UTLS Activities at RAL

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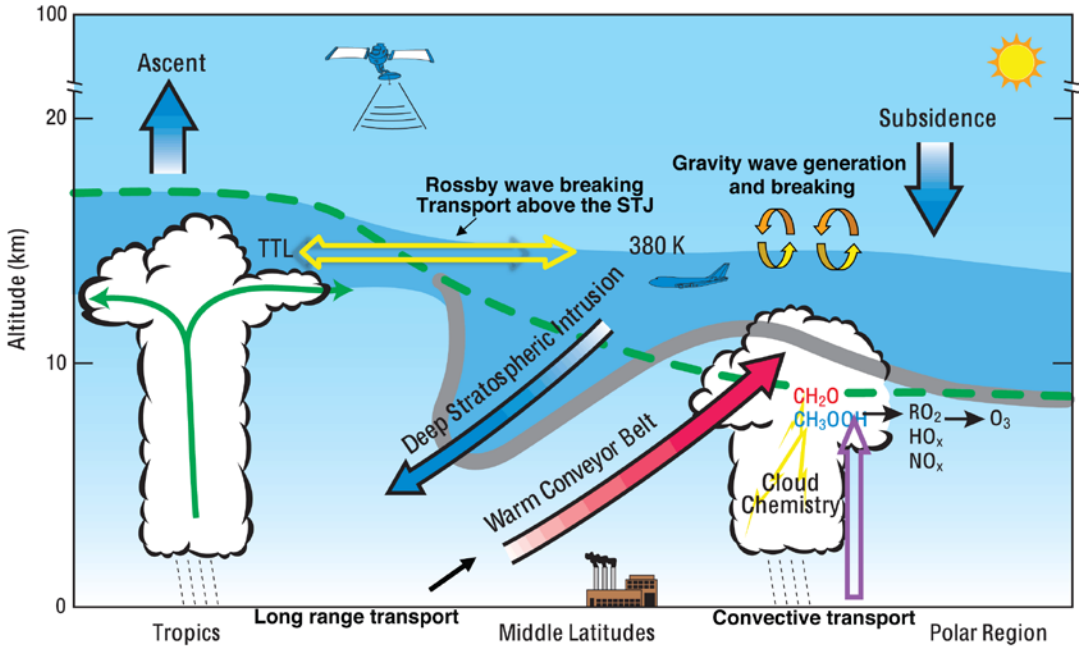
UT/LS Region is Important

- Climate Feedback
  - Rad. forcing
  - Greenhouse
  - Clouds
  - NWP / ESM
- Strat. Chemistry
  - Pollutants
  - ST Exchange
- Dynamics



Gap in Hi.Res. Limb Observations

Table 1: Current and future atmospheric remote sensing missions with high vertical resolution. This illustrates an imminent gap in observations after 2020.

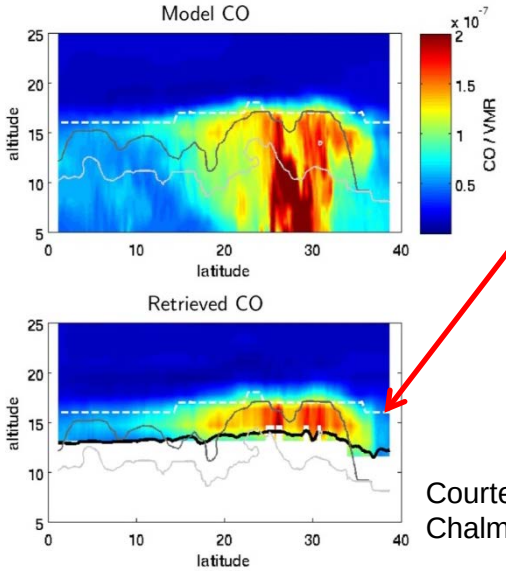
Instrument	Platform	Launch	Lifetime[1]	Products
SMR	Odin	2001	2003	O3, H2O, N2O, HNO3, T, ClO
OSIRIS	Odin	2001	2003	O3, NO2, Aerosol, BrO
FTS	ACE	2003	2005	O3, NO2, Aerosol, H2O, N2O, HNO3, T, CO, HCN
MAESTRO	ACE	2003	2005	O3, NO2, Aerosol, H2O
HiRDLS	Aura	2004	2010	O3, NO2, HNO3
MLS	Aura	2004	2010	O3, BrO, H2O, N2O, HNO3, T, CO, HCN, ClO
CALIOP	CALIPSO	2006	2009	Aerosol
SOFIE	AIM	2007	2009	H2O, T
OMPS	Suomi NPP	2012	2014	O3, Aerosol
SAGE III[2]	ISS	2015	2018	O3, NO2, Aerosol, H2O
ATLID	Earth CARE	2017	2020	Aerosol
OMPS	JPSS-2	2022	2029	O3, Aerosol

