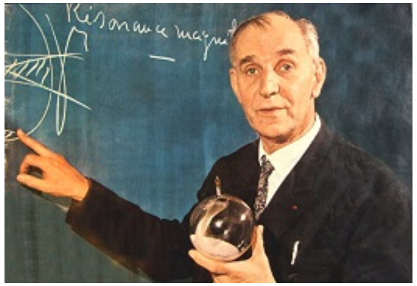
2016 : CALIPSO 10th birthday

1960 : First observations of clouds from space in the IR : TIROS-II

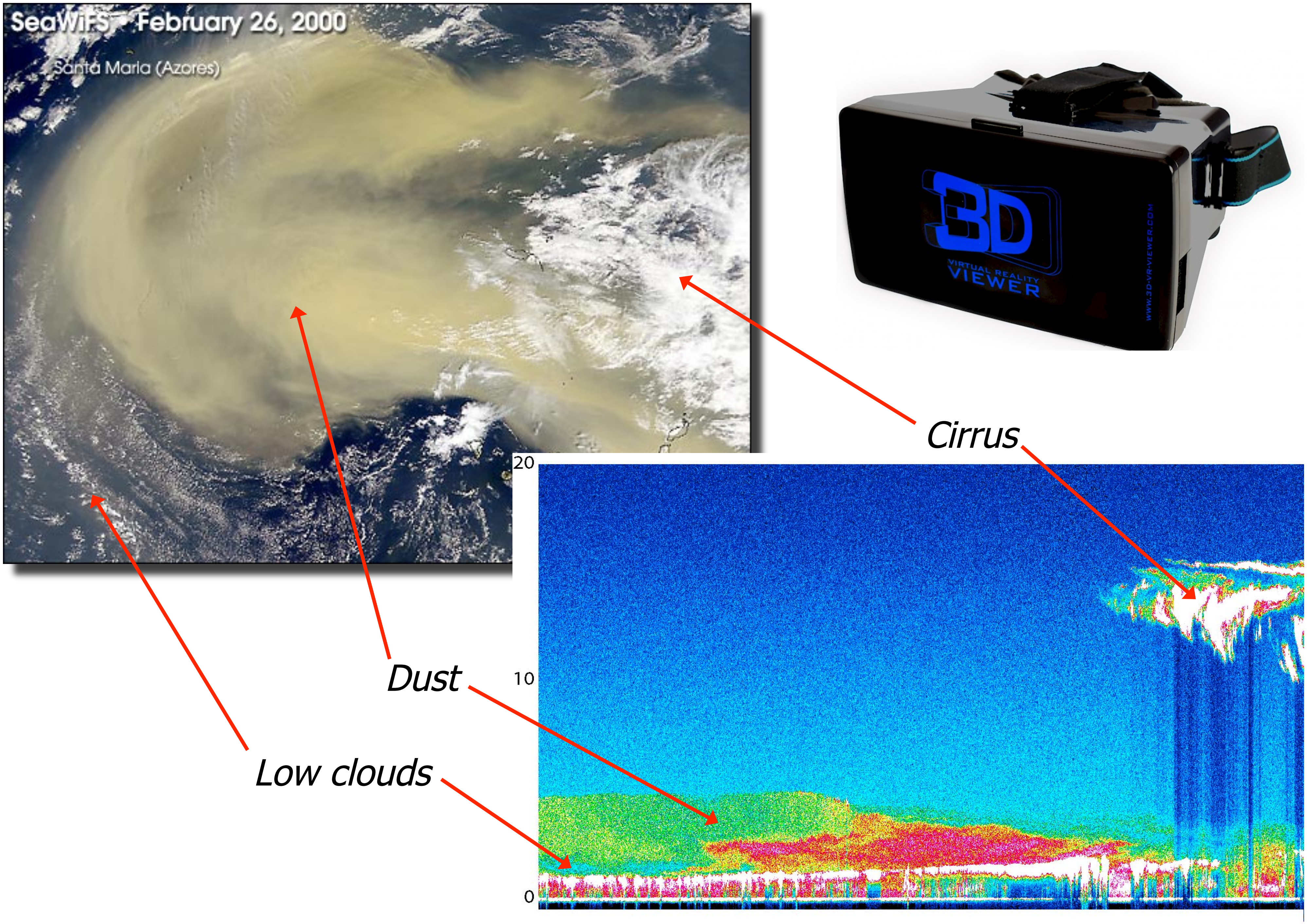
1966 : 50 years ago, Alfred Kastler received the Nobel ¨Price in Physics for the discovery and the development of optical pumping allowing to control excited atoms state with light … and the development of laser sources.

