SPARC Water Vapour Initiative

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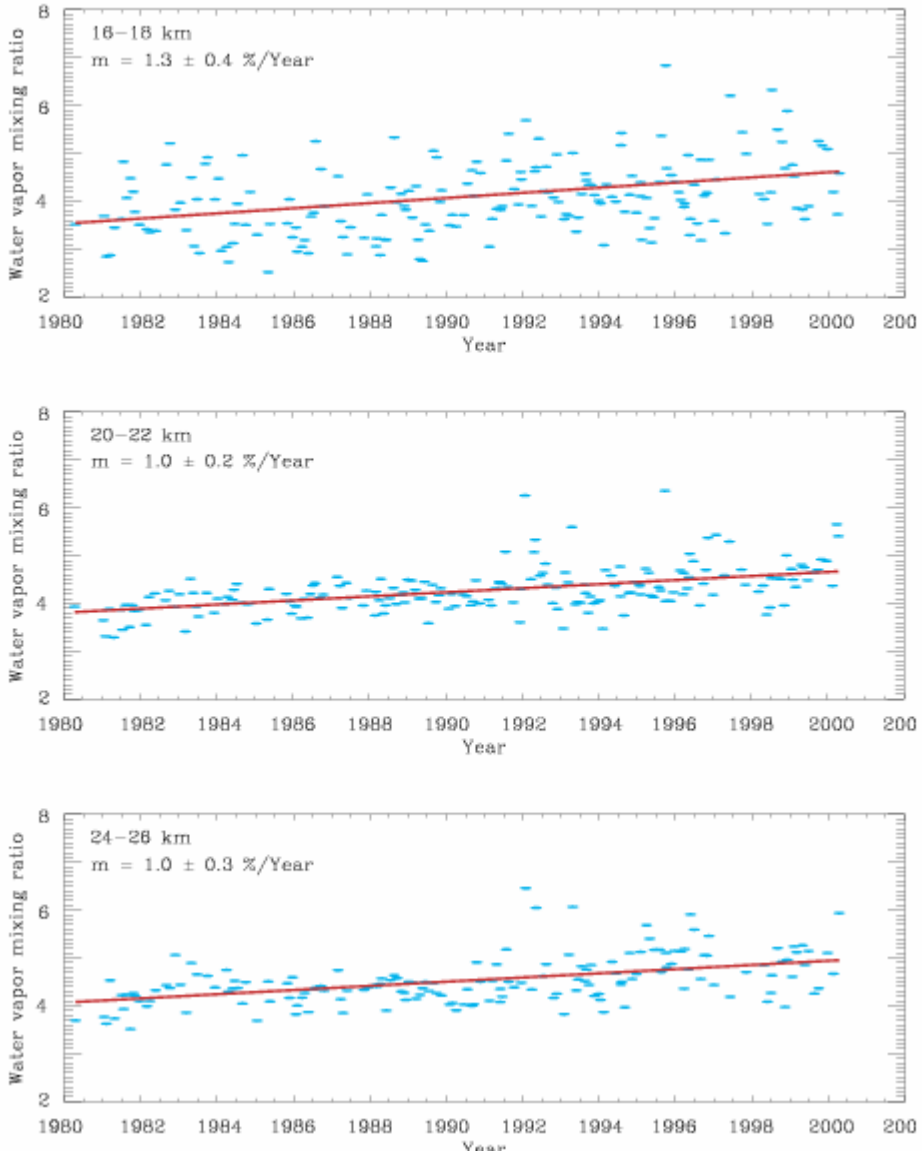