[1] Predicted lifetime. Some instruments have exceeded this and are still operational.
[2] The low inclination orbit of the ISS means that there will be limited coverage of the polar region.

Figure from CEOI study “ALiSS-UK” (Final Report due in May 2015)

History of UTLS Mission Proposals

- Early identification in UK of potential to extend mm-wave sounding down to UT, and synergy with infrared (IR)



opacity limit for infra-red and shorter wavelengths due to cirrus

Courtesy of Jo Urban, Chalmers U.

1985-1990: **MLS** (UARS/AURA)
- UK simulations for Trop. extension

1990-1995: **AMAS**
- UK(NERC) / D / EC
- mm/sub-mm wave limb sounder

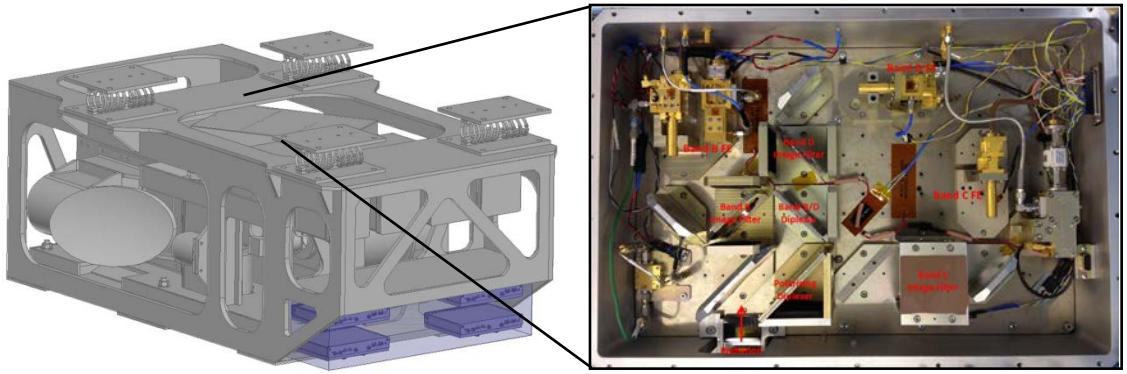
1996-2001: **ACECHEM**
- ESA Explorer 3 candidate
- Infrared & mm/sub-mm wave limb sounders

