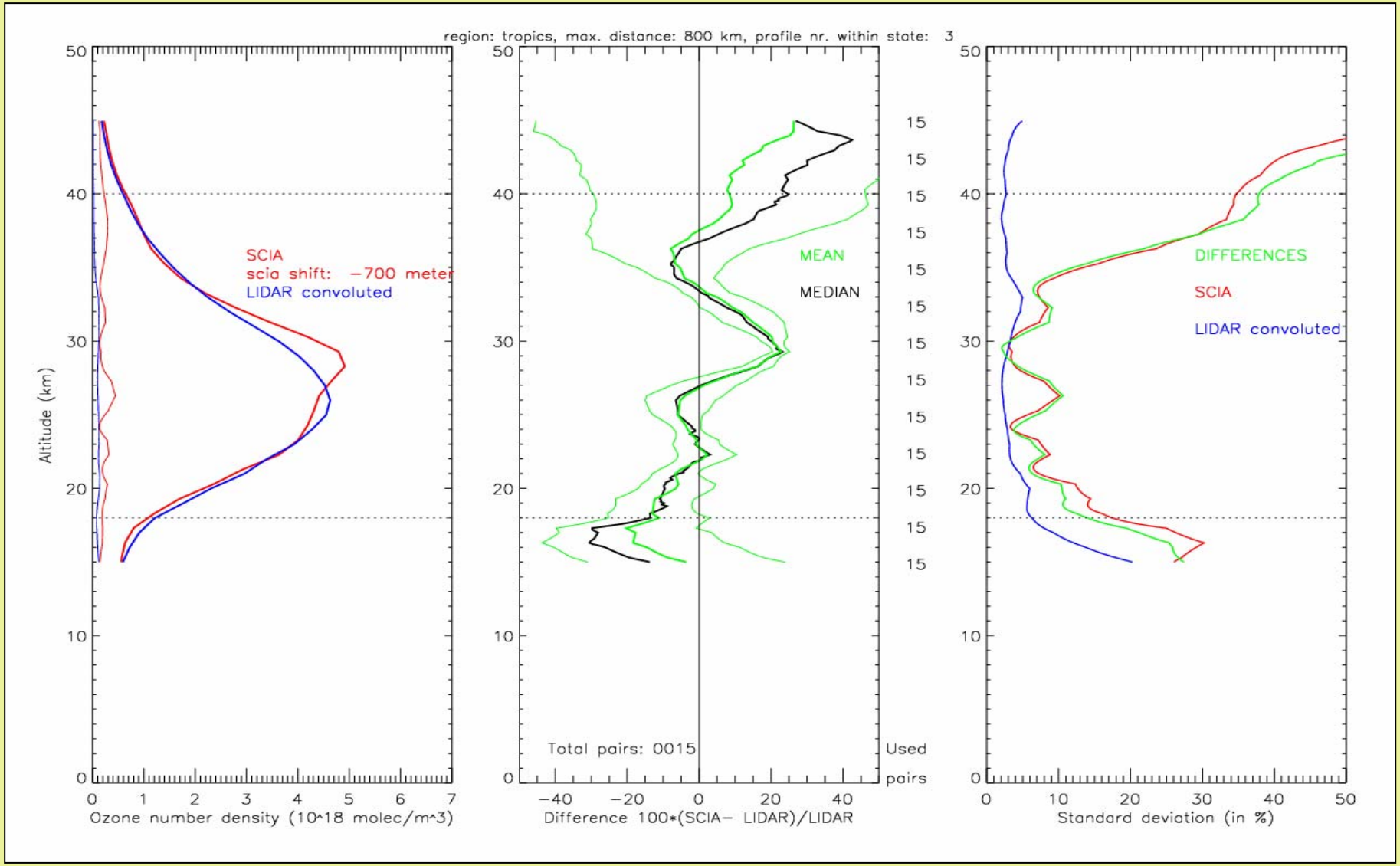
IFE v1.62 P3 – tropics shift: -700 m



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Results: IFE version 1.62

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Within range 18-40 km: -2% ± 10% compared to lidar
  - This strongly depends on the profile-nr. within state!
- Geographical location (latitude)
  - *Best results for mid-latitudes NH*
  - *No collocations for polar regions*
- **Solar Zenith Angle**

