Symposium

Uncertainty of ozone retrieval

The European Metrology Research Programme (EMRP) is jointly funded by the EMRP participating countries within EURAMET and the European Union.

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Symposium Introduction

In **metrology** uncertainties are generally generated by uncertainty of **physical measurements** depending on the instrument:

- mechanics of the instrument
- electronics of the instrument
- design of the instrument
- sensitivity of the detectors
- stability of the instrument
- temperature (Humidity) dependence of the instrument
- calibration of the instrument

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Symposium Introduction

E.g. Measurement of global **UV Radiation** (Array Spectroradiometer):

- linearity of the detector (correction)
- wavelength scale calibration
- uncertainty of calibration lamp (ageing, distance etc.)
- effect of different integration time
- dark signal handling
- cosine response
- spectral resolution (sampling depending on slit function)
- sensitivity of the detector (NEI=Noise Equivalent Irradiance)

- stray light (correction) -> uncertainty of stray light matrix generation and correction algorithm.

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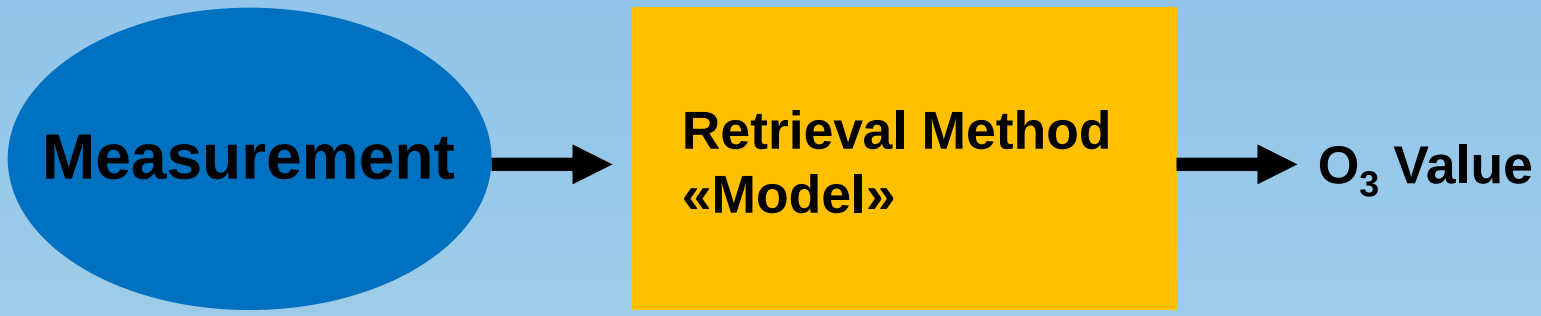
Ozone Retrieval



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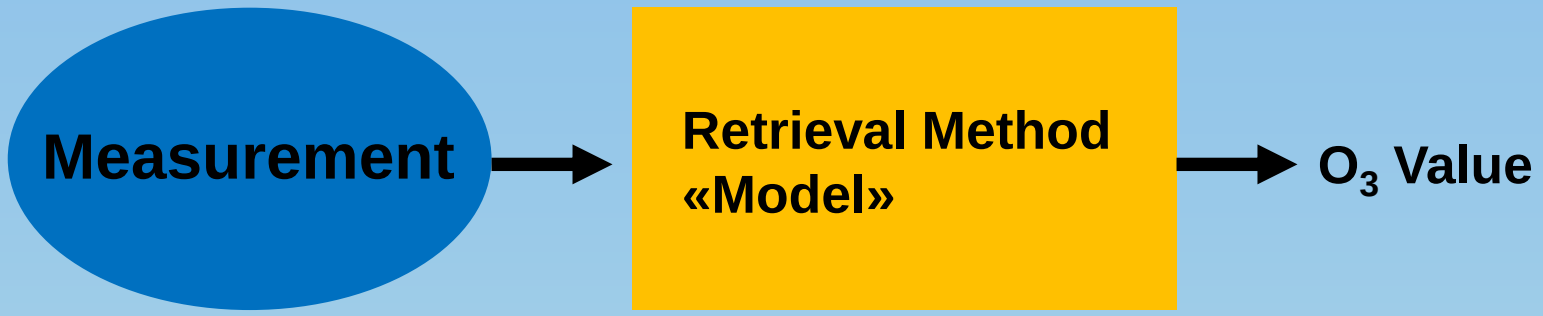