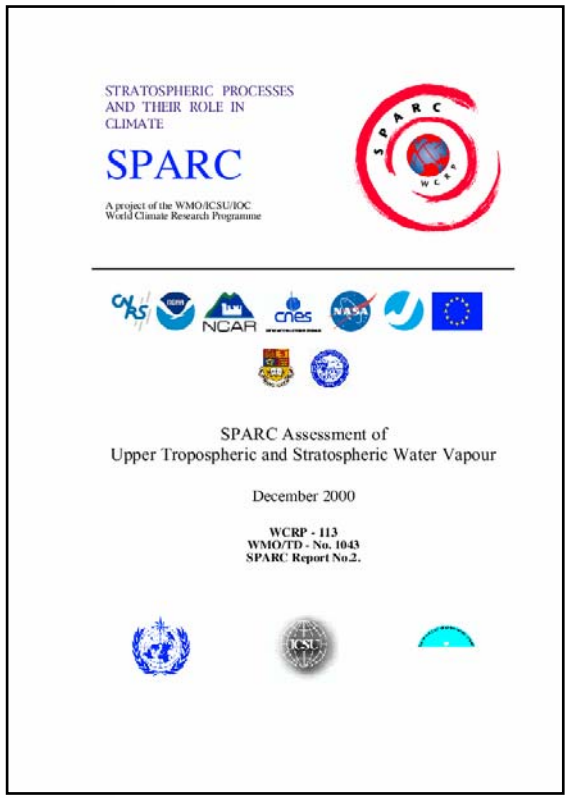
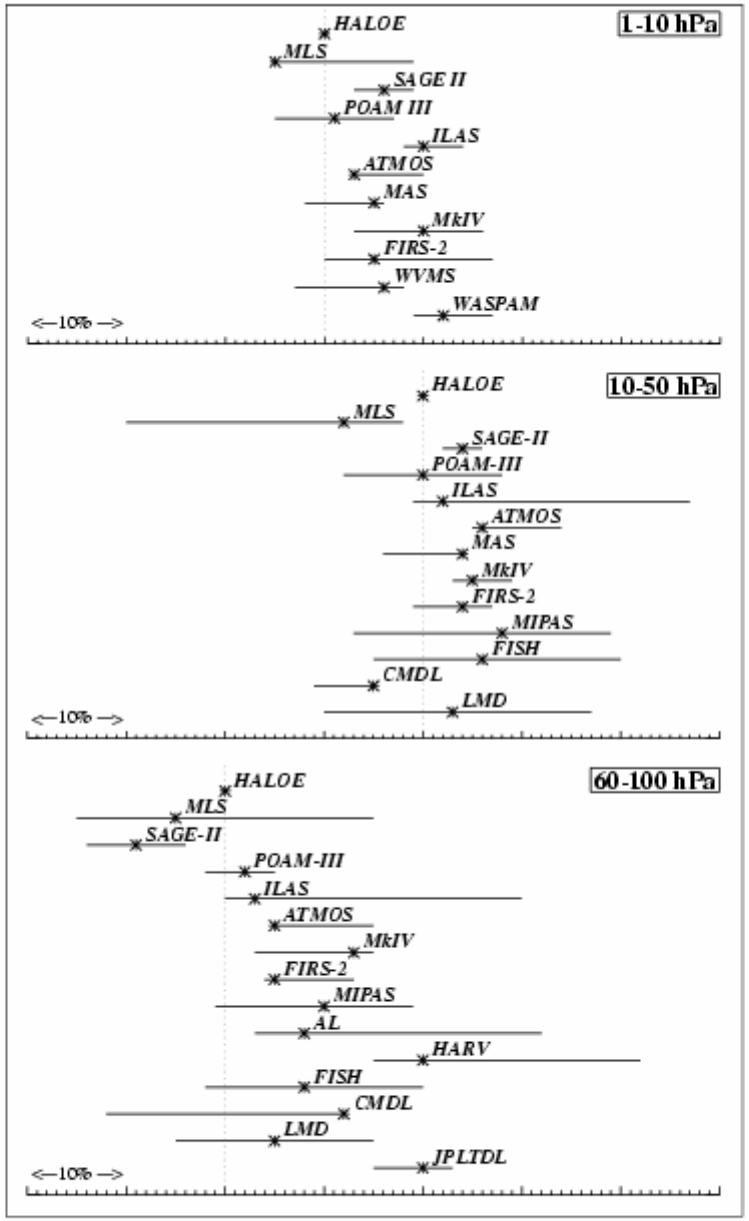
The scientific rational for WAVAS 2000

