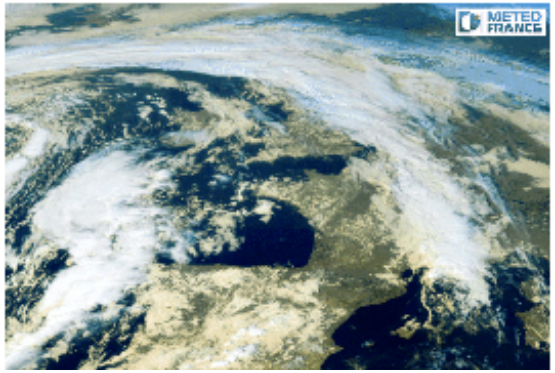
Post-Calipso perspective:

EarthCare and MESCAL

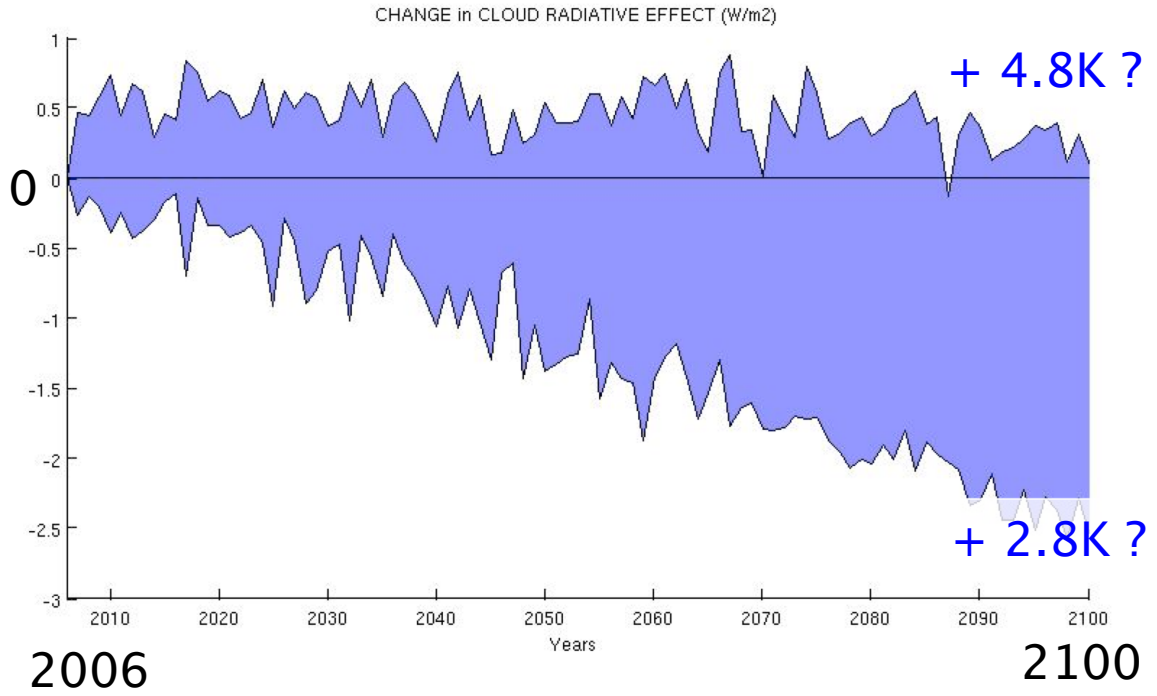
Hélène Chepfer (IPSL/LMD) and Chris Hostetler (NASA/LaRC)

What we want to know: how clouds change when climate warms ?



To predict future climate
we need to know how the clouds change and why ?