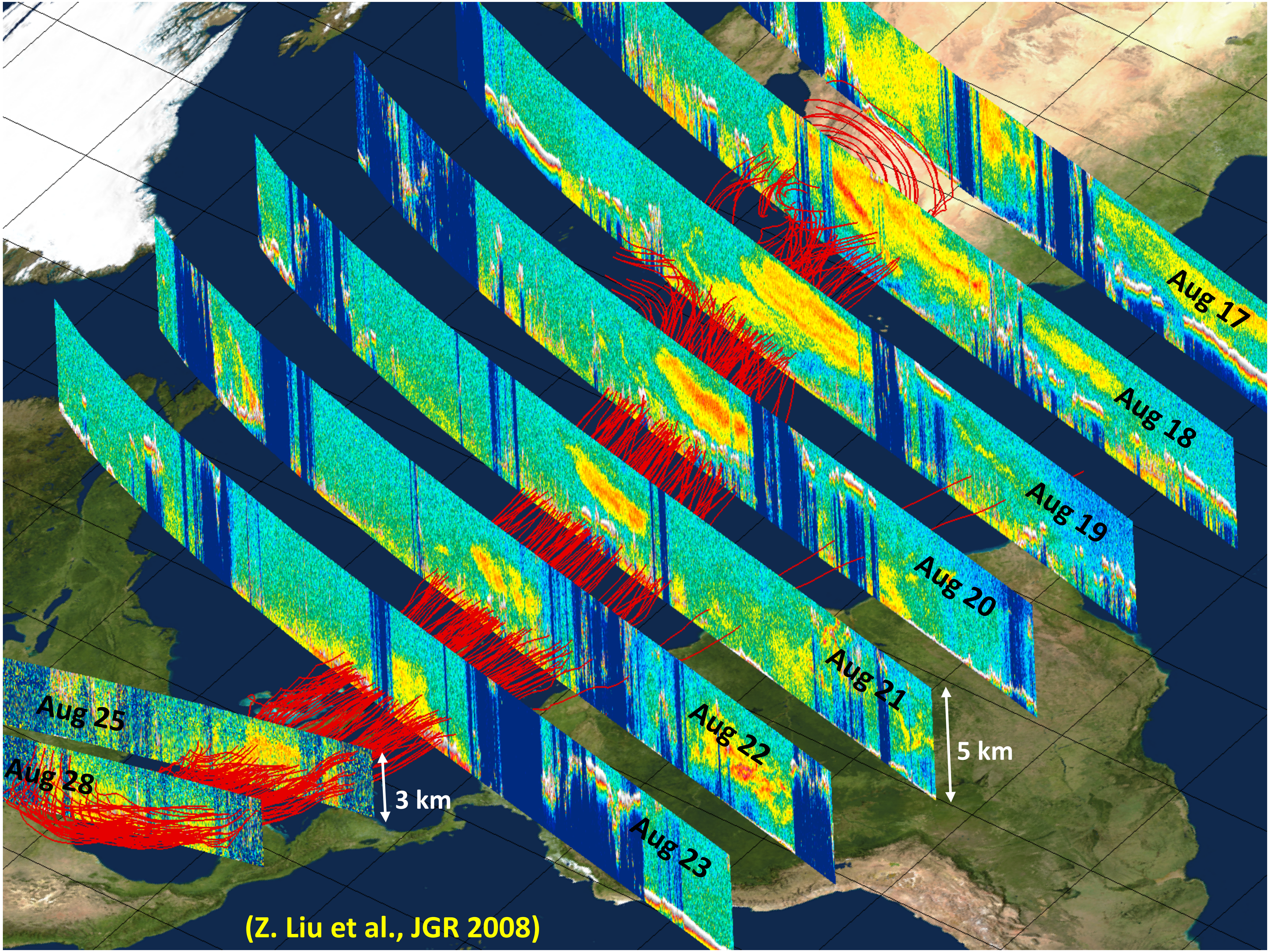


1994 : The Laser in Space Technology Experiment was launched by NASA as proposed by P. Mc Cormick

1996/7: Discussions between Pat and Gérard Mégie,
and Gérard with Pierre Morel

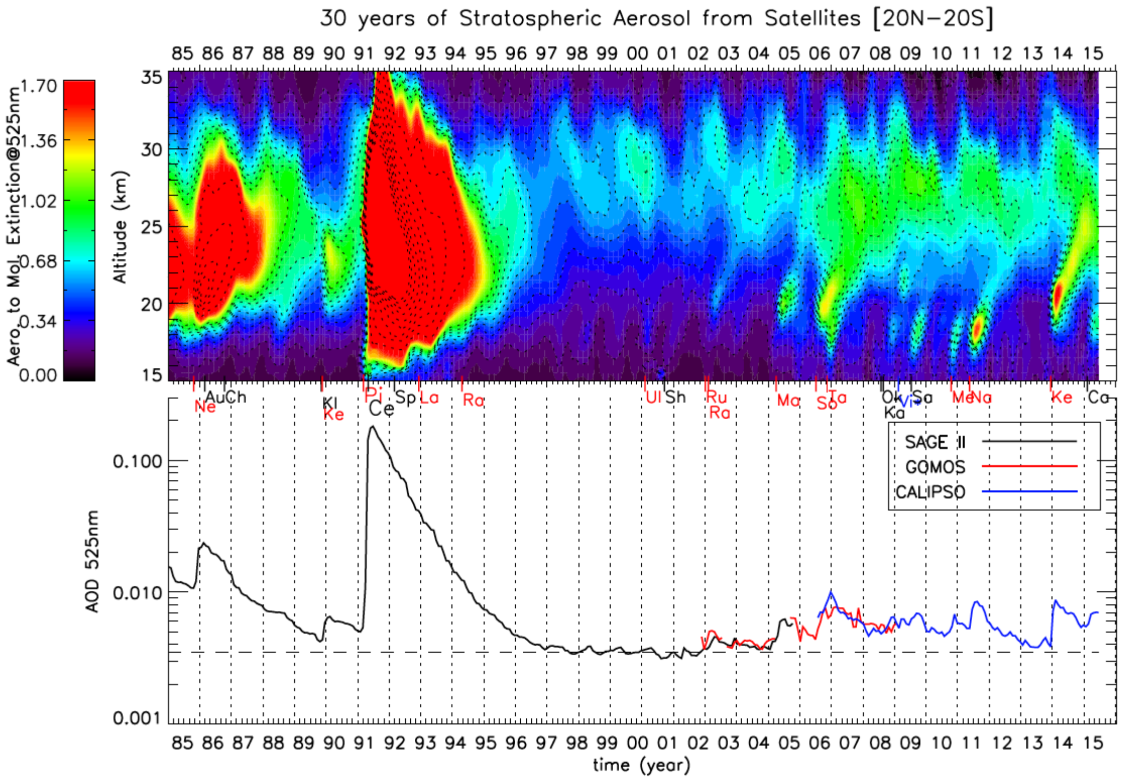
2006 : CALIPSO was launched by NASA and CNES embarking a solid-state laser source and an un-cooled microbolometer array


SeaWiFS • February 26, 2000
Santa Maria (Azores)
3D
VIRTUAL REALITY
VIEWER
Cirrus
Dust
Low clouds
20
10
0