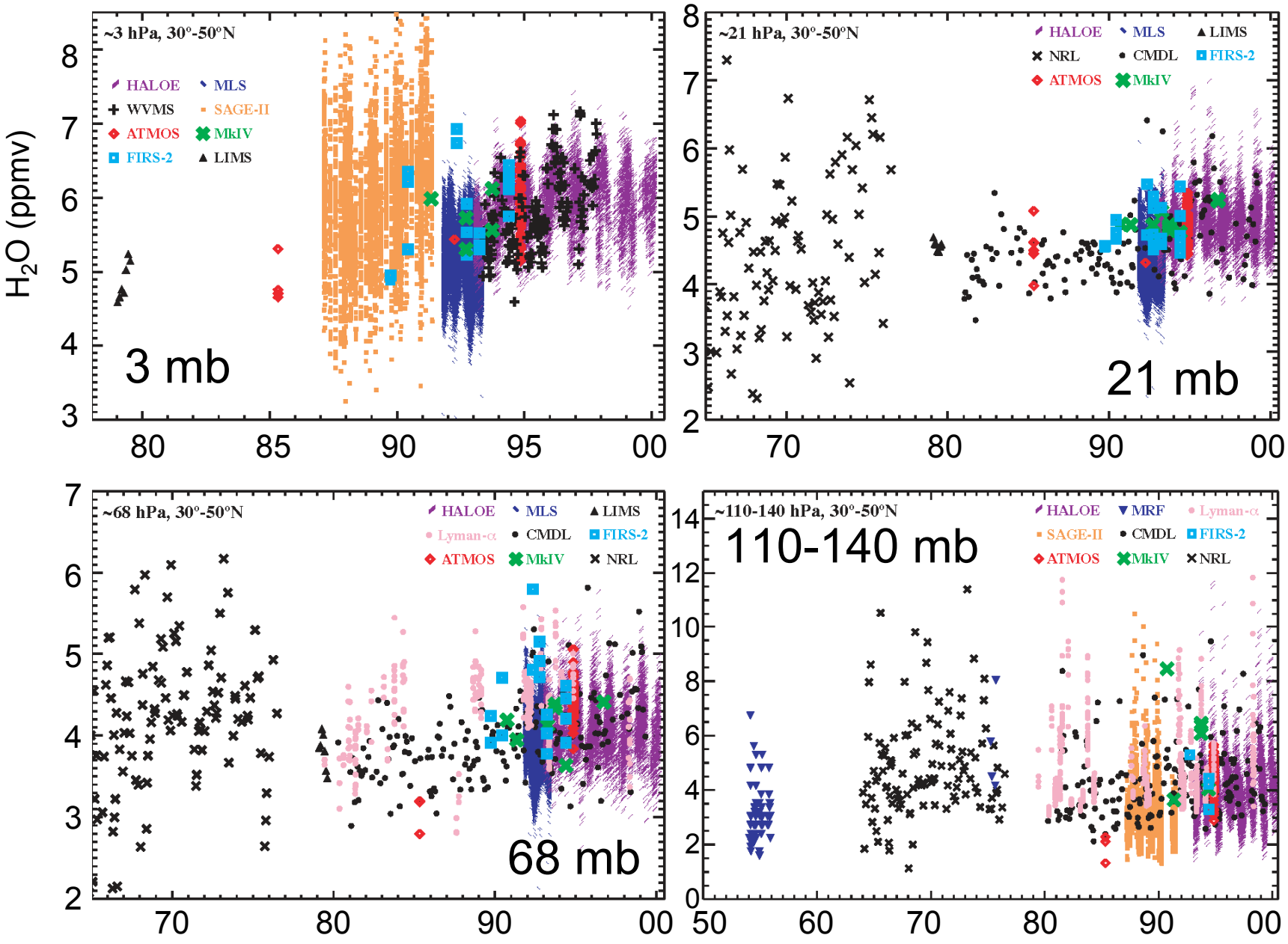


Oltmans et al., 1995 + 2001



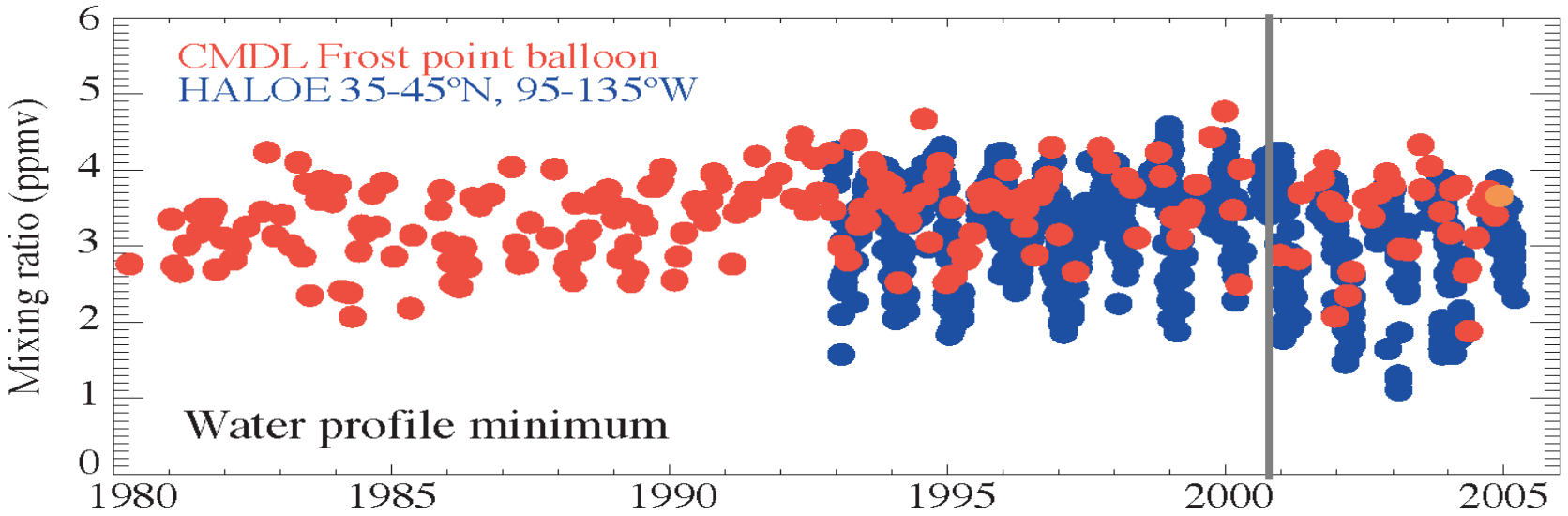


SPARC Assessment of water vapour in the UTS 2000



From SPARC H_2O assessment, 2000, 20-50°N historical measurements.

What happend after SPARC 2000?