Effect of the clouds on the global Earth Temperature



Models predict that cloud changes enhance the greenhouse warming

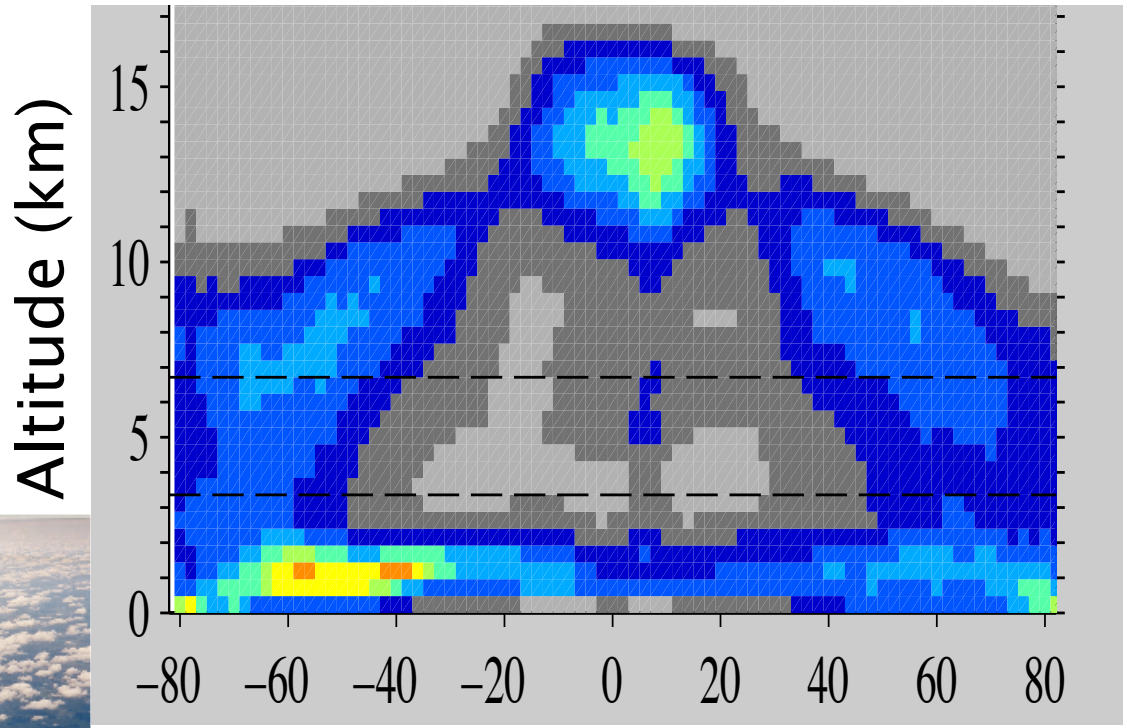
Models predict that cloud changes weaken the greenhouse warming

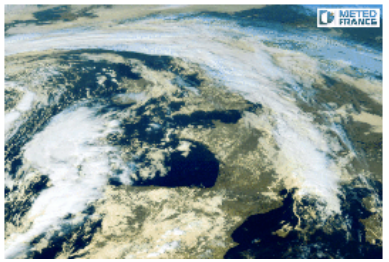
Illingworth et al. 2015, BAMS

Clouds remain the main source of uncertainty for futur climate prediction (IPCC AR5, WCRP