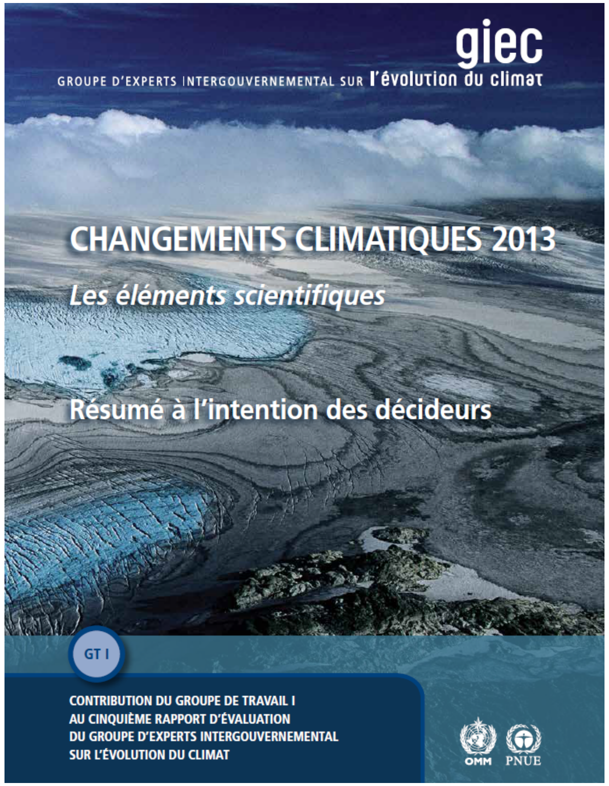

Aug 17
Aug 18
Aug 19
Aug 20
Aug 21
Aug 22
Aug 23
Aug 25
Aug 28
5 km
3 km
(Z. Liu et al., JGR 2008)

IPCC 5th Assessment Report

- Twenty-seven CALIPSO papers (thru 2012) cited in IPCC AR5
  - ✓ Chapter 7 – Clouds and Aerosols (17)
  - ✓ Chapter 8 – Anthropogenic and Natural Radiative Forcing (3)
  - ✓ Chapter 9 – Evaluation of Climate Models (7)

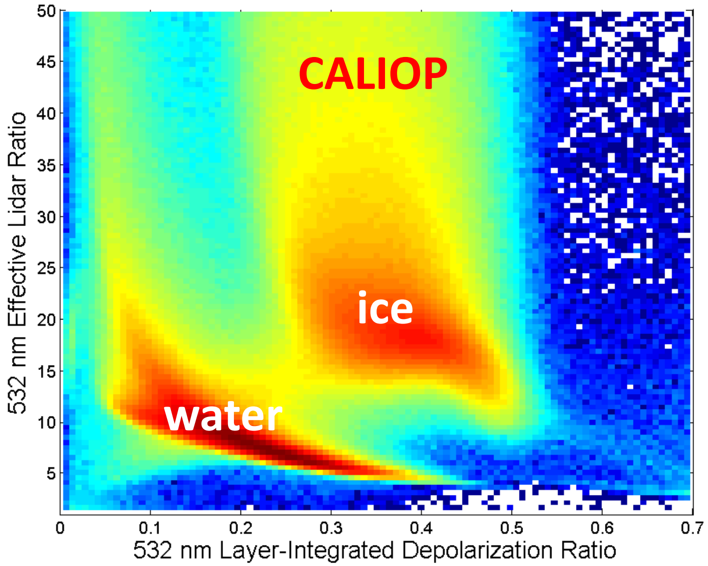


← SAGE II → | ← CALIOP →

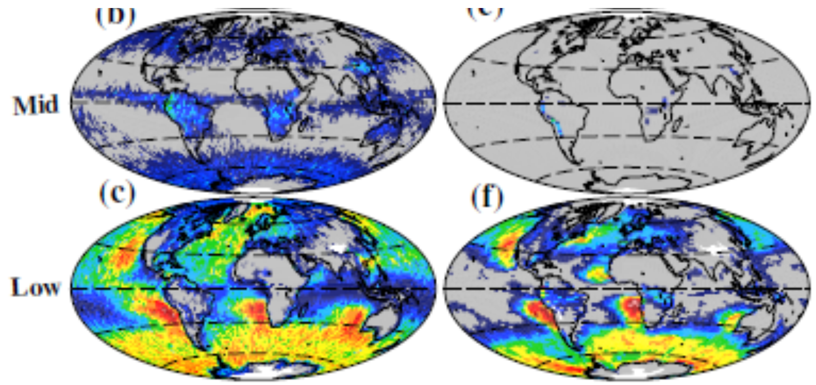


Cloud Water Phase

Cloud ice/water phase:
polarization techniques (CALIOP, POLDER) shown to be superior to spectral techniques (MODIS, AIRS)