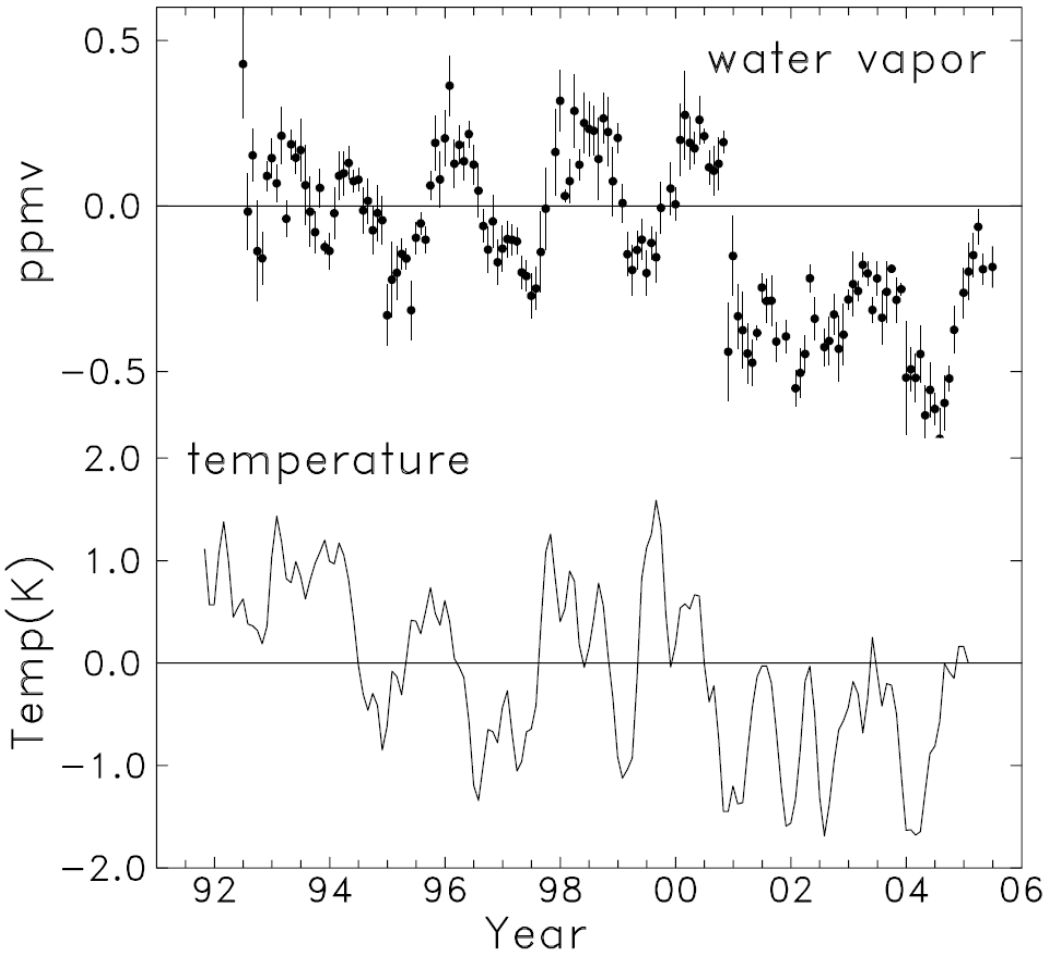


at 40ºN, evidence of a H_2O drop post-2001

both, in situ and satellite

Vömel, Rosenlof

Water vapour and tropopause temperature

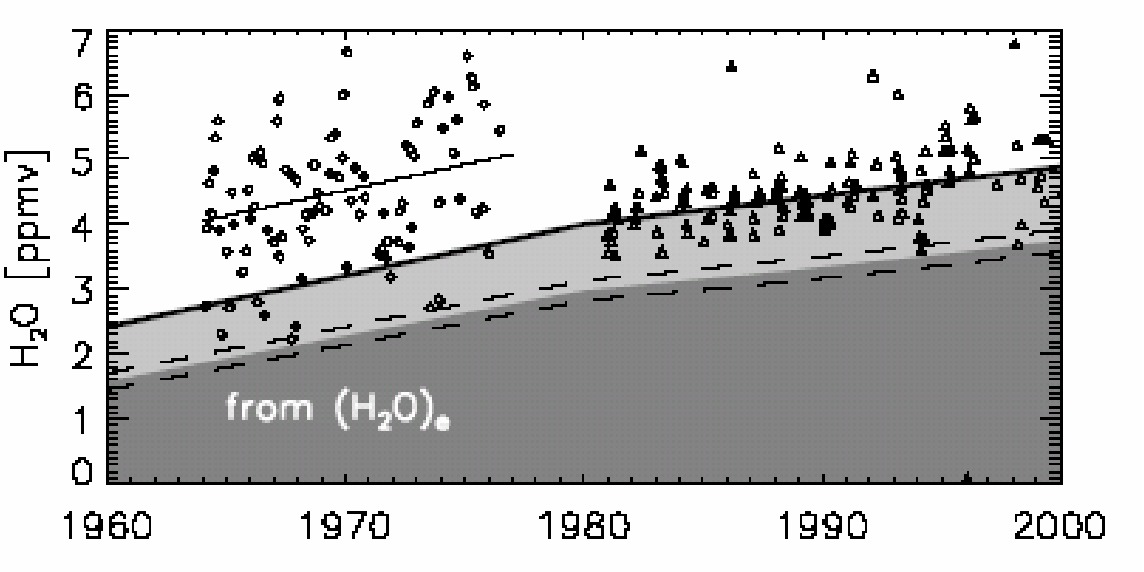


HALOE 82 hPa
60°S – 60°N

Radiosonde data
Cold point tropopause
10°S – 10°N

(Randel et al. 2006, *JGR*)