Thank's to Calipso and the A-train,
we know where the clouds are

Detailed vertical distribution of clouds



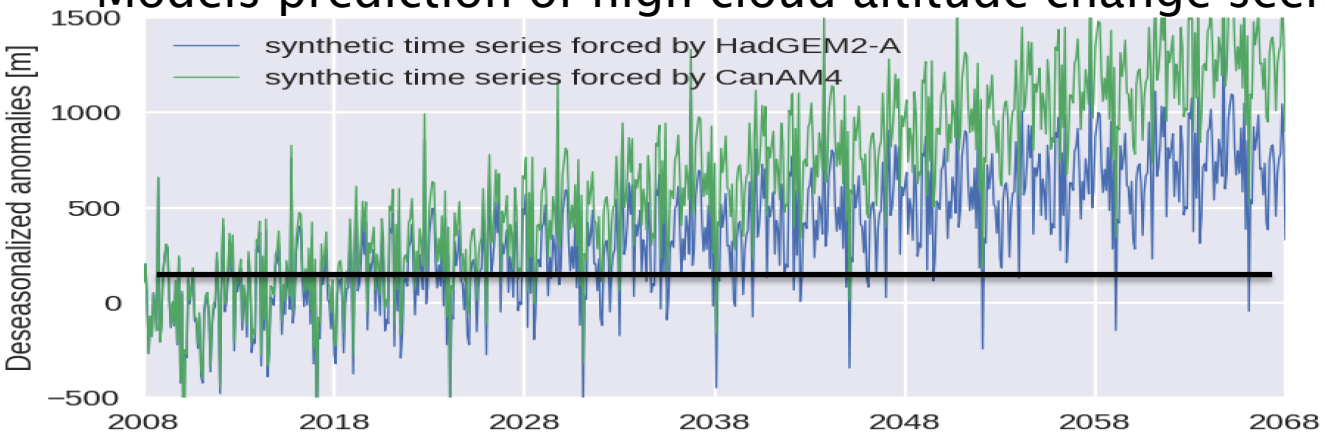


Chepfer et al. 20
Cesana et al. 201

To quantify how the clouds change and why, we need a long term lidar record

HIGH ALTITUDE

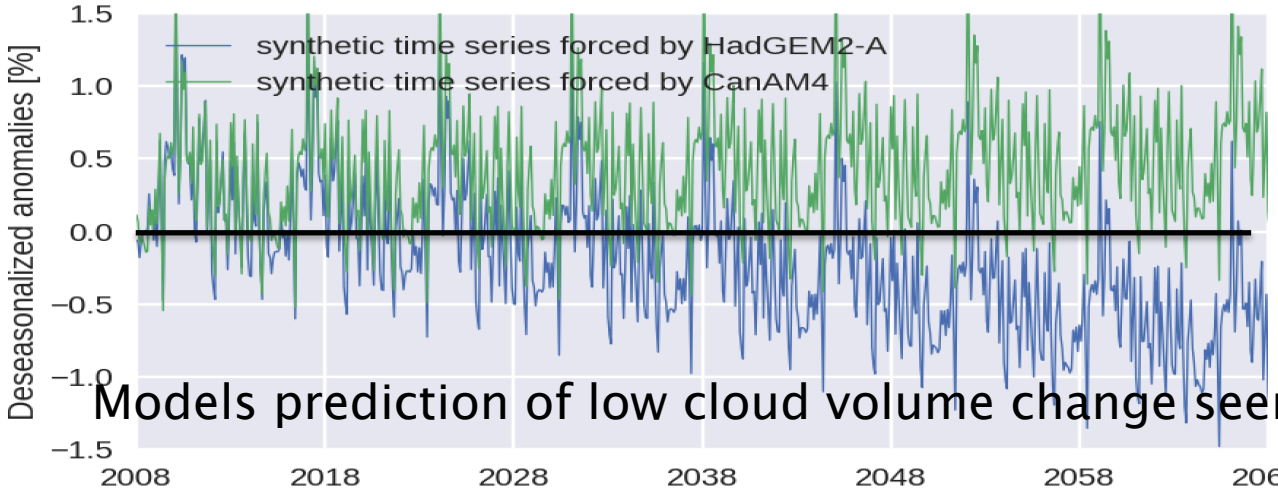
Models prediction of high cloud altitude change seen by lidar