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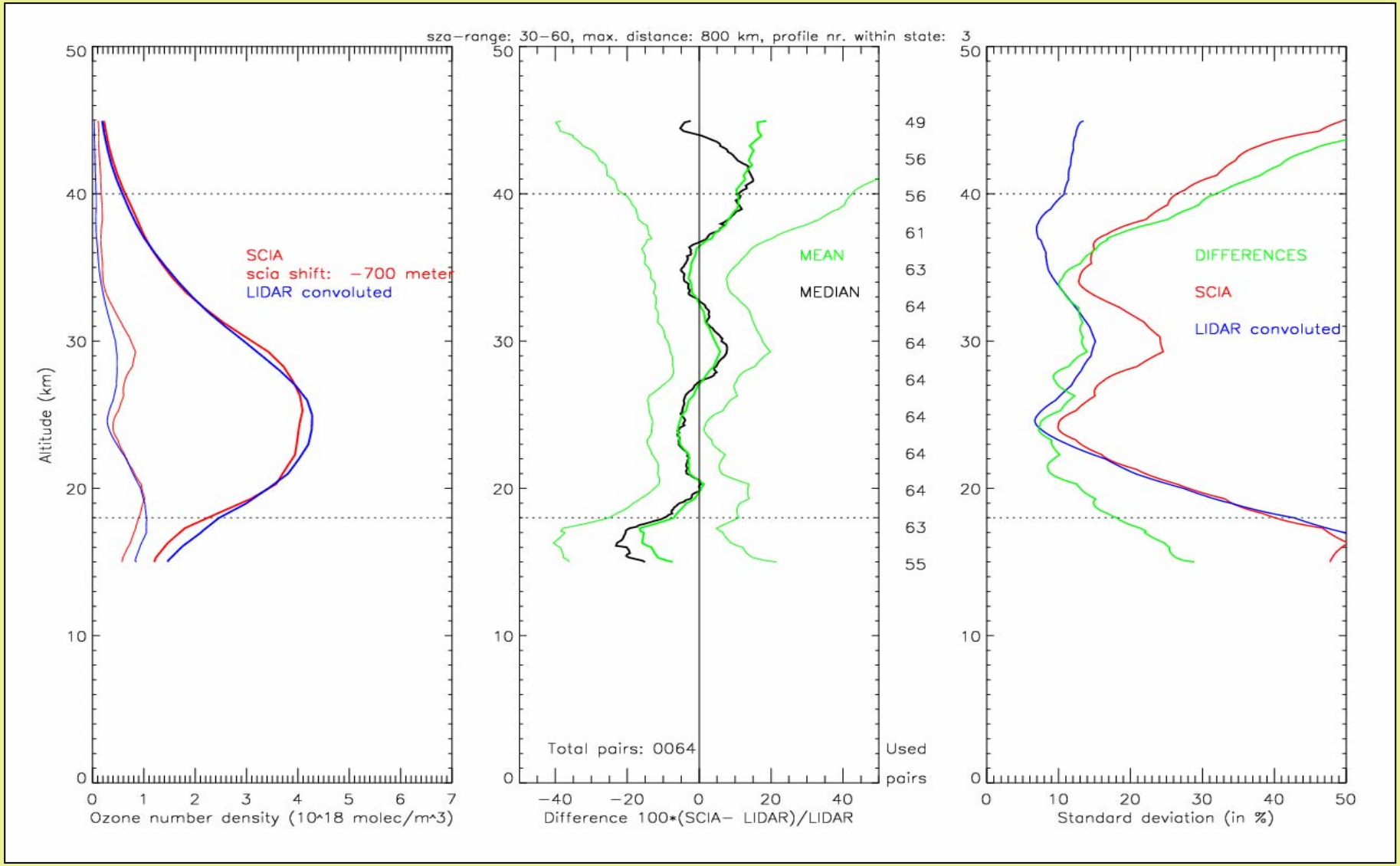
IFE v1.62 P3 – SZA: 30-60 shift: -700 m