Backward extrapolation of H_2O trends

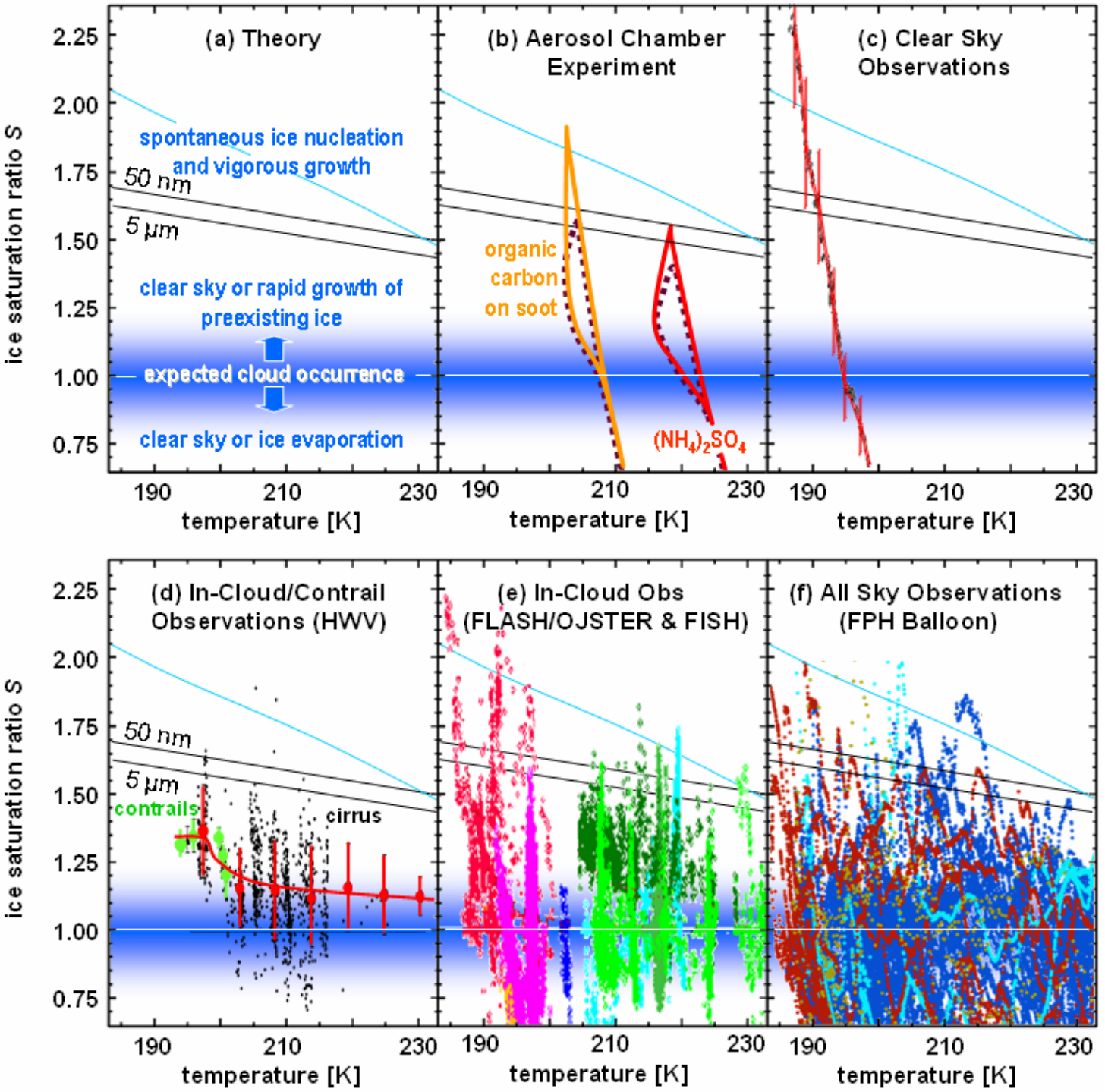


$(H_2O)_e$ of 1.5-2.5 ppmv in the 60ies implies ΔT_{ttrop} ~ 2-4 K

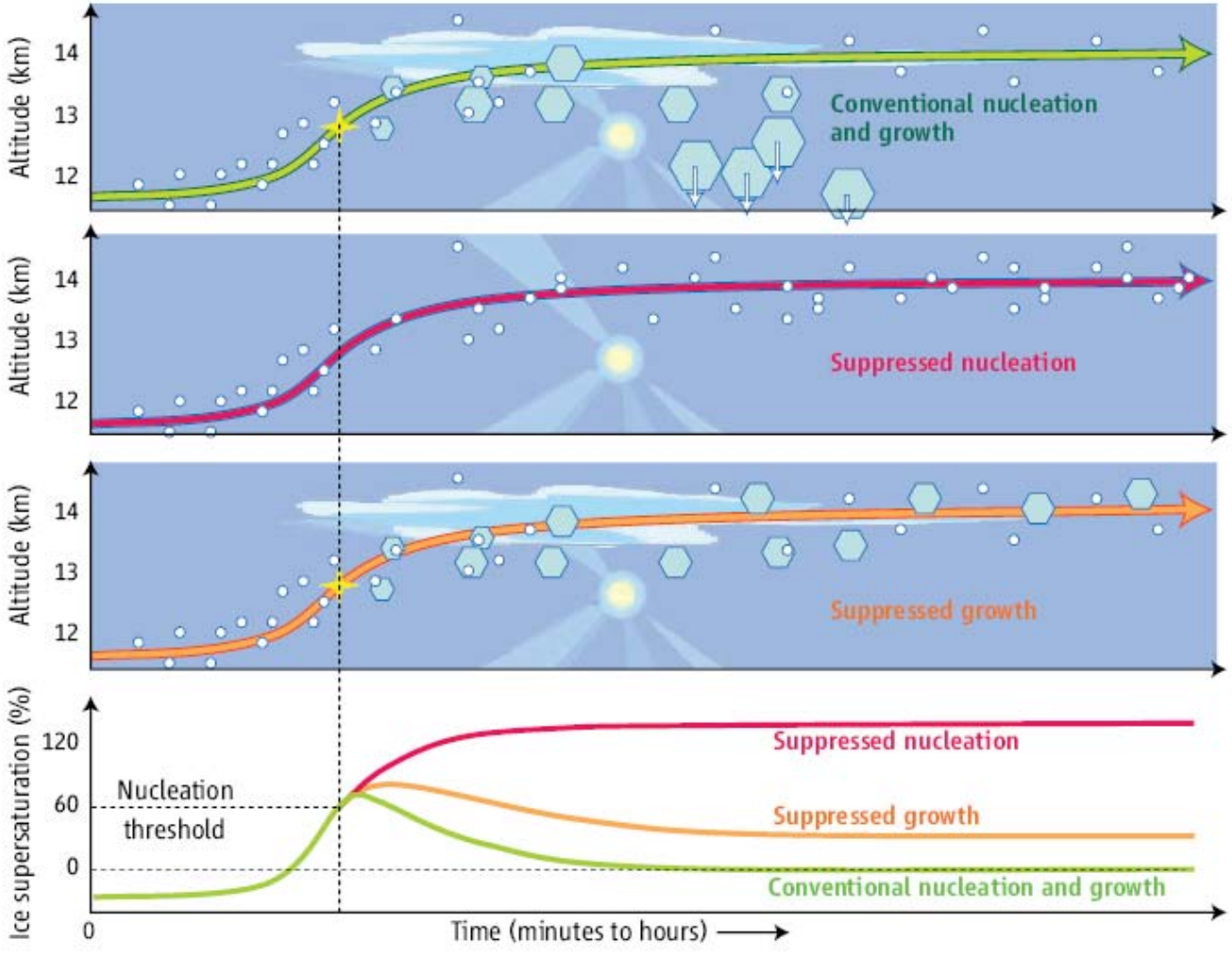
Fueglistaler and Haynes, JGR 2005

Super-saturation puzzle – the obser-vations

(f) Balloon observations (all sky), Costa Rica / Indonesia, Vömel et al., JGR, 2007 (greenish), Arctic (bluish),



The supersaturation puzzle



Conventional Nucleation and Growth

Suppressed nucleation of ice → enhanced humidity

Suppressed crystal growth → enhanced humidity

Peter et al., Science, 2006

The Supersaturation Puzzle – Potential Explanations

→ **How good are the data?** — ***Not good, but good enough to accept S > 1.2 inside and S > 1.6 outside clouds …***