Uncertainty of **measurement**: + Uncertainty of **model**: = Uncertainty of **O_3 value**

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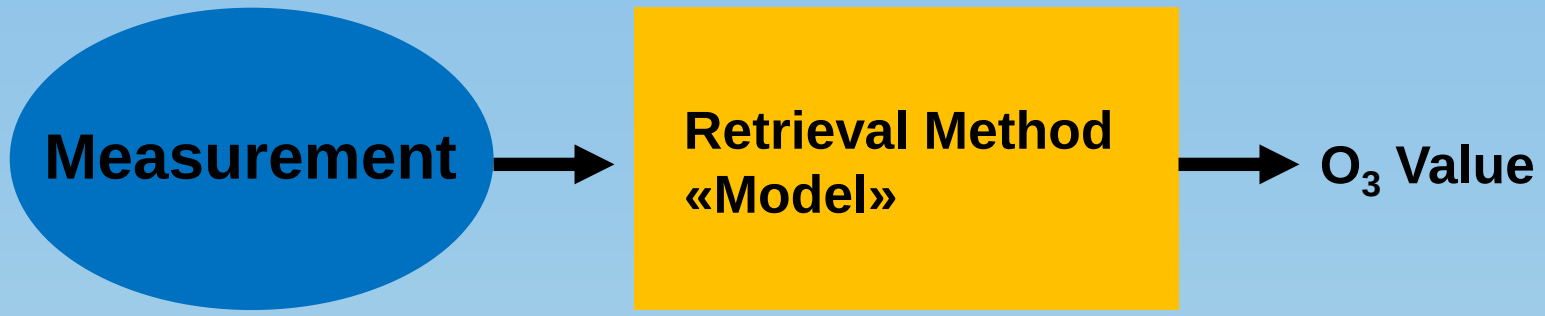

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Metrology (Physics)

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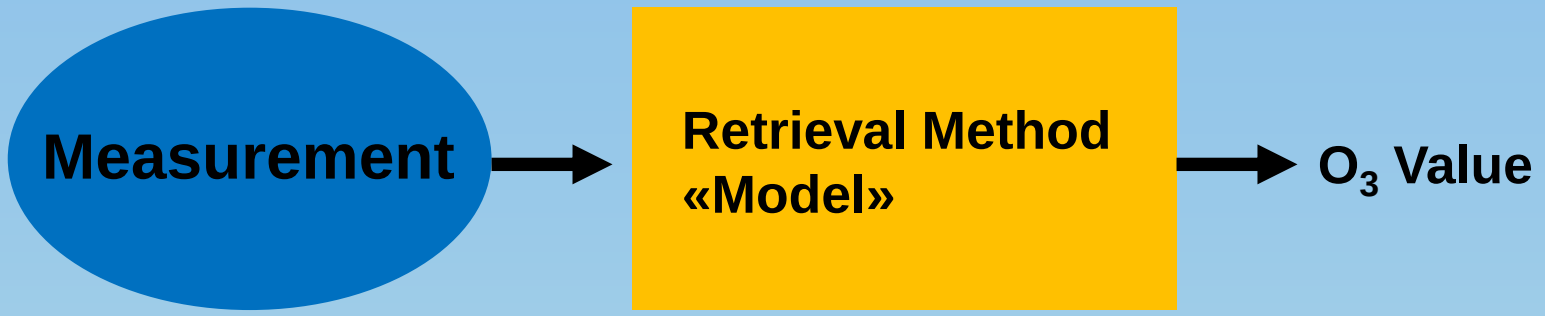

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Metrology (Physics)

Physics: Beer-Lambert law

$$I_\lambda = I_\lambda^0 e^{-\tau_\lambda m}$$

$$\log I_\lambda = \log I_\lambda^0 - \tau_\lambda^R m_R - \tau_\lambda^{O3} m_{O3} - \tau_\lambda^{SO2} m_{SO2} - \tau_\lambda^{aod} m_{aod}$$