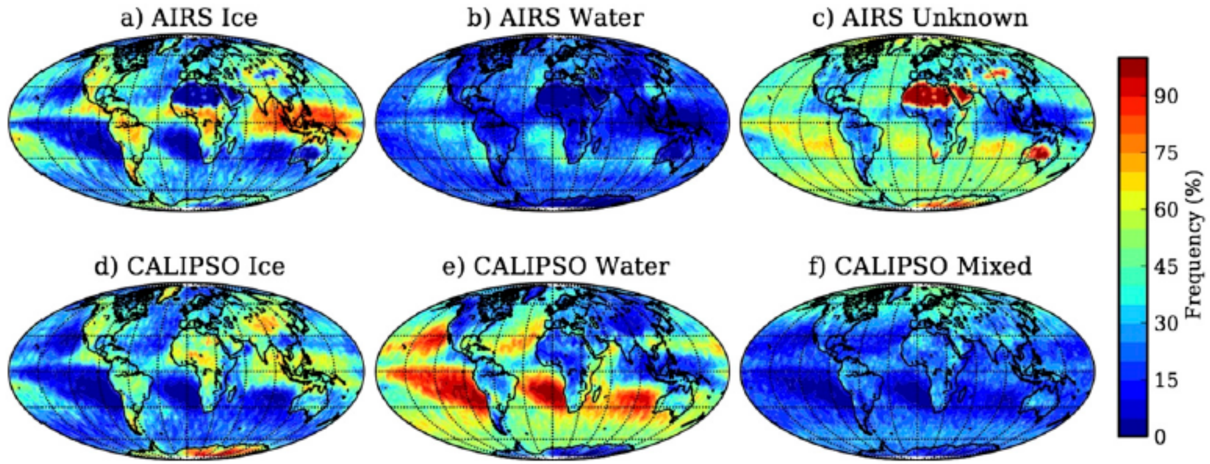


Observation Model

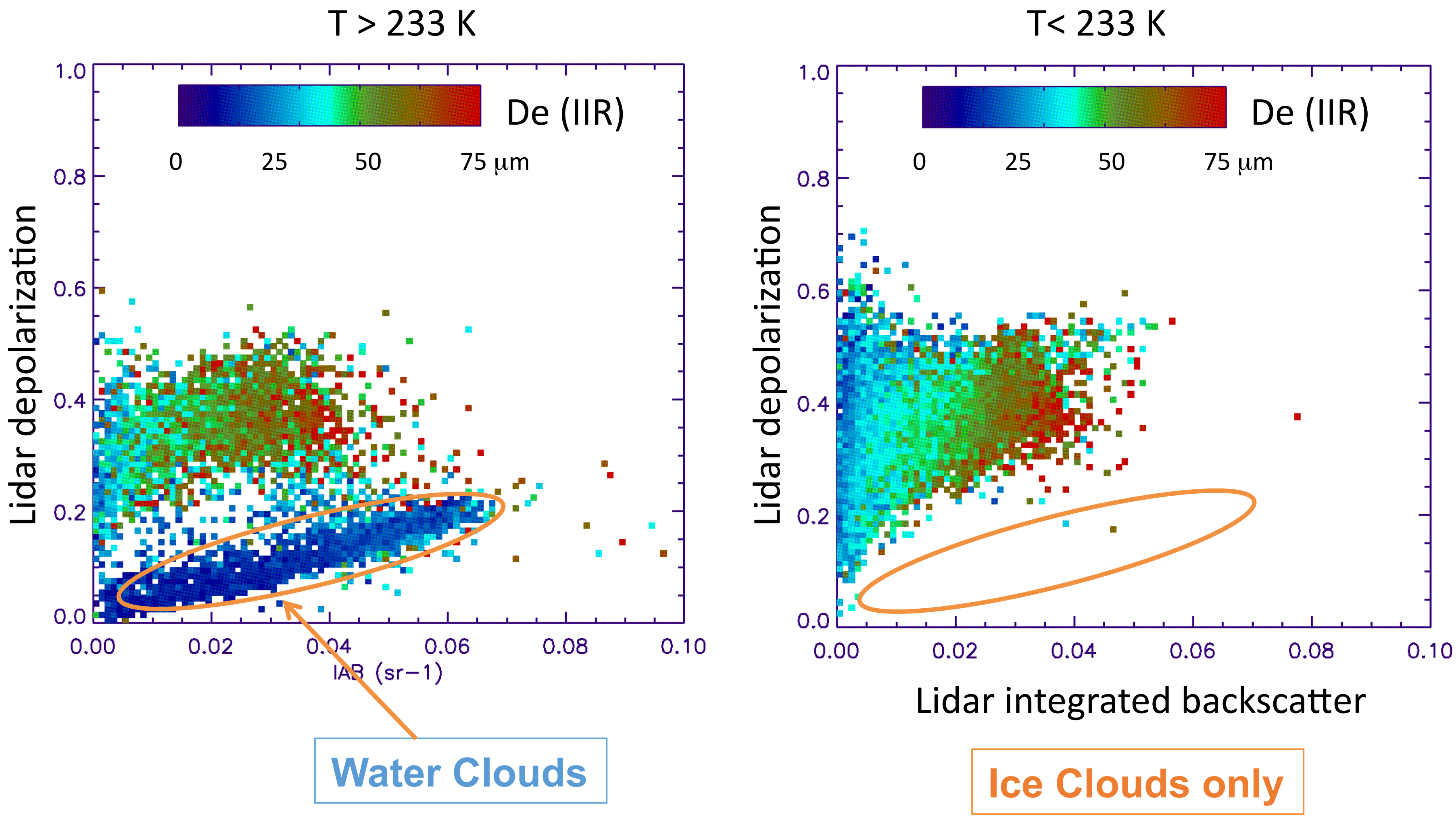


Liquid cloud cover observed by CALIPSO (b-c) and simulated by the LMDZ GCM (e-f).
(Cesana and Chepfer, 2013)

AIRS vs. CALIOP:



CALIOP-IIR synergism

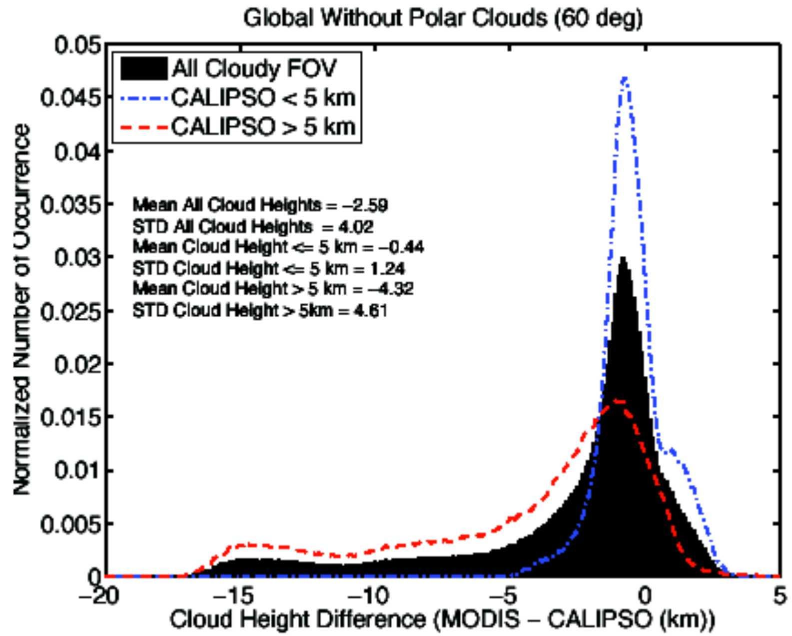


CALIPSO widely used to evaluate and improve passive cloud retrievals

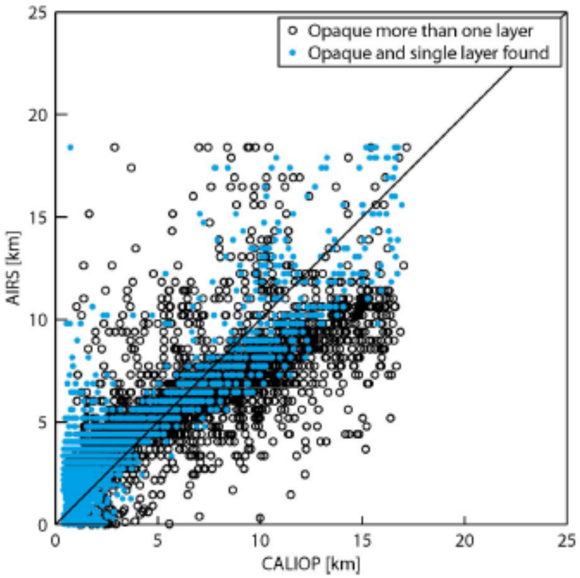
Evaluation of MODIS cloud mask/cloud heights:

•MODIS low-cloud heights biased by PBL temperature inversions

•Cirrus heights biased in multi-layer situations



(Holz and Ackerman, 2008)



(Di Michele et al., 2012)

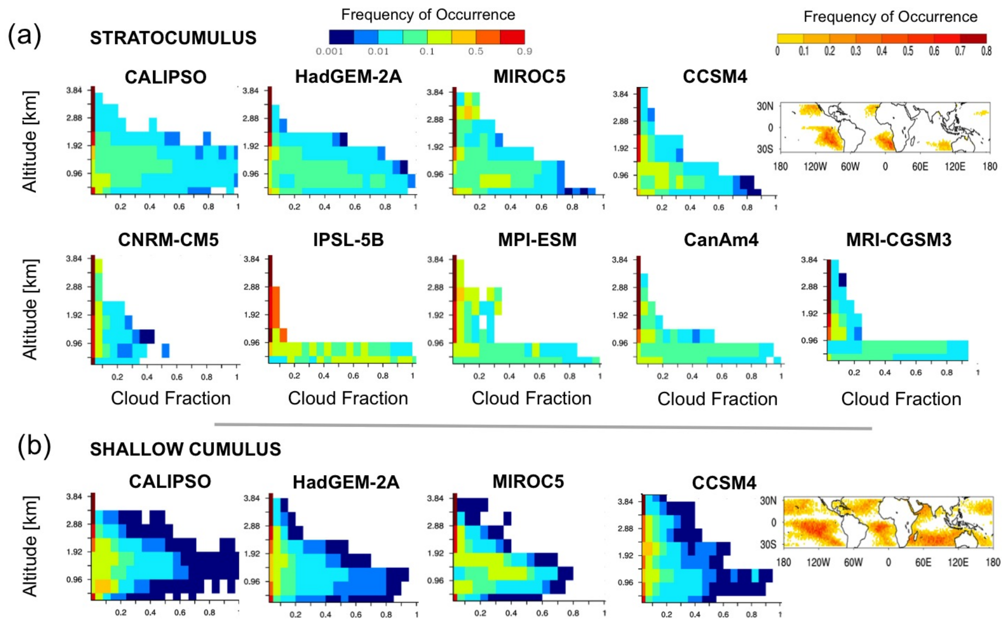
CALIOP cloud heights vs. AIRS

- opaque single-layer vs. multi-layer retrievals

Evaluation of Climate Models (CALIPSO-GOCCP)

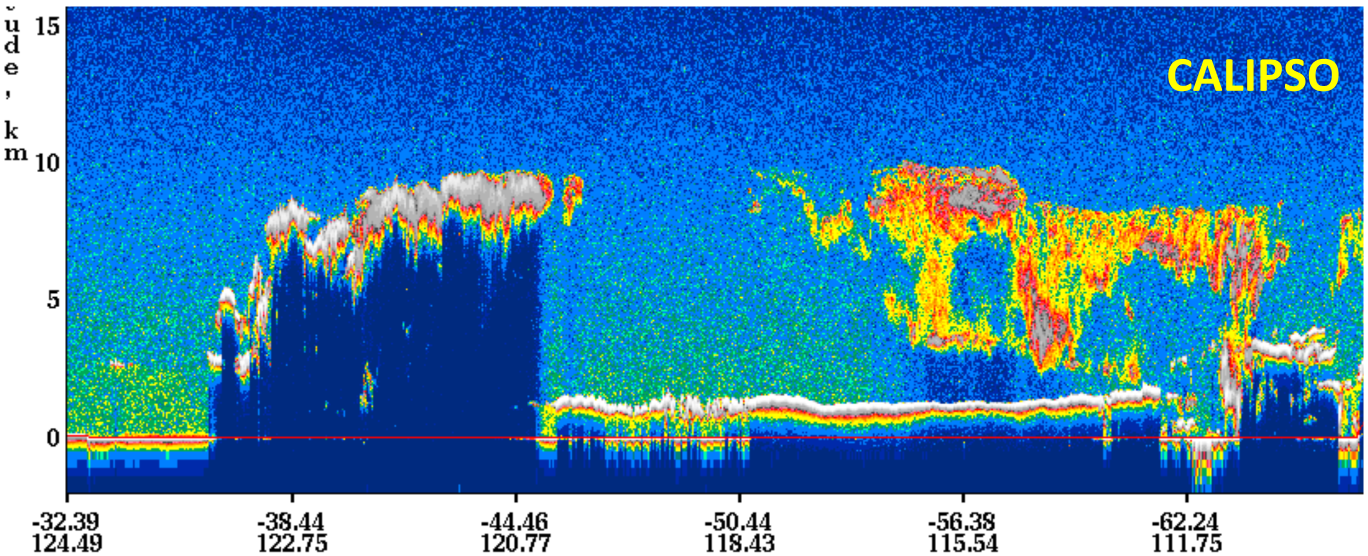
IPCC AR5:
"The application of new observations, such as vertically resolved cloud information from satellites … has enhanced the ability to evaluate processes in climate models … Major progress in this area has resulted from both the availability of new observational data sets …"

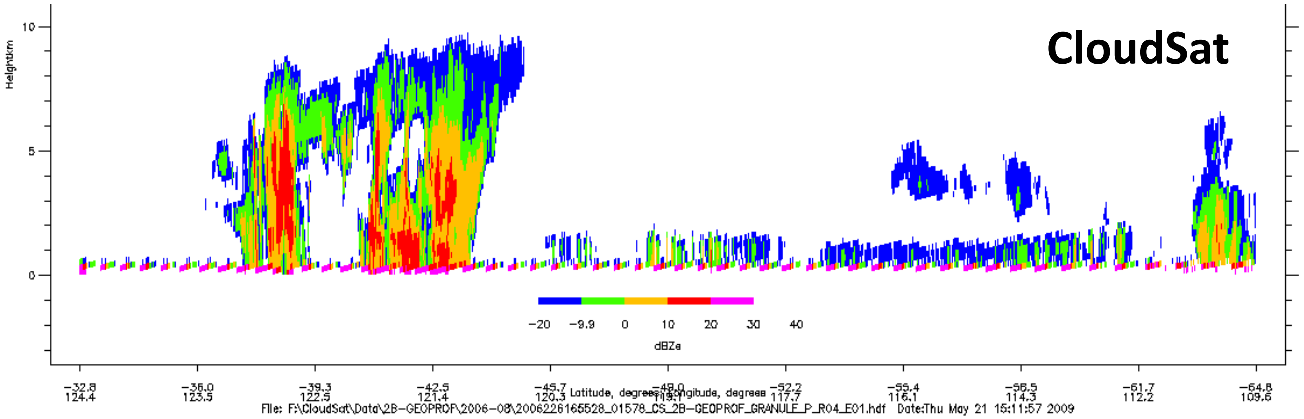
Models show large regional biases in shortwave cloud radiative effects, and these are particularly pronounced in the subtropics …