→ **Potential out-of-cloud effects:**

- ***Lack of preexisting aerosol?*** — ***No***
- ***Low mass accommodation of H_2O on aerosol?*** — ***Speculative***
- ***Underestimated vapor pressure of supercooled water?*** — ***10 %***
- ***Surface nucleation?*** — ***Speculative***

→ **Potential in-cloud effects:**

- ***Control by ice nuclei?*** — ***Not persistent***
- ***Mesoscale temperature fluctuations?*** — ***No***
- ***Subresolution patchiness?*** — ***Hot candidate***
- ***HNO_3 deposition on ice, forming NAT?*** — ***Lab evidence missing***
- ***Low mass accommodation of H_2O on ice?*** — ***Hot candidate***
- ***Cubic ice? Glasses?*** — ***Hot candidate***
- ***Overpopulated tail of high velocity molecules?*** — ***Speculative***

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Topics

- Data quality (in-situ, remote)
- Clear air and in-cloud supersaturation
- UTS water vapour changes
- Impact on atmospheric chemistry and climate

- tbd: UTH

But not a complete review on UTS H2O!

- e.g. SCOUT-O3 position paper on tropical H2O entry

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Related activities

- RHi workshop, Karlsruhe, June 2007
- AquaVIT campaign, Karlsruhe, Oct 2007
- AquaVIT workshop, Zürich, May 2008
- Kick-off for Assessment/reviews, Bologna, Sept 2008
- Next author‘s meeting: spring 2009, connected to COST?

Related literature

- SPARC WAVAS 2000
- Peter et al., Science 2006
- Peter, Krämer, Möhler, SPARC newsletter 2008
- Schiller, Peter, Rosenlof, SPARC newsletter 2008