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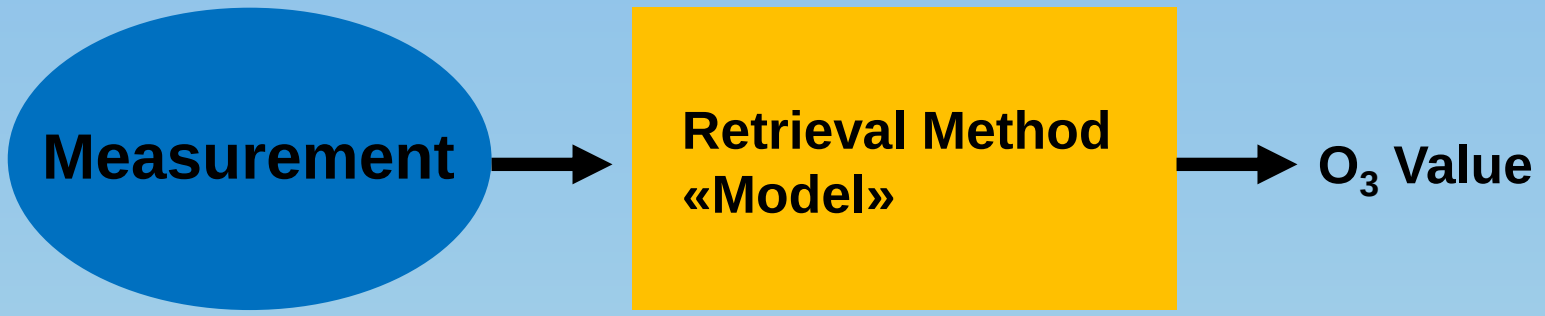

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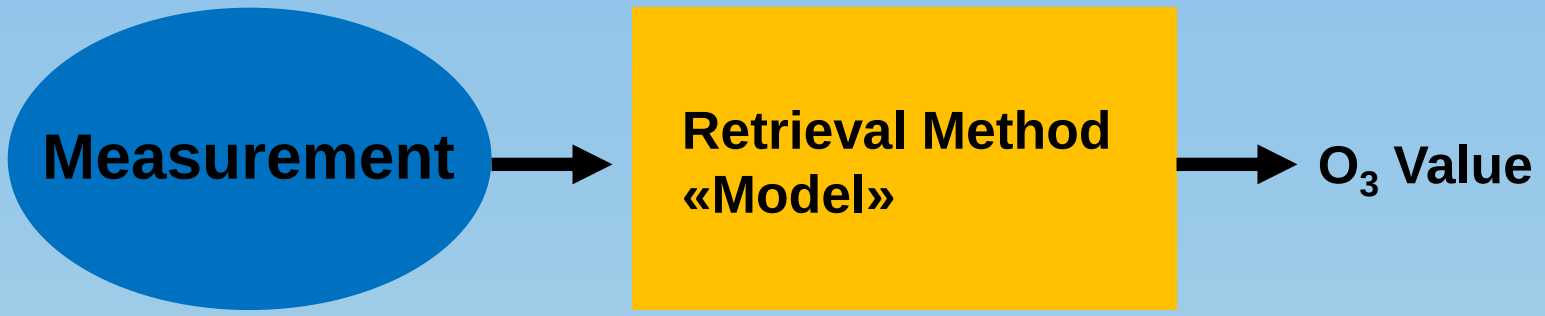

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Physics: Beer-Lambert law

- selected wavelength
- selected cross-section
- selected atmospheric temperature
- selected atmospheric layers
- aerosol estimation
- trace gas estimation
- post processing of data for the model
- computational uncertainty (used functions)
- Extraterrestrial spectrum

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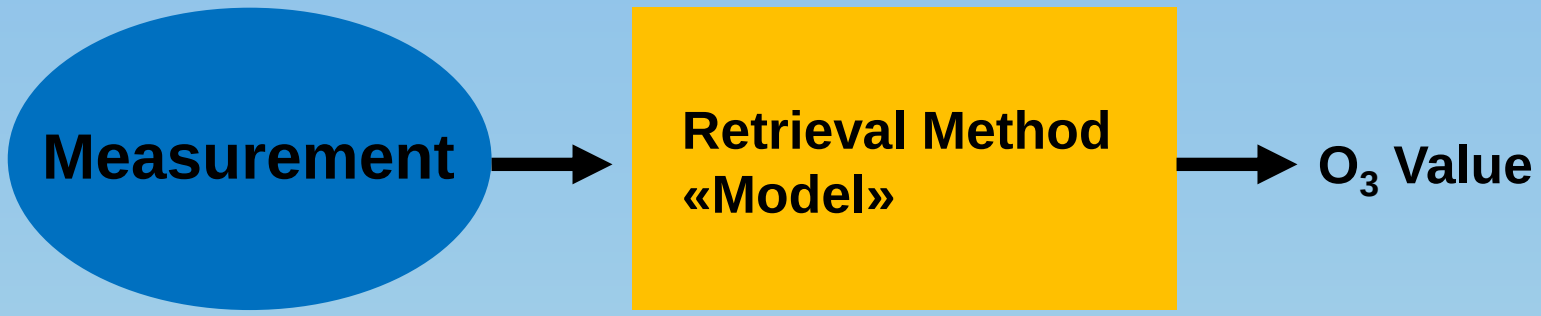