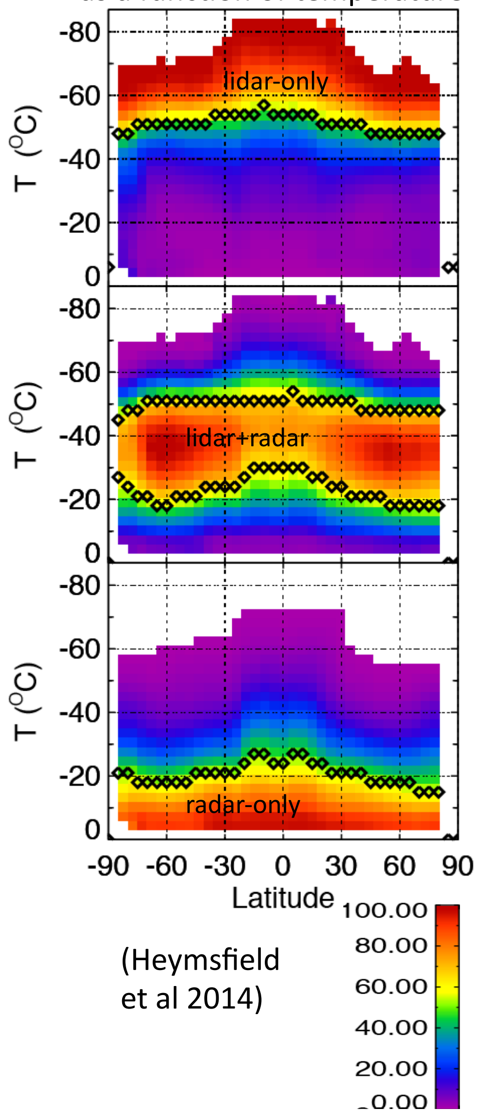
(Nam et al. 2012)

Lidar and Radar are Complementary



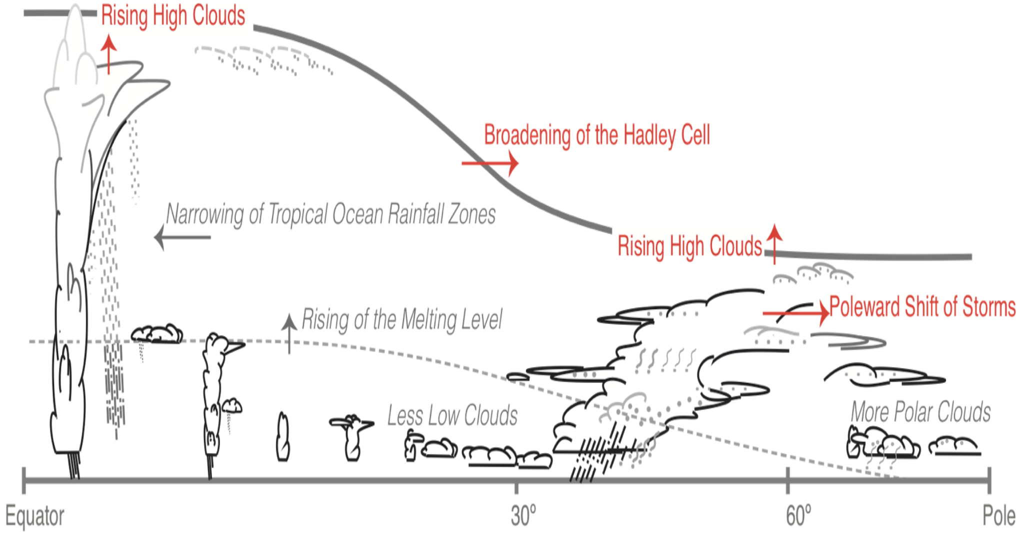


Probability of cloud detection as a function of temperature

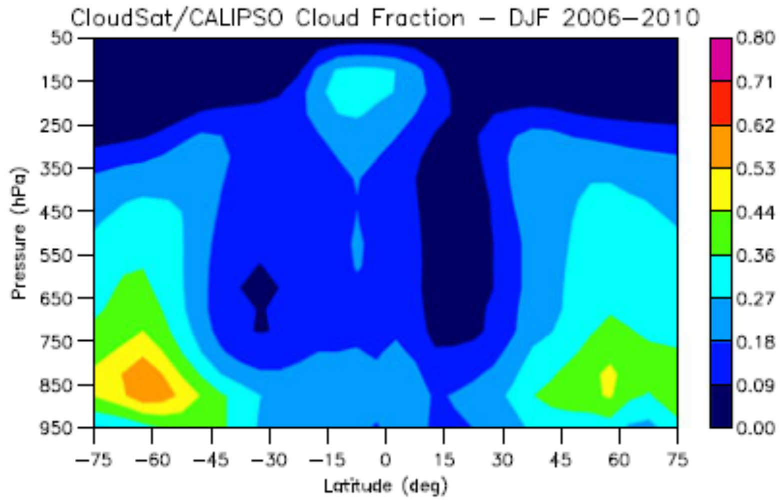


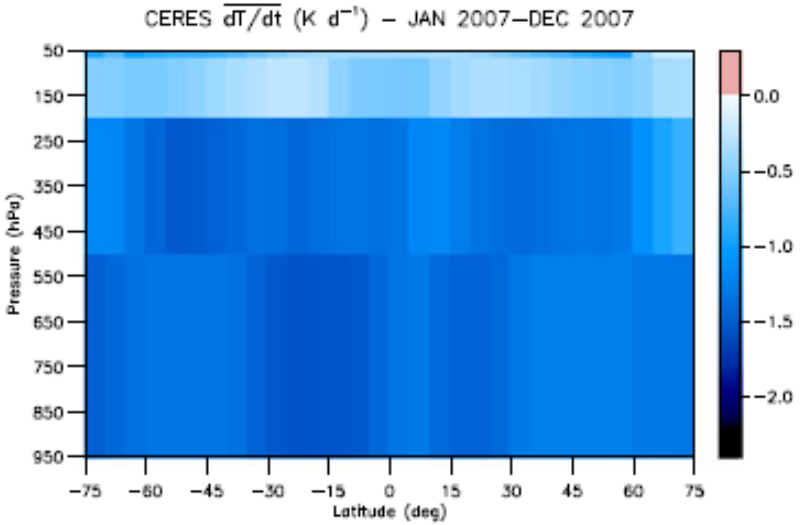
(Heymsfield et al 2014)