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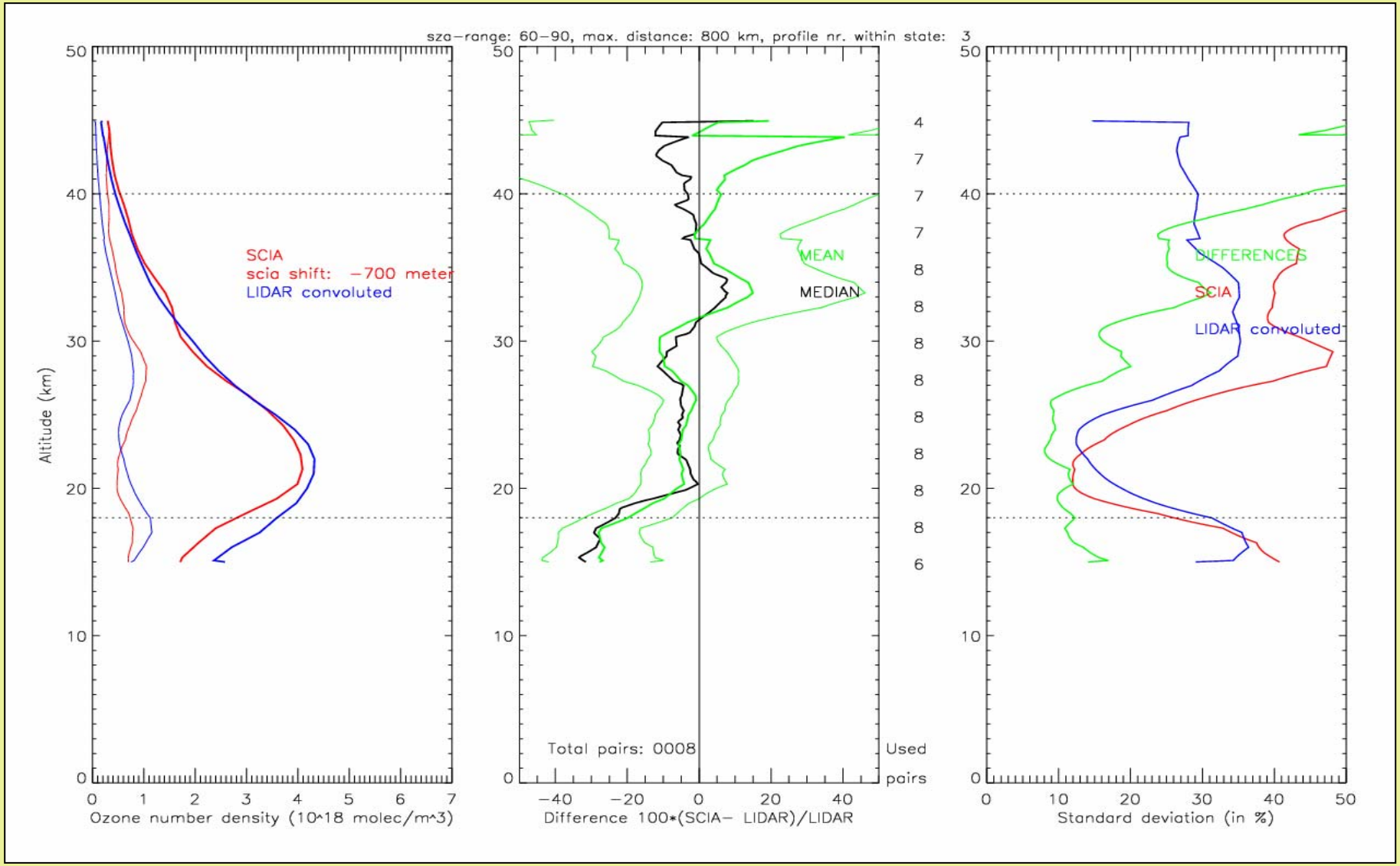
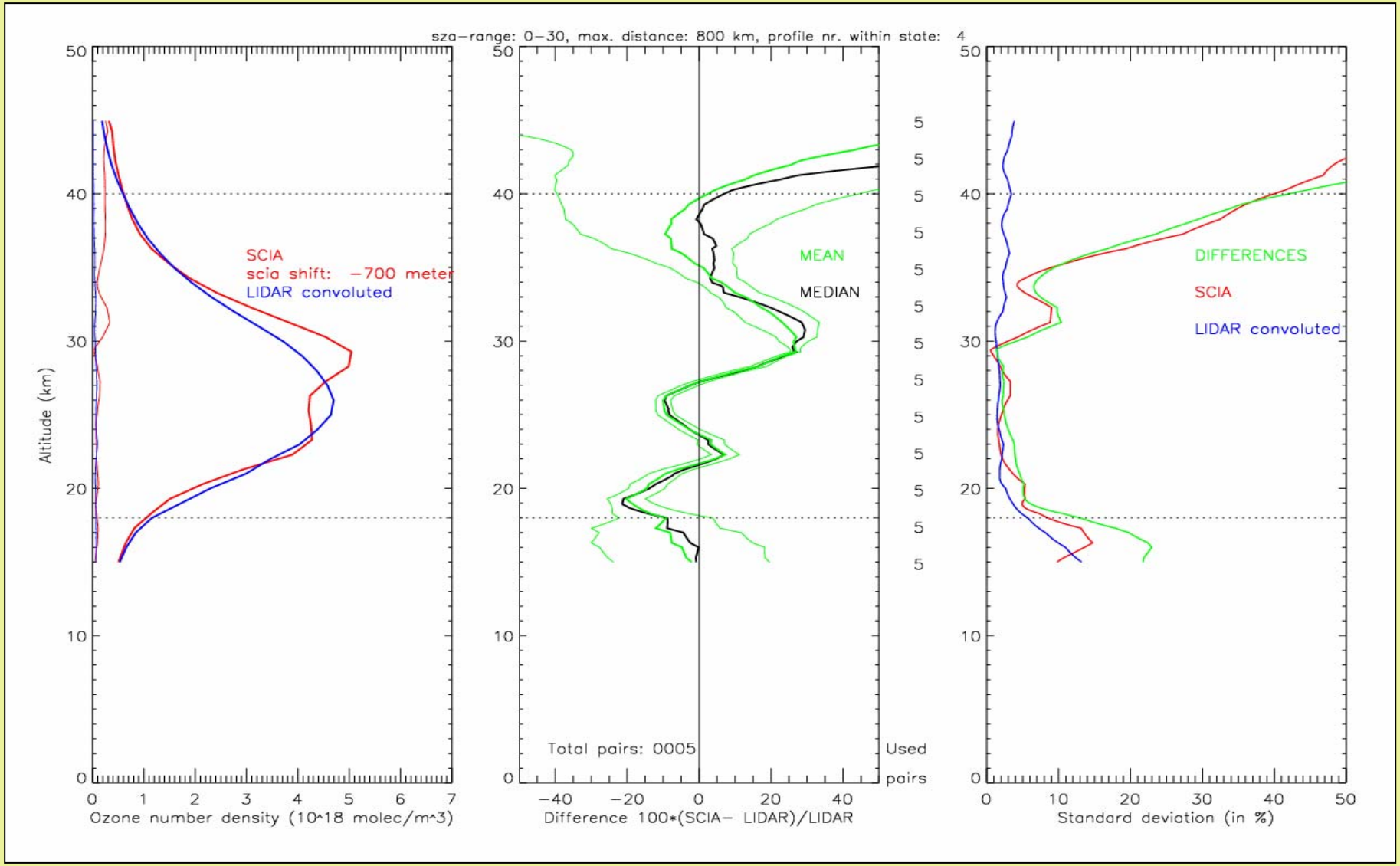
IFE v1.62 P3 – SZA: 60-90 shift: -700 m