Uncertainty of **model**: = Uncertainty of **O_3 value**

Physics: Beer-Lambert law

- selected wavelengths → Brewer / Dobson; Full spectrum (range)
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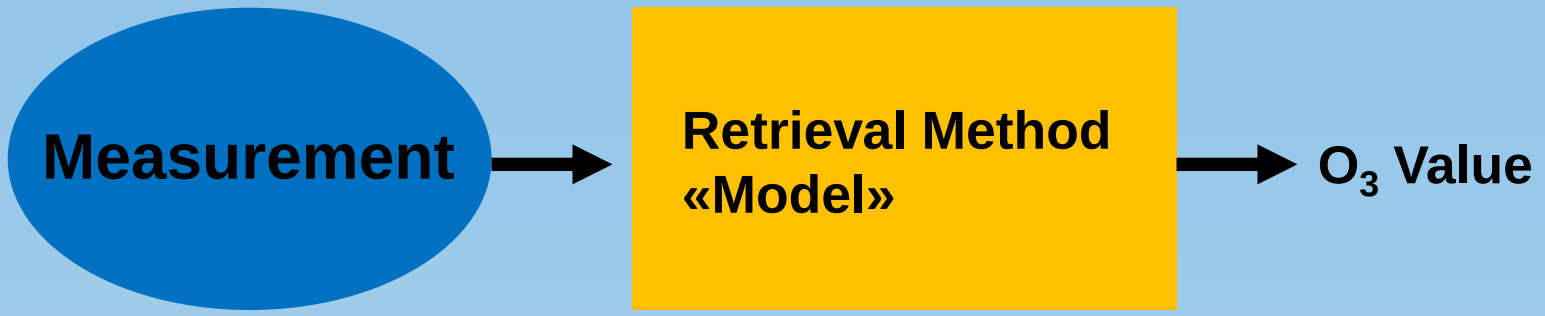

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Physics: Beer-Lambert law

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Brewer / Dobson
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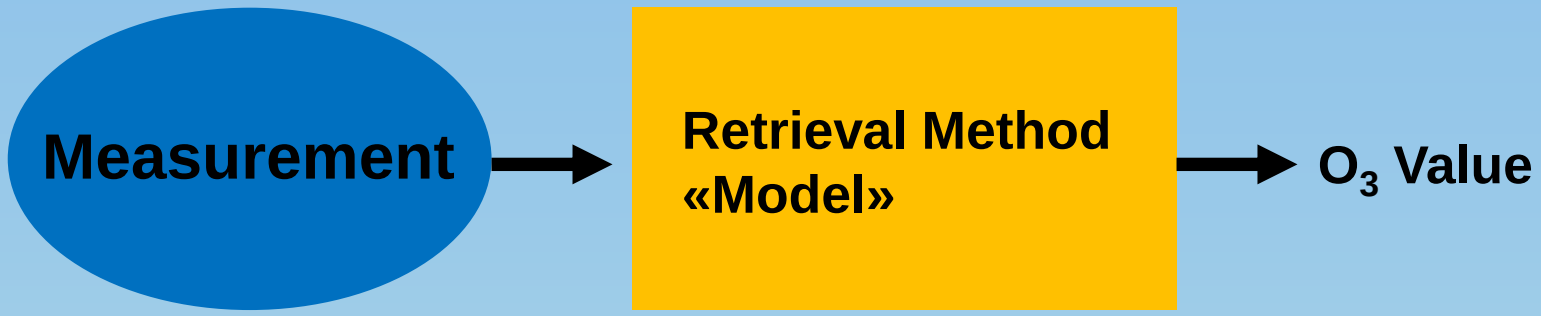