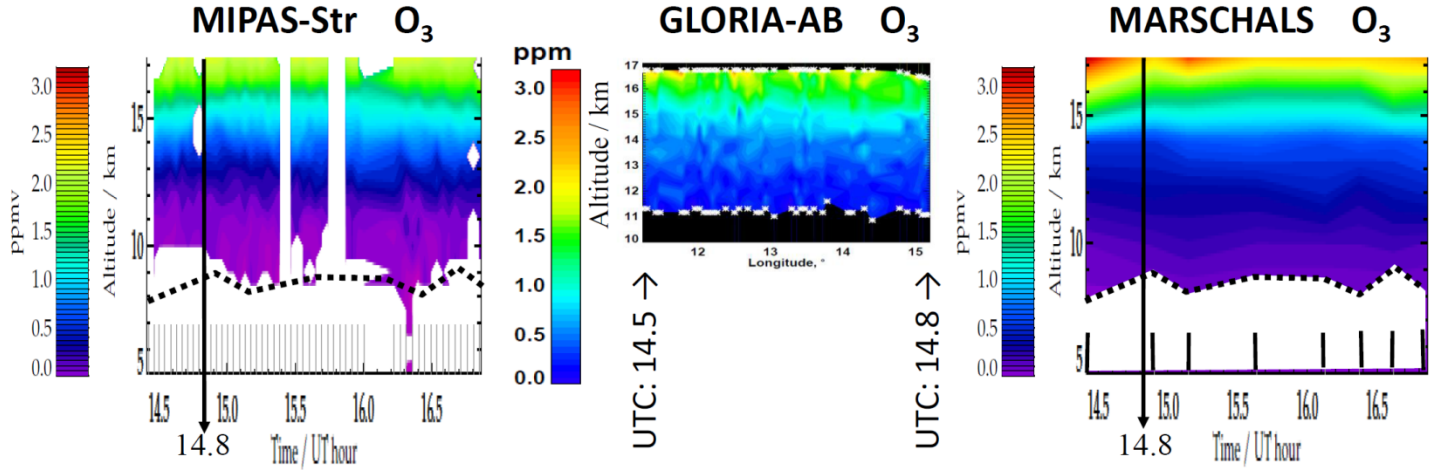
2006-2013: **PREMIER/STEAMR**
- ESA Explorer 7 candidate
- Infrared limb imager (2D) & mm-wave limb sounder

2015-????: TBD

MARSCHALS

Airborne demonstrator for mm-wave limb sounding

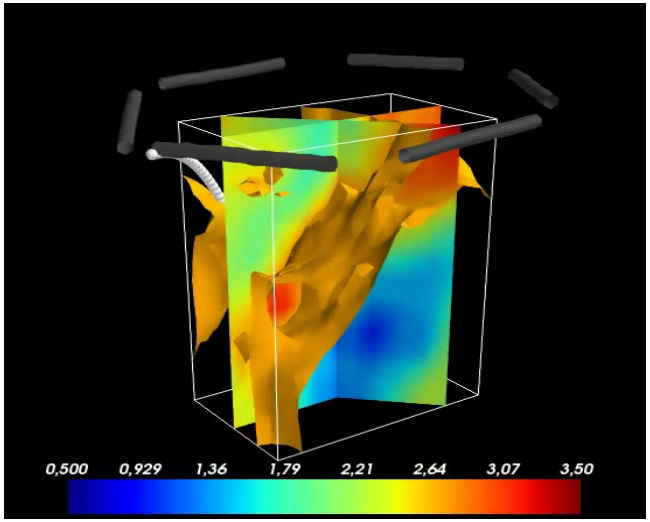




Technology Matures and Evolves…

INFRARED

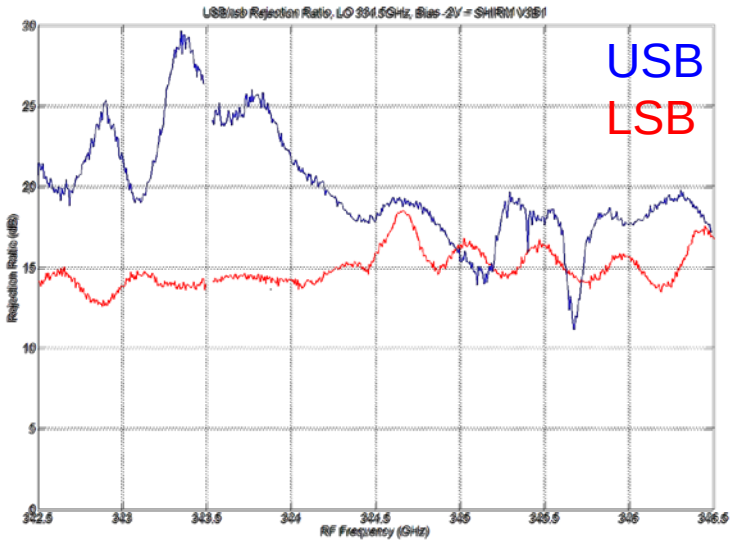
- Sounder → 2D Imager (i.e. GLORIA-AB)
- 3D Tomography
- Increased resolution