only 8 collocations

IFE v1.62 P4 – SZA: 0-30 shift: -700 m



only P4, only 5 collocations

Results: IFE version 1.62

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Within range 18-40 km: -2% ± 10% compared to lidar
  - This strongly depends on the profile-nr. within state!
- Geographical location (latitude)
  - *Best results for mid-latitudes NH*
  - *No collocations for polar regions*
- Solar Zenith Angle
  - *Slightly better results for SZA-range: 30-60, but need for more data*
- **Solar Azimuth Angle**

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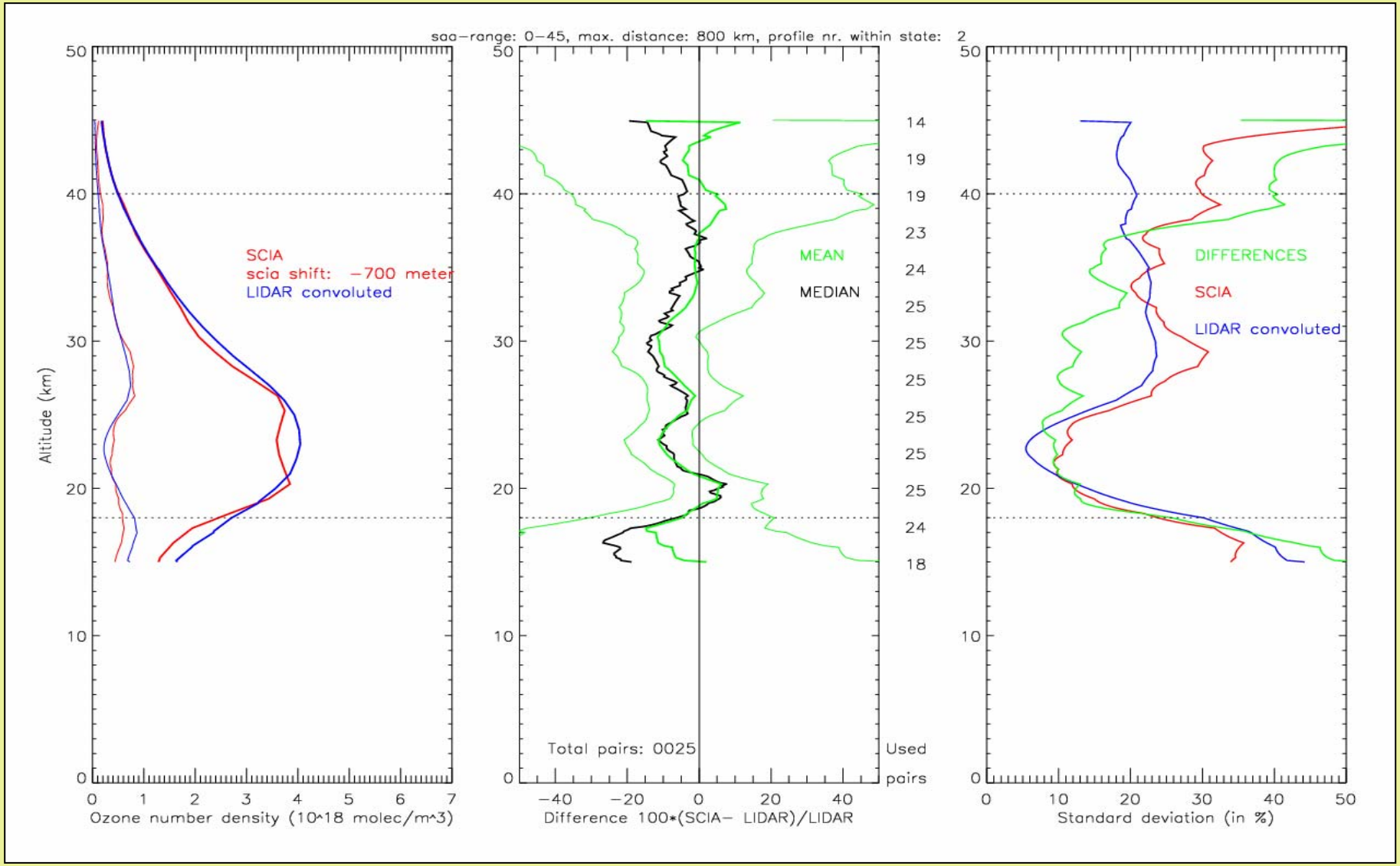
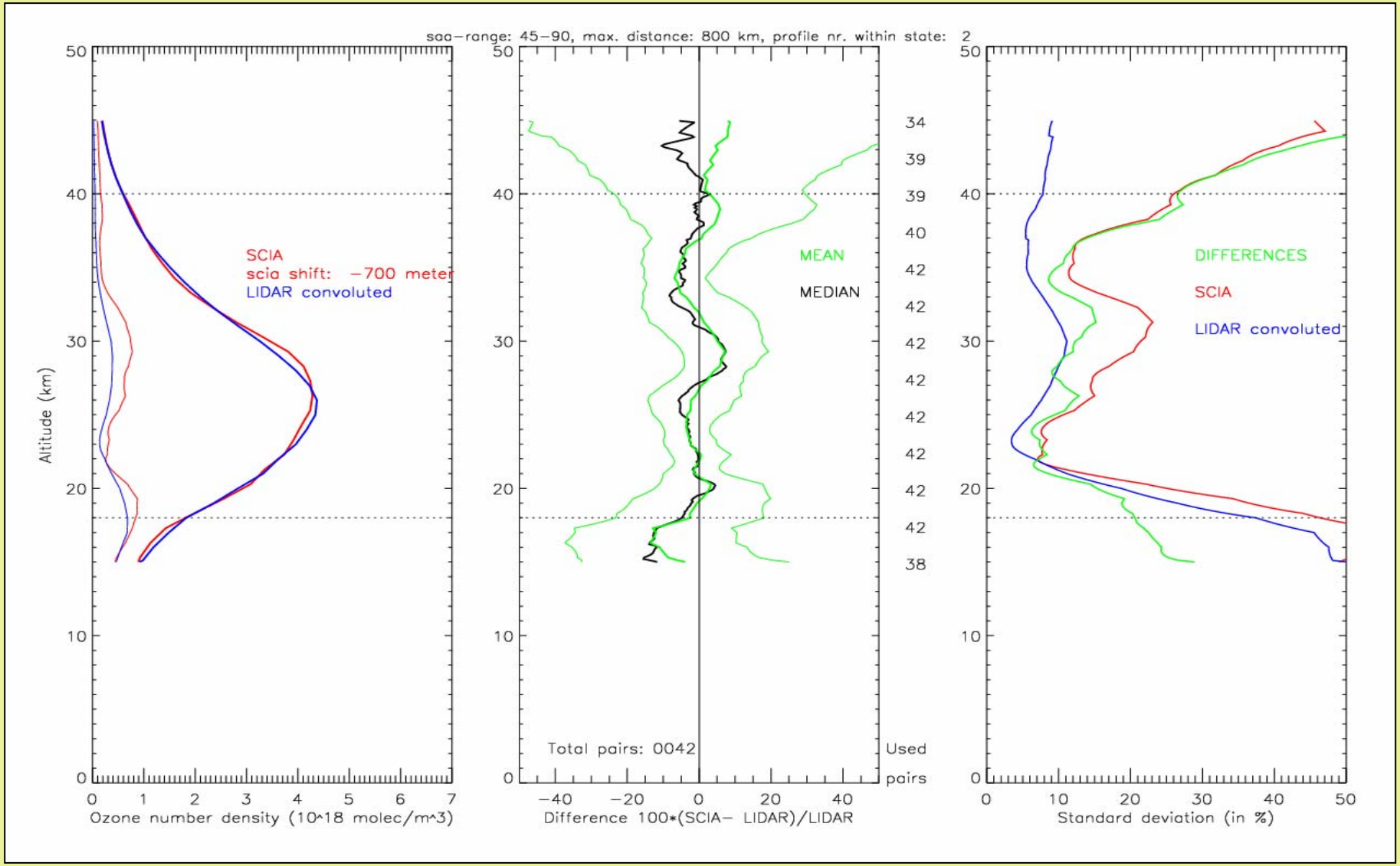
IFE v1.62 P2 – SAA: 0-45 shift: -700 m