High clouds enhan significantty the Earth warming

High Clouds enhance slightly the Earth warming

LOW ALTITUDE



Low louds weaken the Earth warming

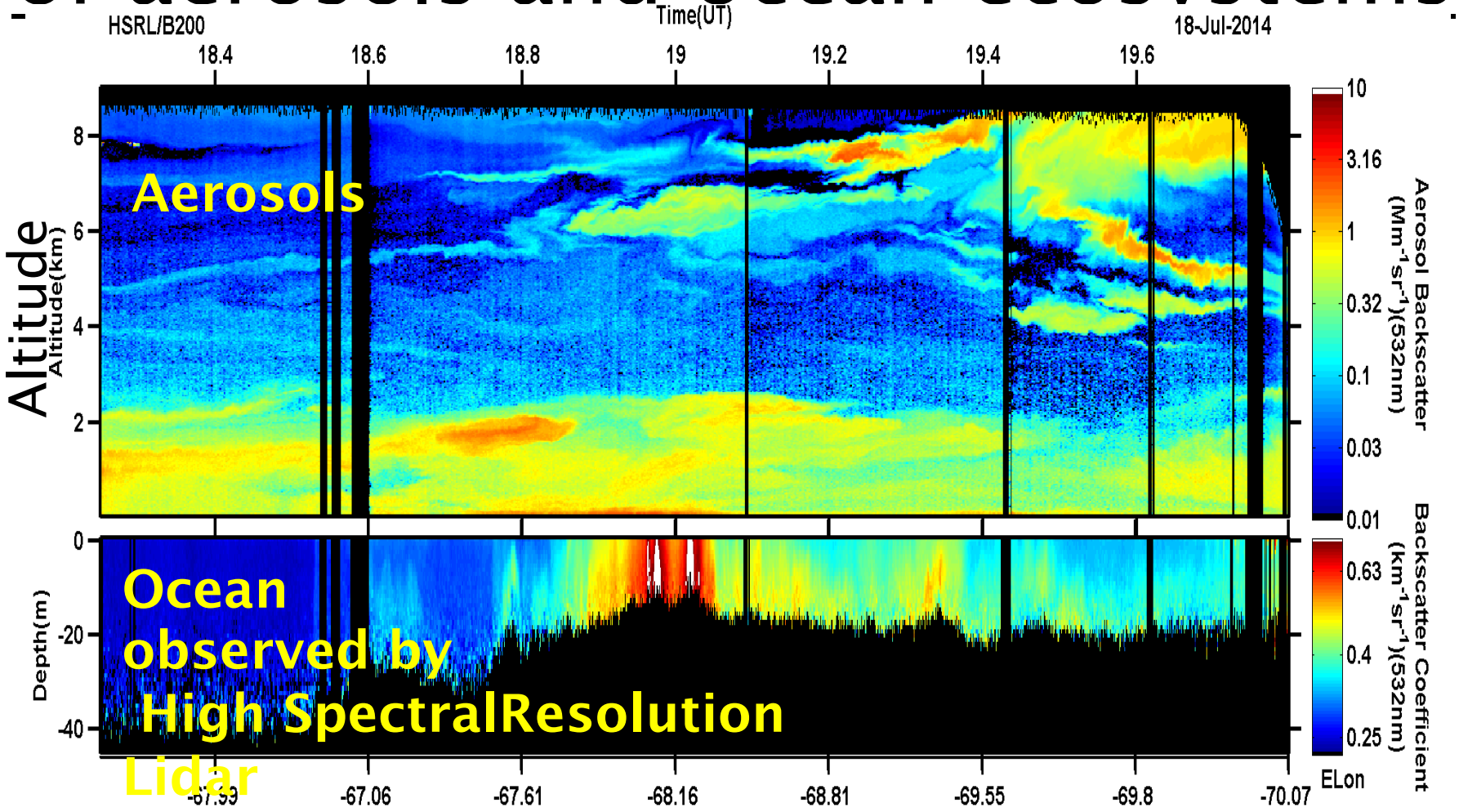
Low clouds enhance the Earth warming

Models prediction of low cloud volume change seen by lidar

Need for 25+ years spaceborne lidar record –CALIPSO/EarthCare

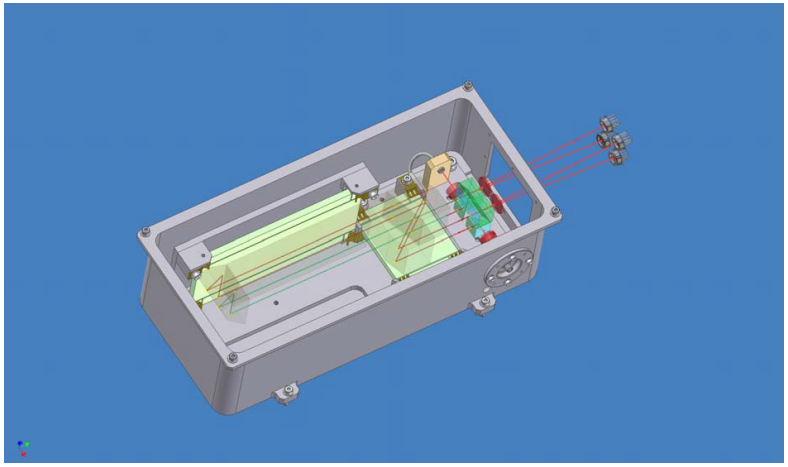