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Modelling of the atmosphere

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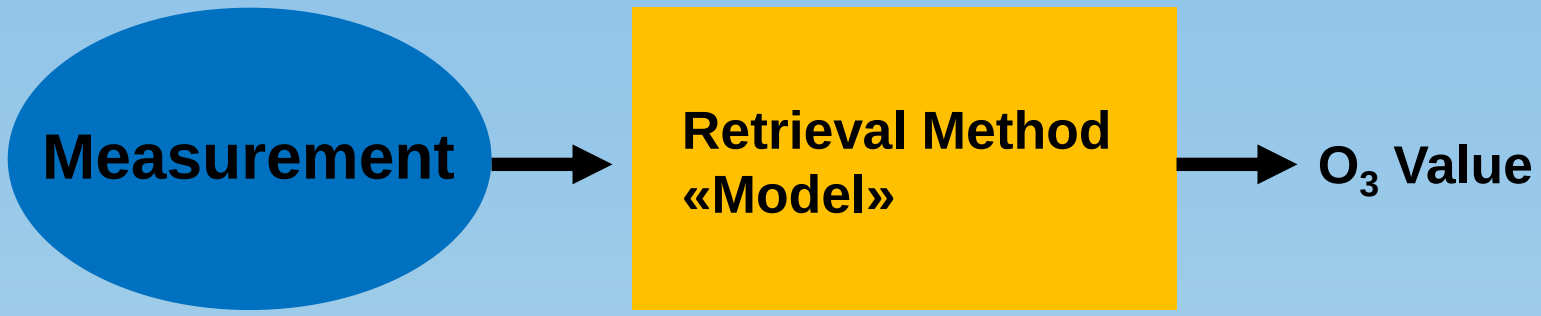

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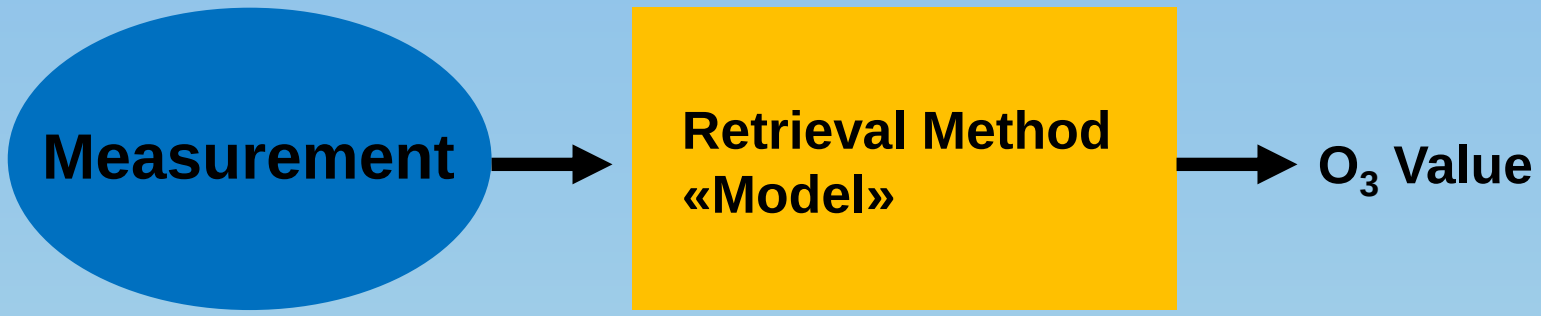