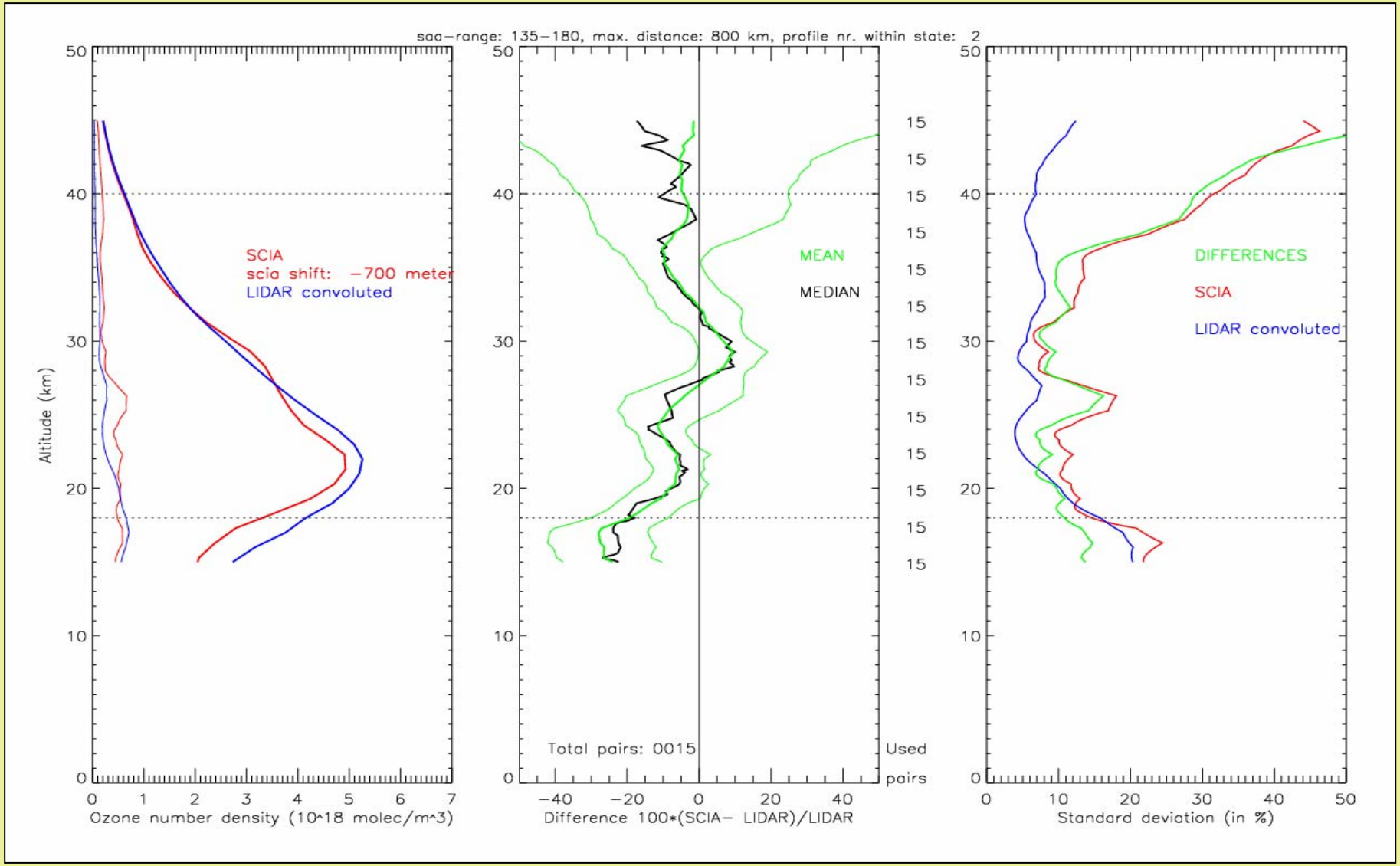
Different results for P1, only 11 collocations

IFE v1.62 P2 – SAA: 45-90 shift: -700 m



Different results for P3 and P4, 21 and 13 collocations resp.

IFE v1.62 P2 – SAA: 135-180 shift: -700 m



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Results: IFE version 1.62

- Profile-nr. within state
  - *Altitude shift varies with profile-nr.*
- Within range 18-40 km: -2% ± 10% compared to lidar
  - This strongly depends on the profile-nr. within state!
- Geographical location (latitude)
  - *Best results for mid-latitudes NH*
  - *No collocations for polar regions*
- Solar Zenith Angle
  - *Slightly better results for SZA-range: 30-60, but need for more data*
- Solar Azimuth Angle
  - *Slightly better results for SAA-range: 45-90, but need for more data*
  - *No collocations for SAA-range: 90-135*

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Overall conclusions

- General:
  - ESA v2.5: compares well to within 10% in range: 25-40 km
  - IFE v1.62: within range 18-40 km: -2% ± 10% compared to lidar
- Altitude shift varies with profile-nr!
- Geographical location: best results for mid-latitudes NH
- SZA
  - ESA v2.5: slightly better results for SZA-range: 60-90
  - IFE v1.62: slightly better results for SZA-range: 30-60, but need for more data
- SAA
  - ESA v2.5: best results for SAA-range: 0-45 and 135-180
  - IFE v1.62: slightly better results for SAA-range: 45-90, but need for more data