To quantify how clouds change and why,

we also need to understand the role of aerosols and ocean ecosystems



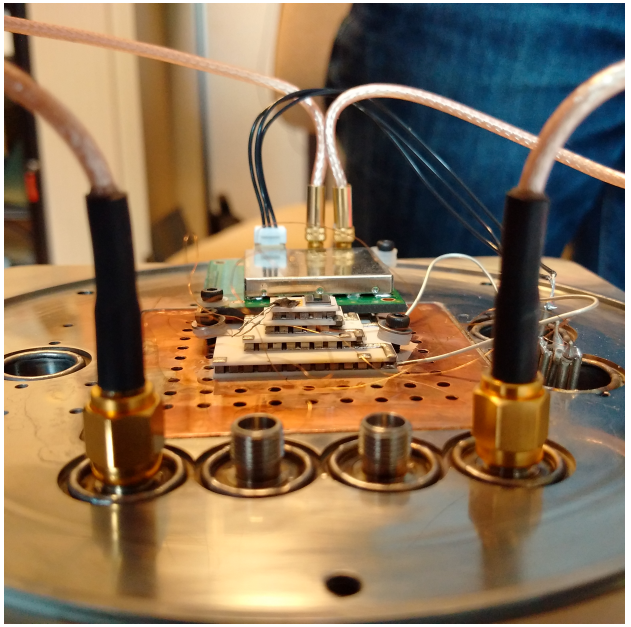
To know how the clouds change and why,

we need an innovative lidar with new technology



QMZ IPSL/LATMOS

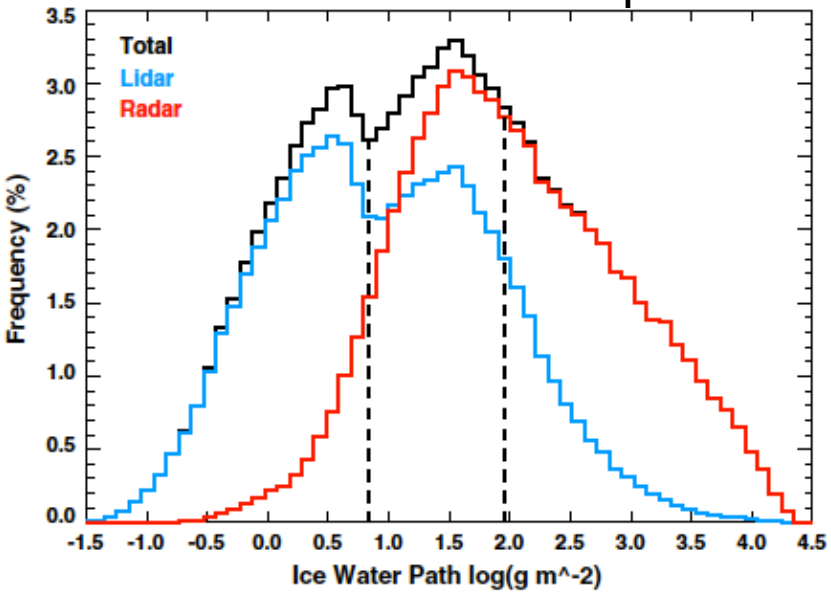
Airbus Defence&Space



Detector CEA-LETI

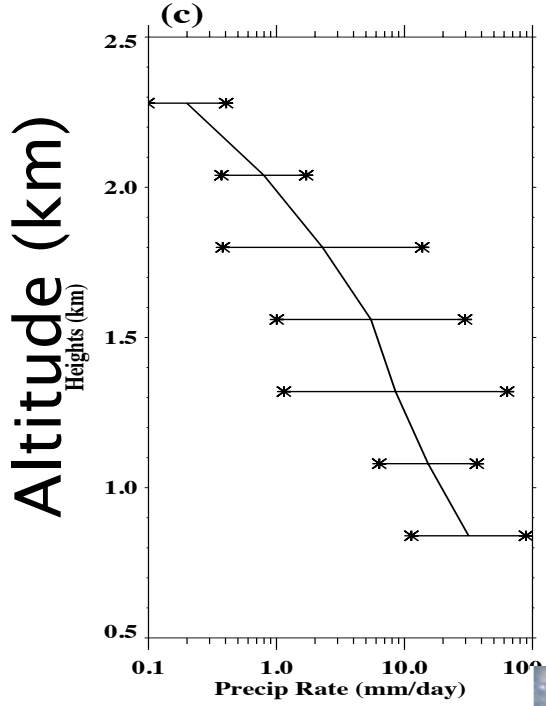