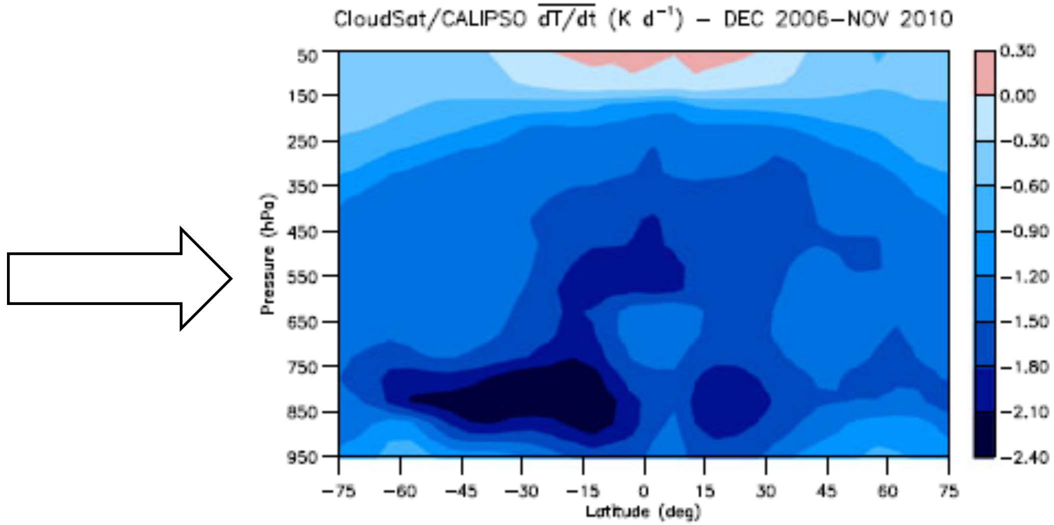
from ***cloud radiative effects*** *to the coupling of* ***clouds and circulation***



CALIOP + CloudSat



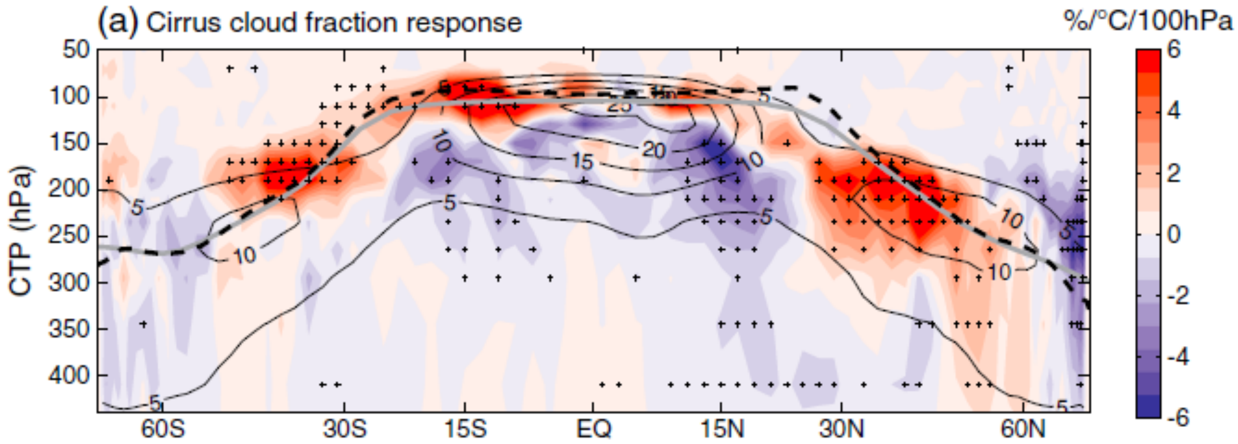




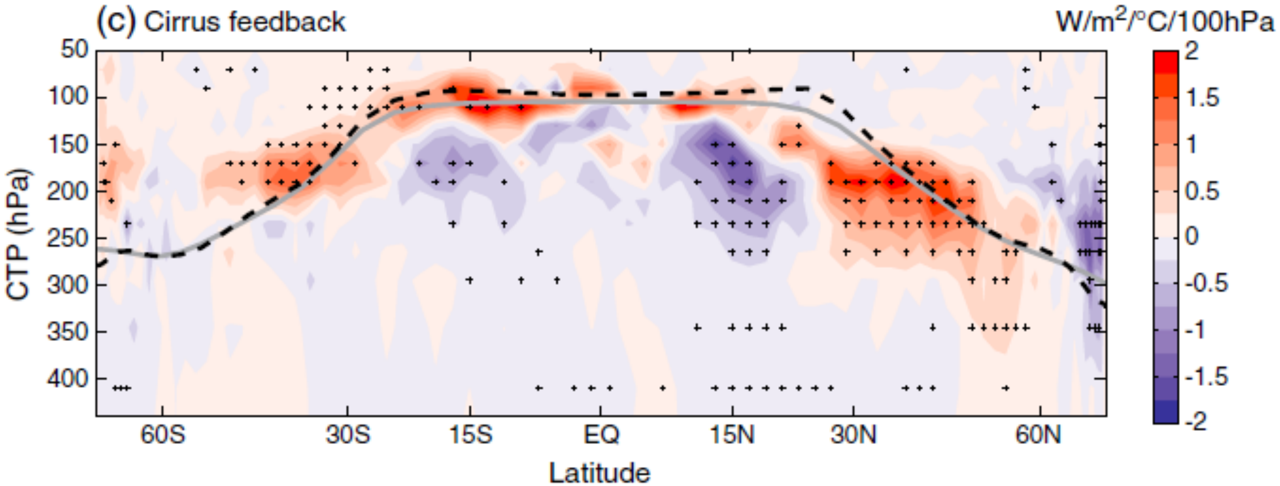
(Haynes et al., 2013)

Cloud-Climate Feedbacks

- Due to CALIPSO's extended mission, cloud feedbacks have been estimated from observed interannual variability



Response of cirrus cloud fraction to inter-annual surface warming (shading). (contours: mean cirrus cloud fraction)



Cirrus radiative feedback as a function of latitude and altitude.