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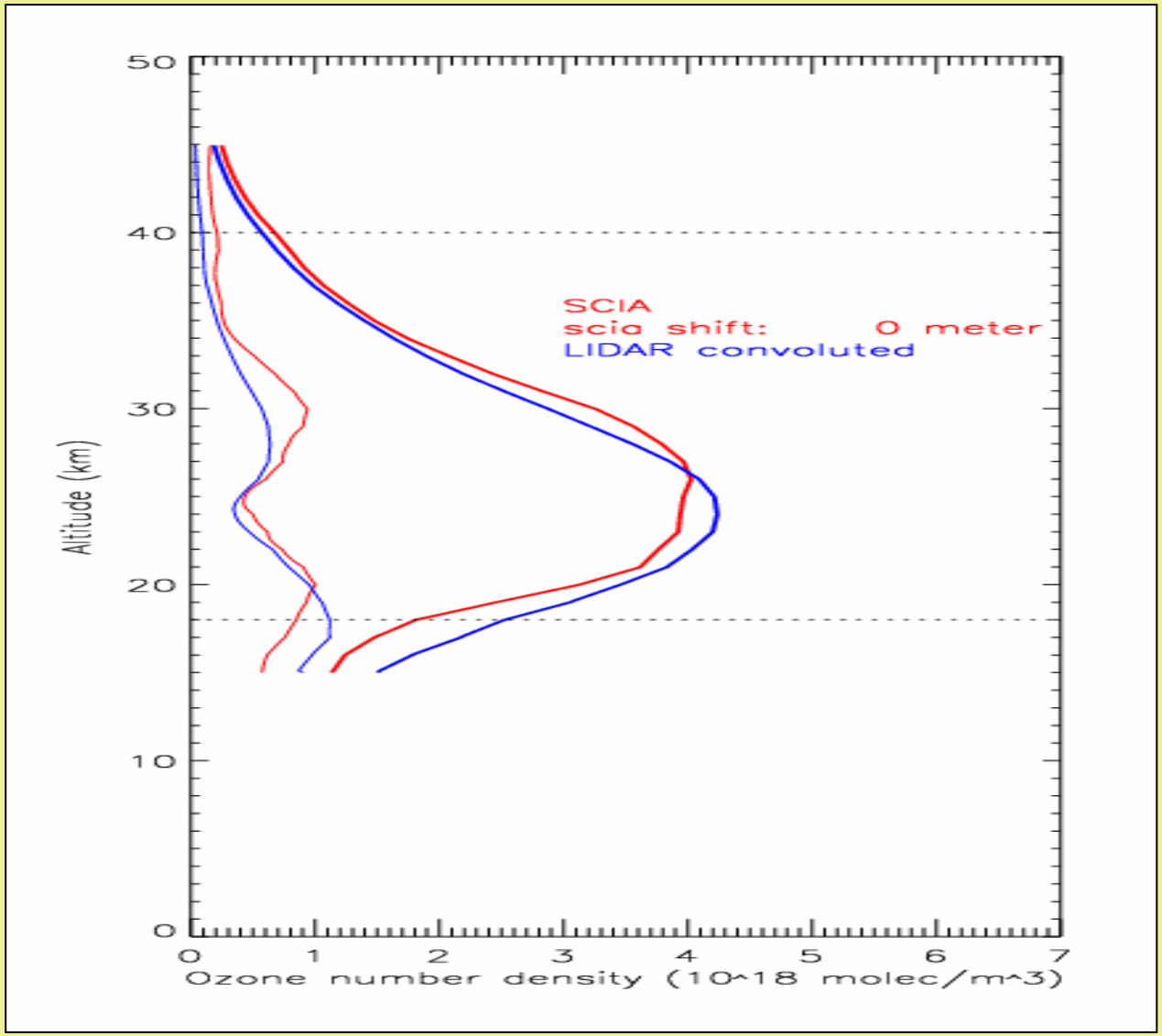
IFE version 1.62