To know how the clouds change and why, we need the lidar to fly with radar and radiometers

Amount of ice in tropical clouds

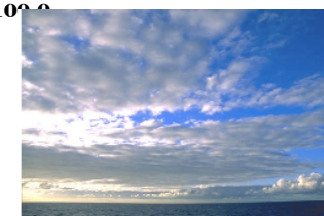


Berry and Mace , 2014

Precipitations (mm/day)



Mace et al. 2016



To know how the clouds change and why, we must implement the MESCAL mission

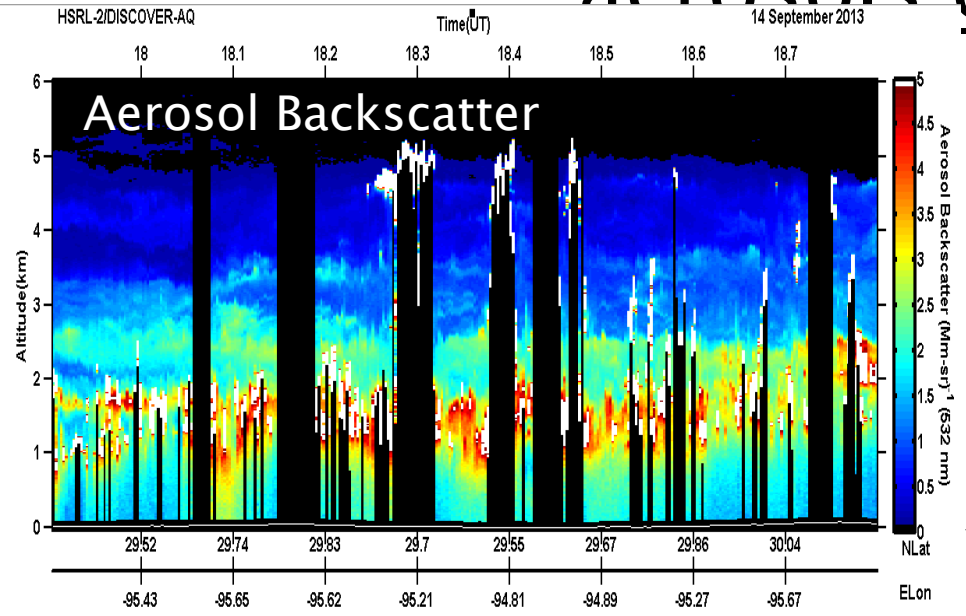
MESCAL:

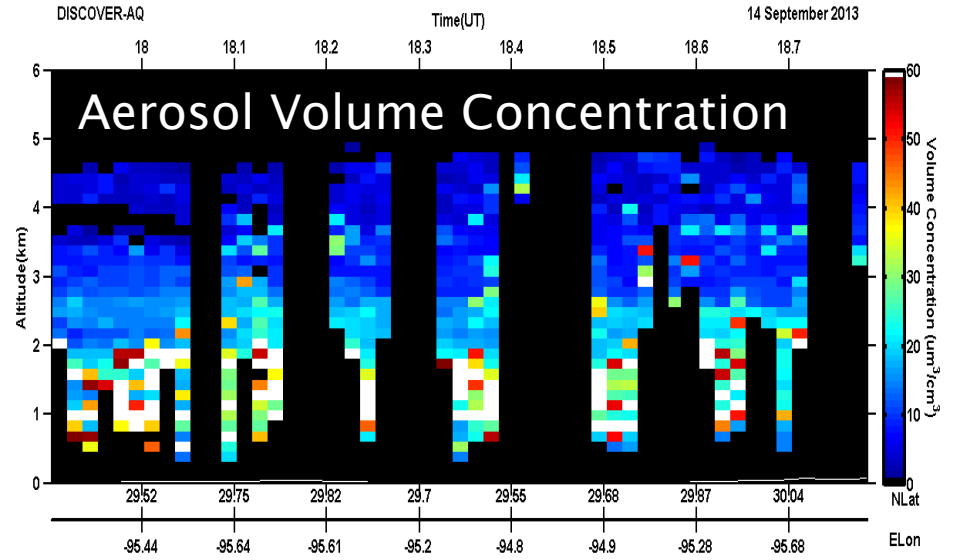
- A lidar mission co-proposed by the French-EU/EECLAT and the US/ACE science communities.

- Will fly in formation with radar and radiometers, building on the demonstrated synergies of CALIPSO +CloudSat+A-train and EarthCARE

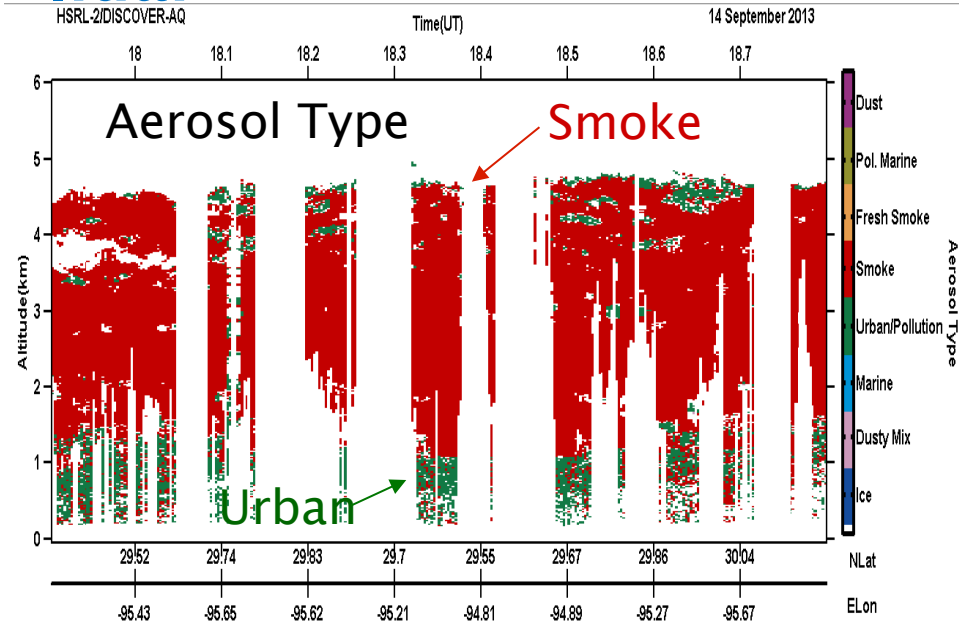
Back up

To quantify how clouds change and why, we also need to understand the impacts of aerosols on clouds





For this we need to build on the advances of EarthCARE to deploy a multi-wavelength high spectral resolution lidar



To quantify how clouds change and why, we also need to understand the role of aerosols and ocean ecosystems

Airborne High Spectral Resolution Lidar (HSRL) demonstraton. HSRL atmosphere & ocean profiling provides insight on linkage between