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pmod wrc

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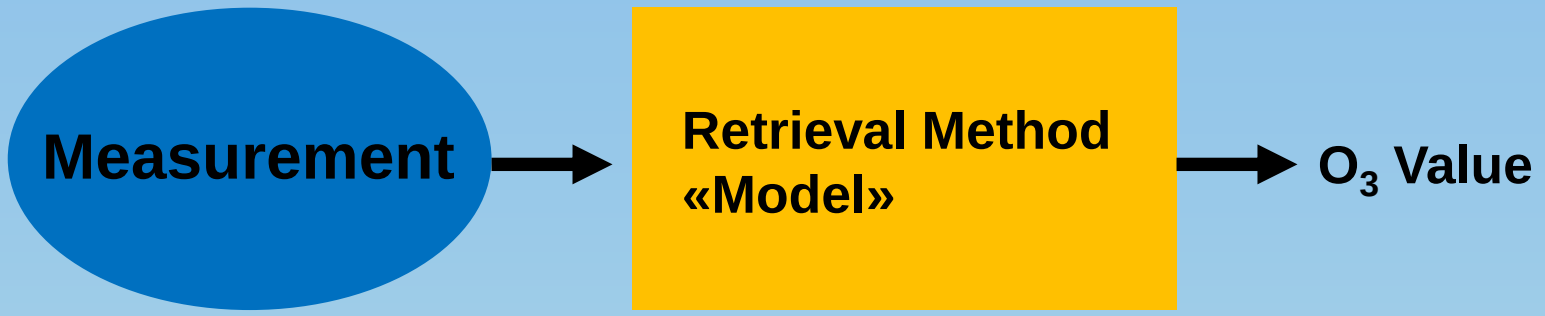

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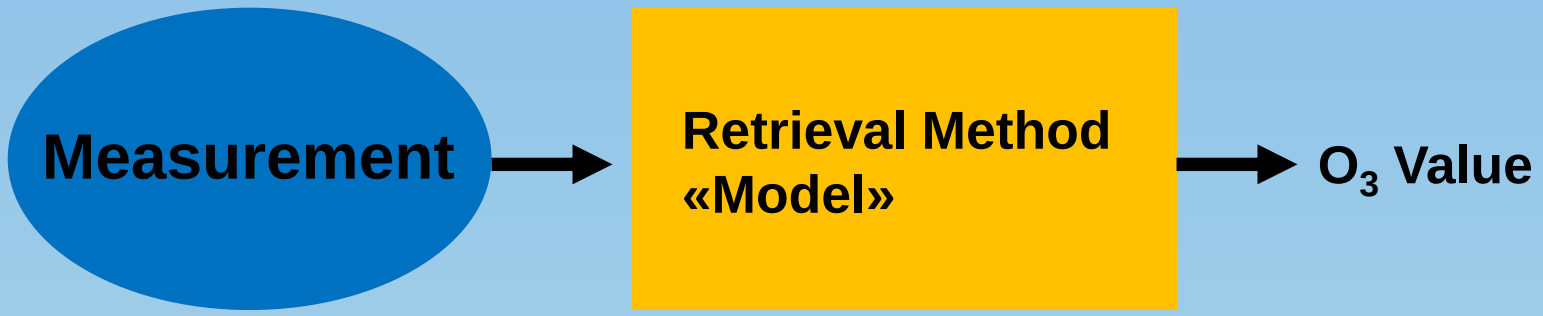

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Several available
New: in this JRP

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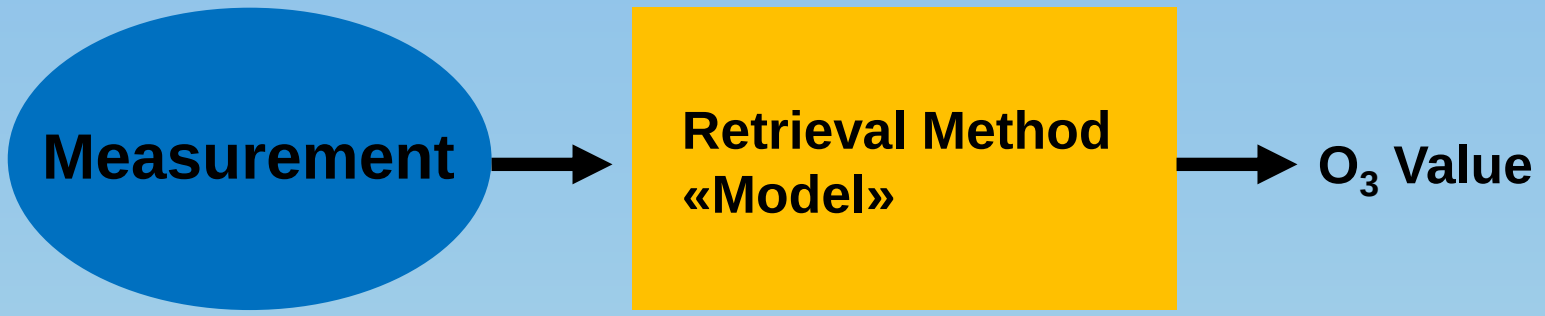

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Conclusion:

The uncertainty of O_3 depends on:

- **Instrument** (physical measurement and corresponding model)
- **Conditions** for the model (atmosphere, cross-section, ET, aerosols etc.)