Courtesy of GLORIA team, FZJ & KIT

Mm-wave

- SHIRM receivers
- Quasi single side-band operation w/o filters
- Reduced cost



SHIRM Development at RAL

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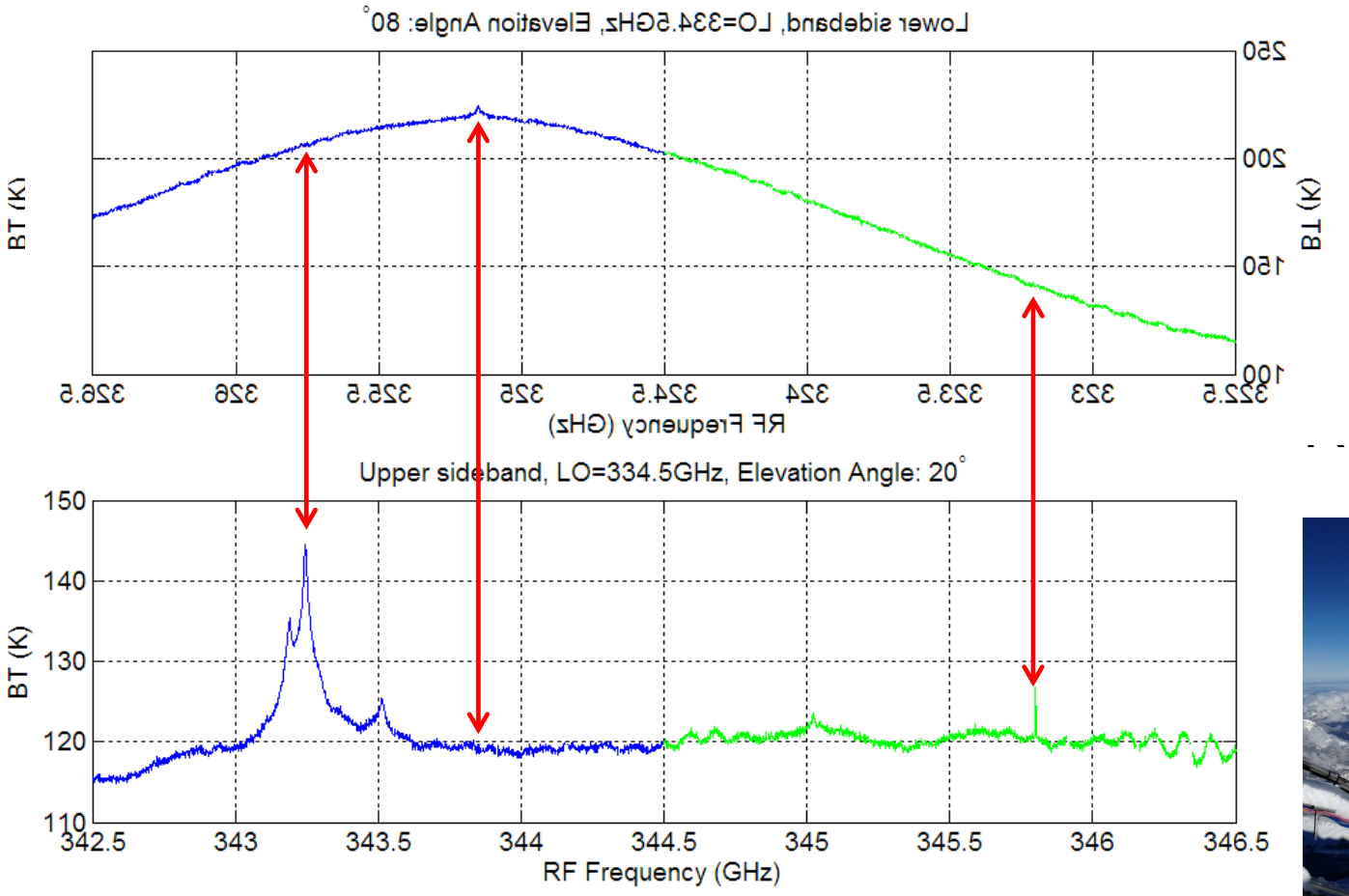
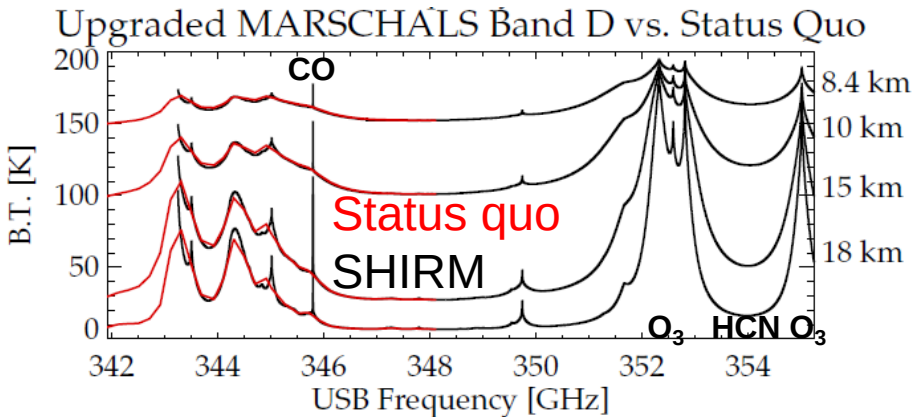
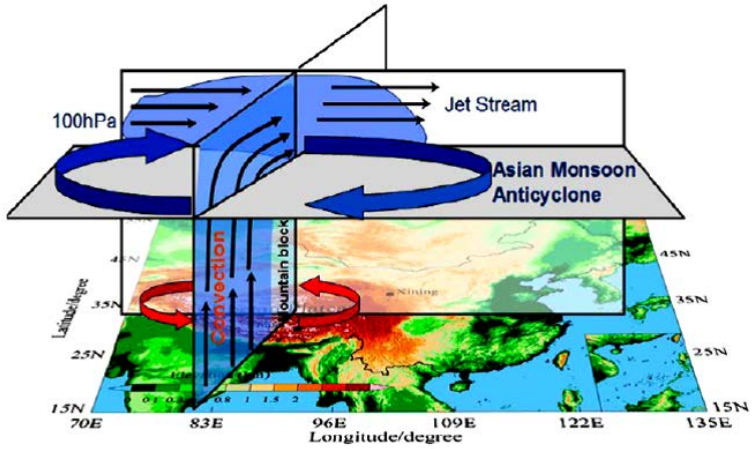