(Zhou and Dessler, 2014)

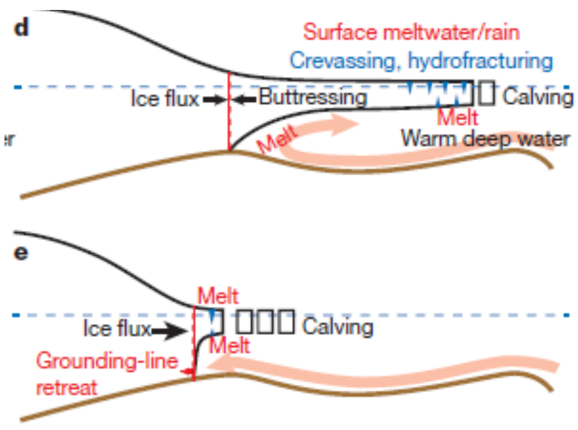
An unexpected result: Meltpond detection

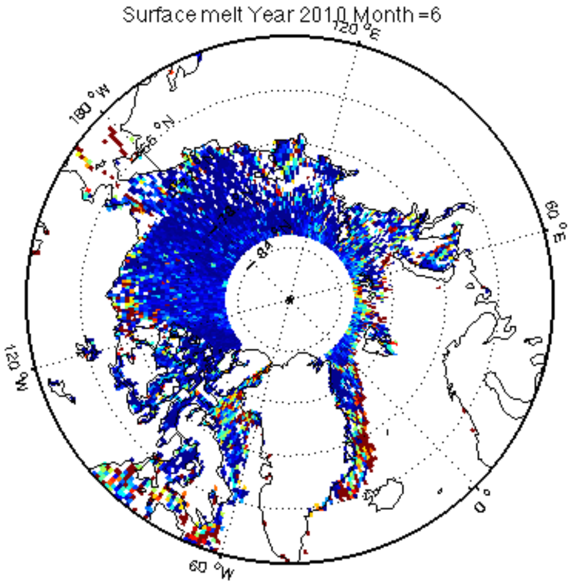
ARTICLE

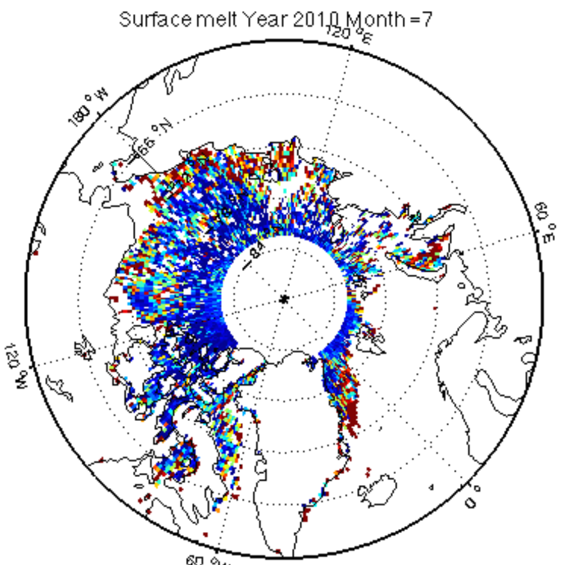
doi:10.1038/nature17145

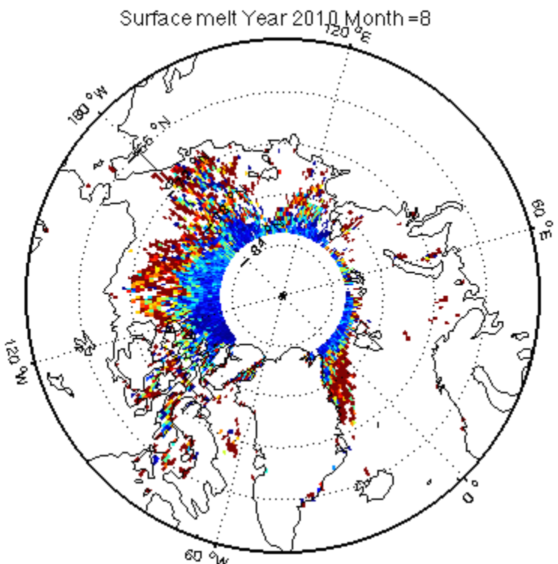
Contribution of Antarctica to past and future sea-level rise

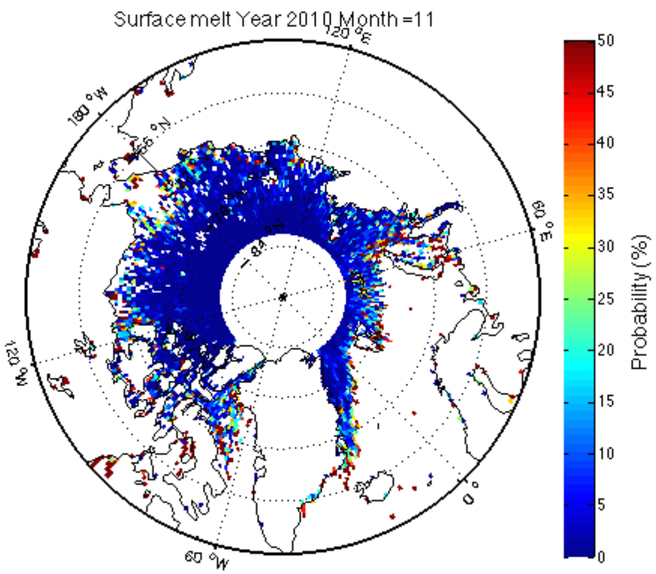
Robert M. DeConto[1] & David Pollard[2]











Monthly distribution of sea-ice meltponds (March-Nov 2010)

Celebrating a 20-year collaboration!