Challenge / Questions:

- What conditions for the model are the **«right» assumptions**?
- What is the **overall uncertainty** using all instruments with their corresponding models with all feasablie conditions (assumptions).
- How are model uncertainty depending on measurement uncertainty?
- What does **traceability** means **when retrieval models** are included ?

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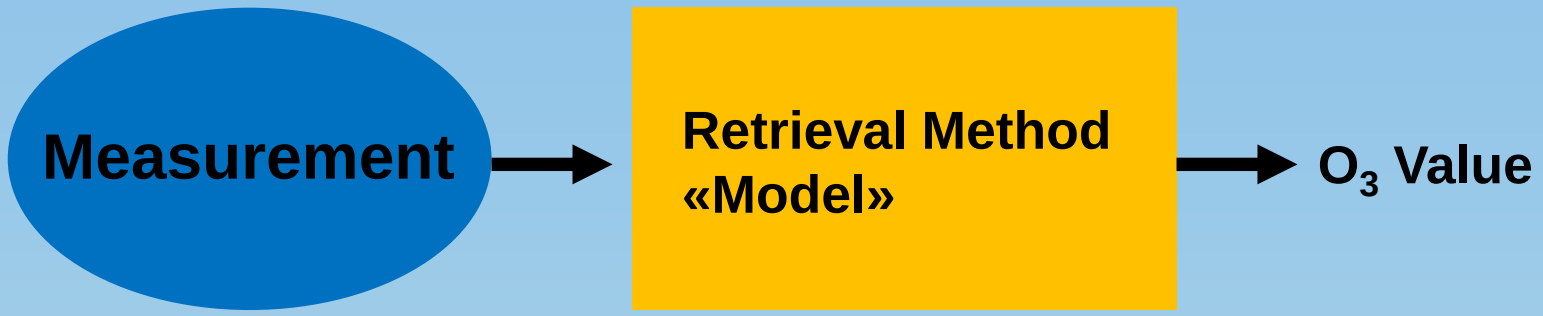
Ozone Retrieval

I am curious about the following presentations

Proposal for Uncertainty of Ozone Retrieval



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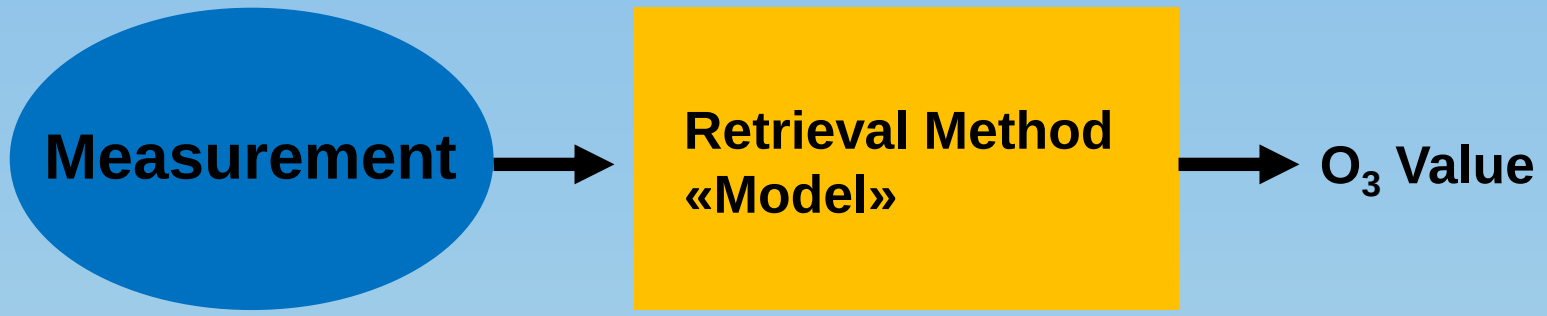
Mathematical uncertainty analysis

Proposal for Uncertainty of Ozone Retrieval



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«True» Spectra

- Measured

- Modelled (with variation of uncertainties)

→ All retrieval methods applying all Conditions

= Benchmark of uncertainty of **O_3**