StratoClim 2016

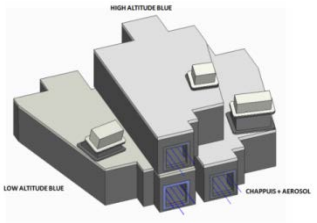
- EC FP7 consortium with large UK participation
- Aircraft campaign Asian Monsoon summer 2016
- Plan for upgraded MARSCHALS with SHIRM band





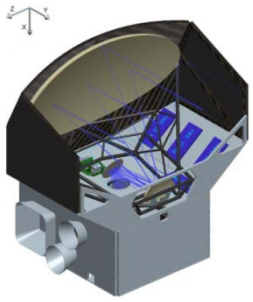
ALiSS (Atmospheric Limb Sounding Sat.)

- Canadian-Swedish satellite mission for the UT/LS
  - CATS: UV/VIS (next gen. OSIRIS / ODIN)
  - STEAMR: mm-wave sounder (PREMIER)
- Potential UK partnership: (STEAMR, possibly µFTS)
- Launch target 2021 (consortium under review)



Canadian
Atmospheric
Tomography
System

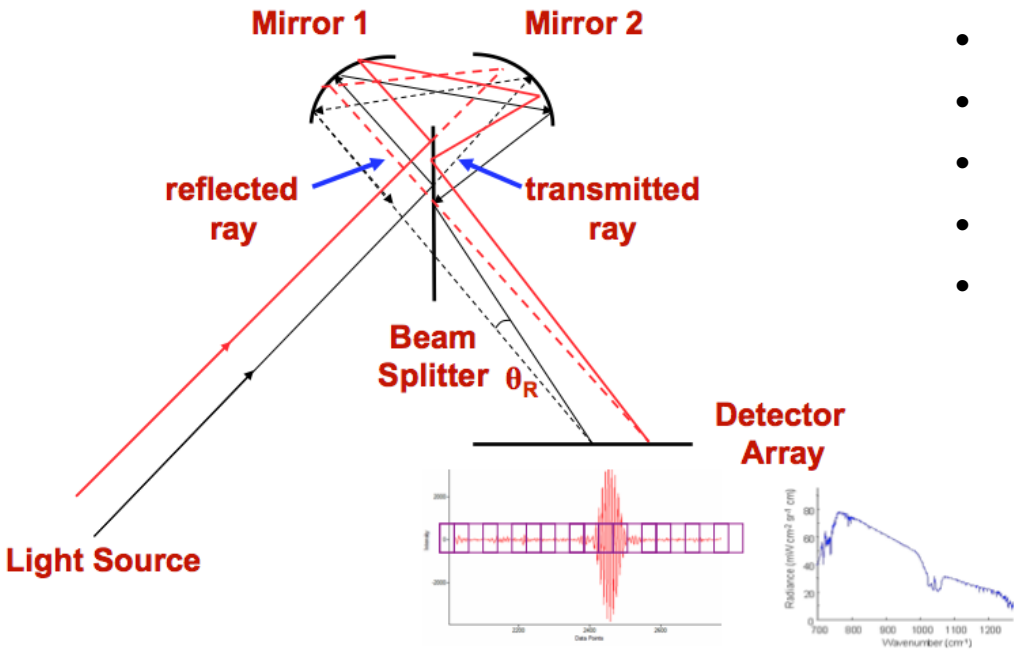
UV/VIS limb scattering.
O_3, NO_2, BrO, Aerosol extinction, Cirrus cloud optical depth.
Mesosphere mode.



Stratosphere
Troposphere
Exchange
And Climate
Monitor
Radiometer

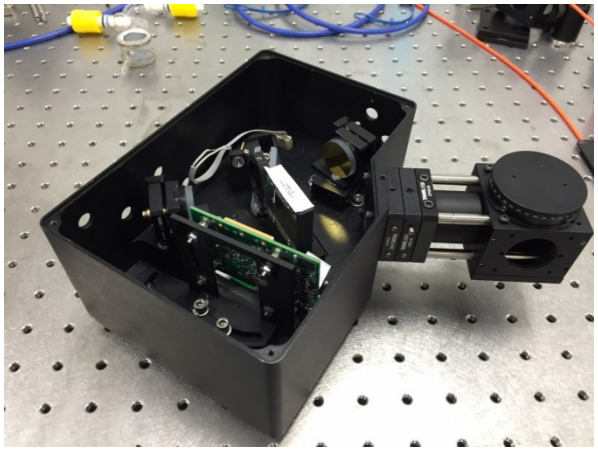
Sub-millimetre-wave limb sounder.
O_3, H_2O, T, N_2O, HNO_3, CO, CH_3Cl, CH_3CN, HCN, CLO, HDO