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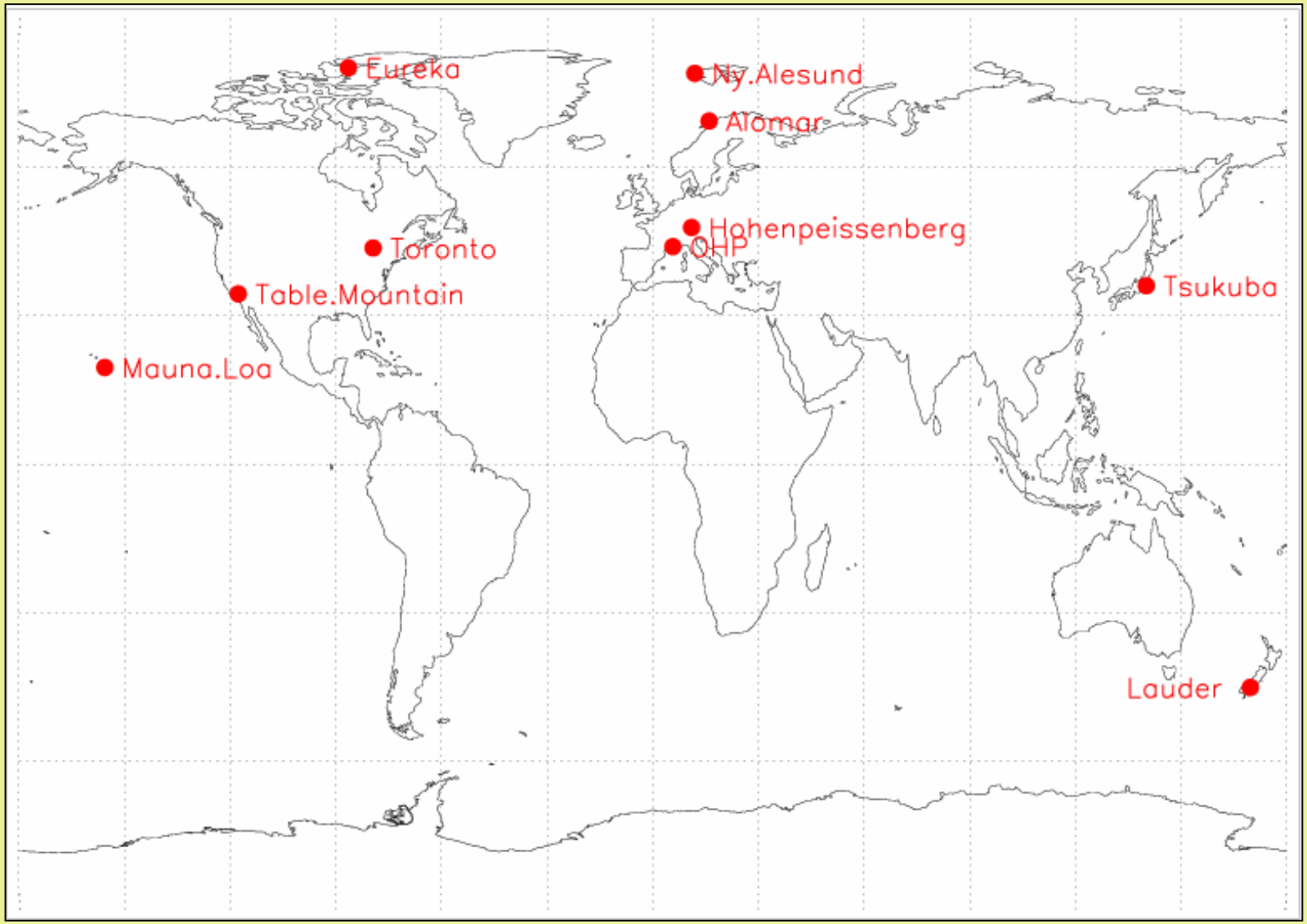
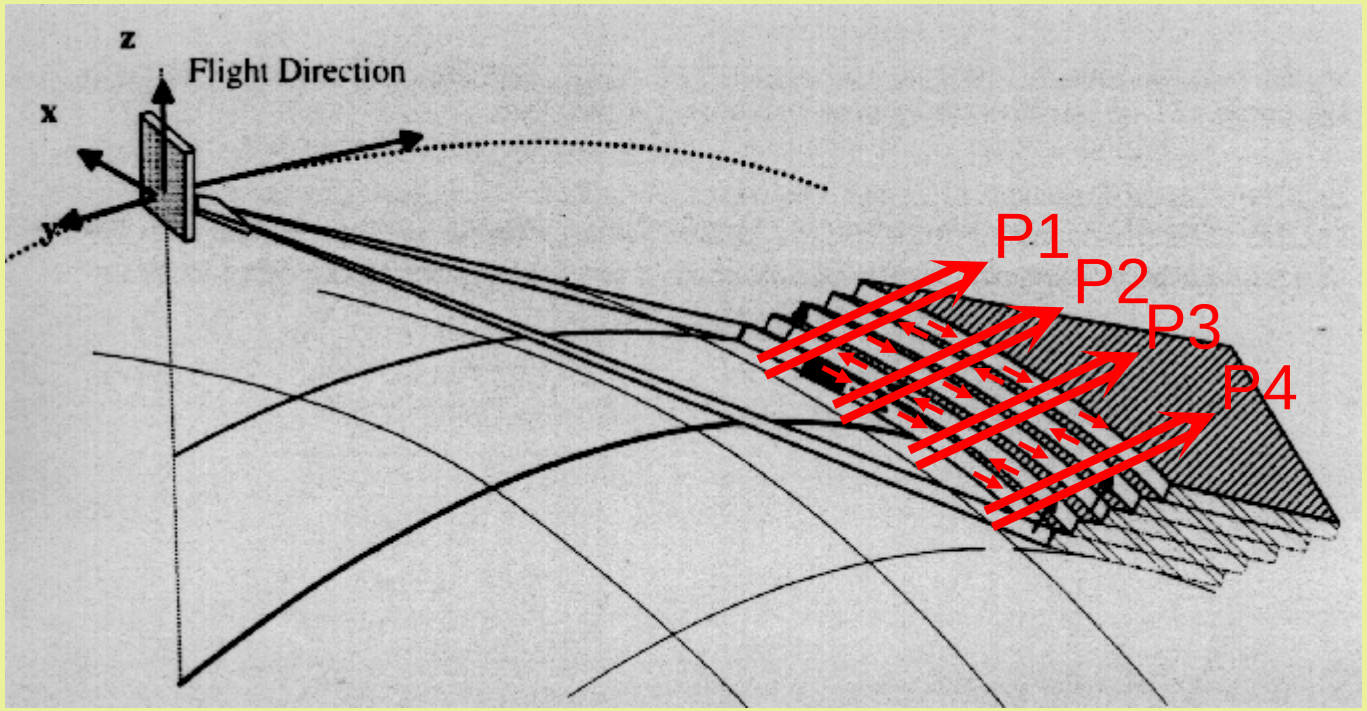
Lidar stations



Acknowledgement: All contributing stations are thanked for their data.

SCIAMACHY limb measurement
Four profiles in one state



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