μFTS (micro Fourier Transform Spectrometer)



Courtesy of Ali Hussain, RAL Space

- Spectral resolution of ~4cm^{-1}
- Low mass spectrometer ~ 1.56kg
- Compact ~ 350 x 300 x 50mm
- Low power ~ 0.5mW (average)
- SNR ~ 513



µFTS Study (CEOI Pathfinder)

- Test viability of a low spectral resolution IR limb sounder for UTLS science

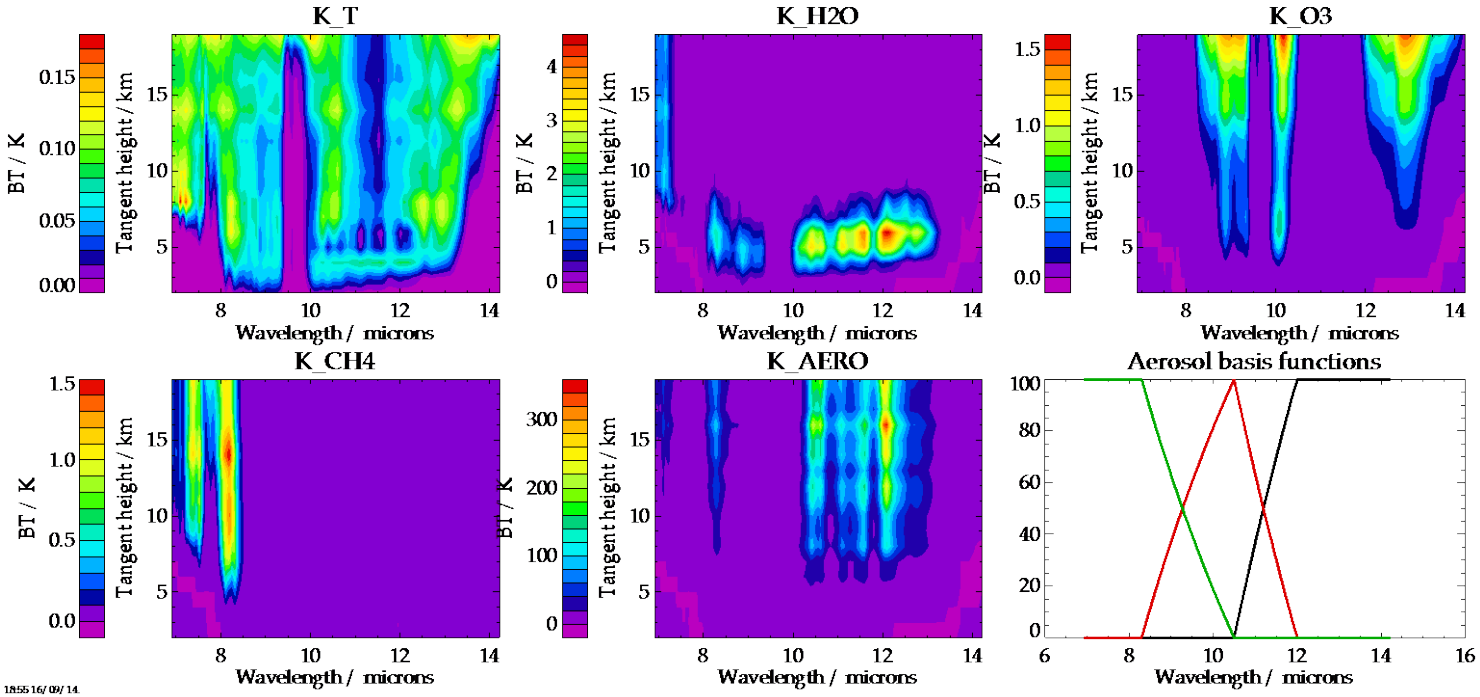
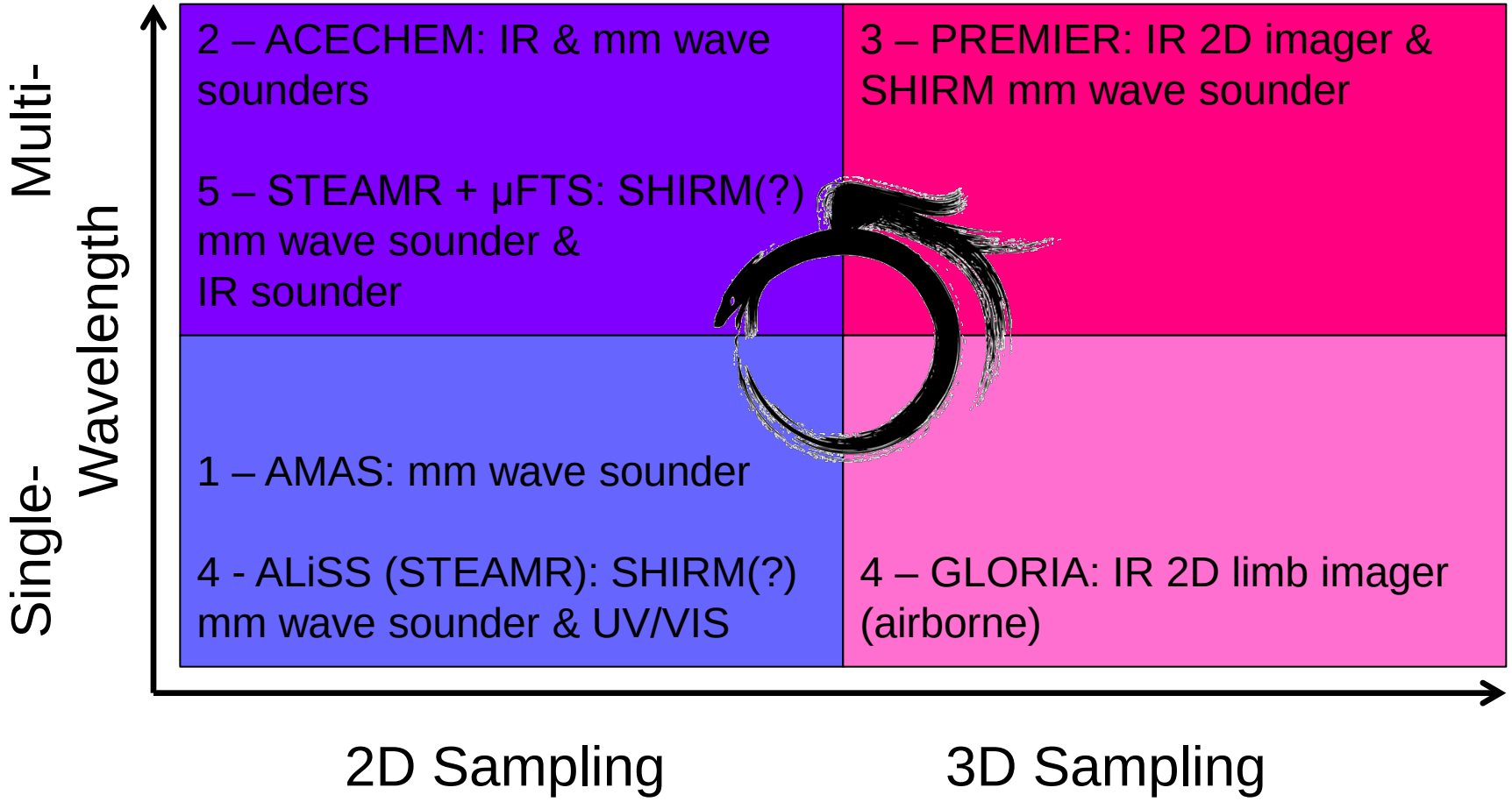


Figure from CEOI study “ALiSS-UK” (Final Report due in May 2015)

Conclusions: What goes around…



Thank you for your attention!