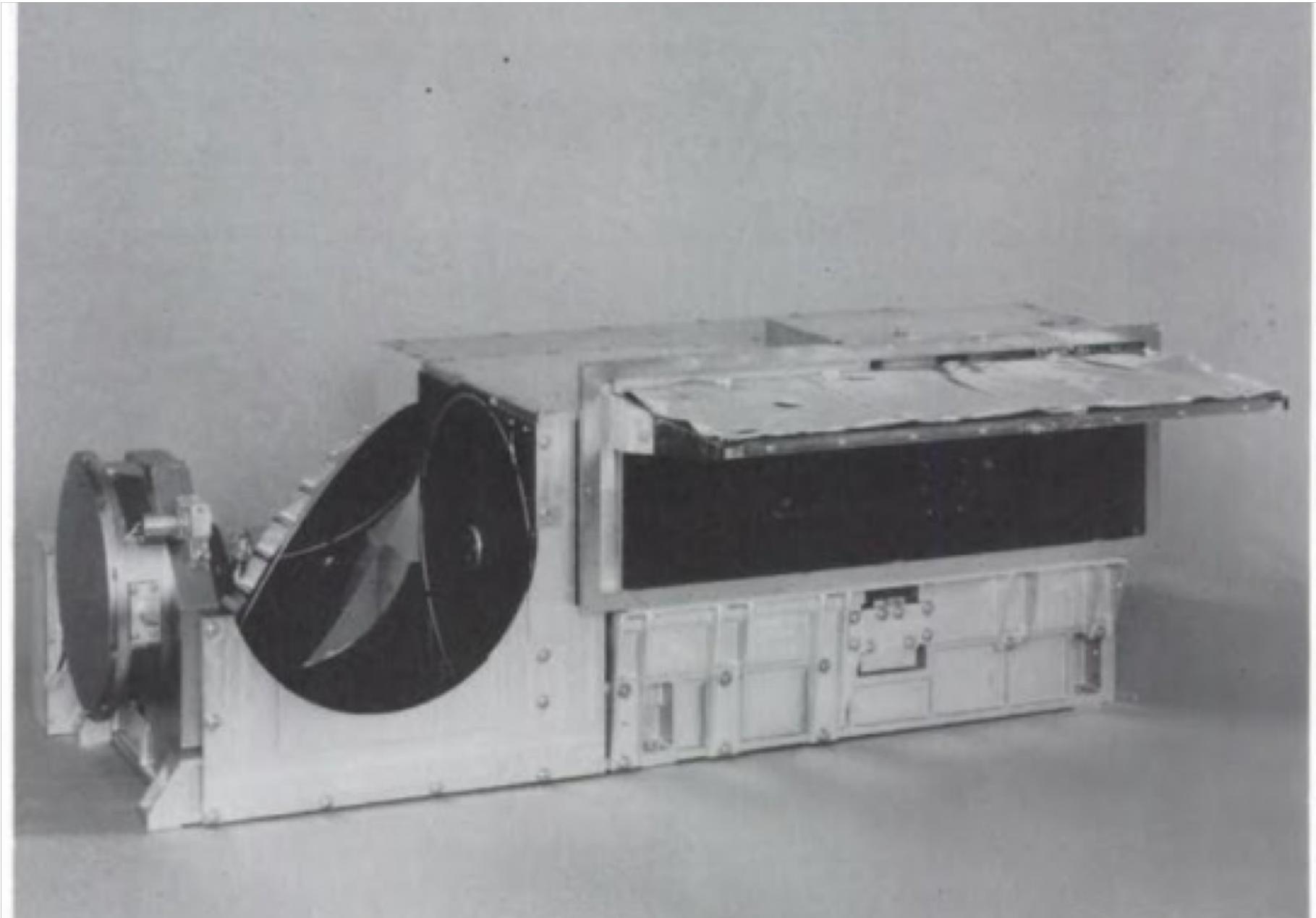


Space Instruments of the day: AVHRR (Advanced Very High Resolution Radiometer) & MODIS (MODerate-resolution Imaging Spectro-radiometer)

Optik, Strahlung, Fernerkundung

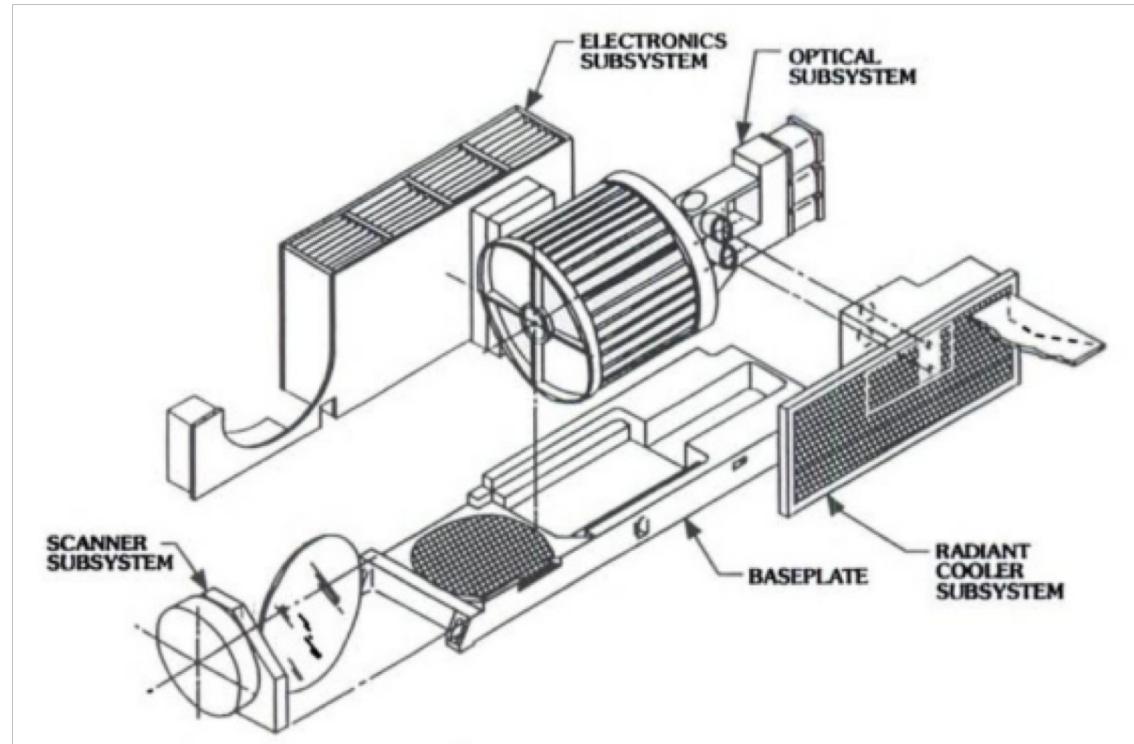
Stefan Bühler
Meteorologisches Institut
Universität Hamburg

AVHRR (Brought to you by M. Burgdorf)



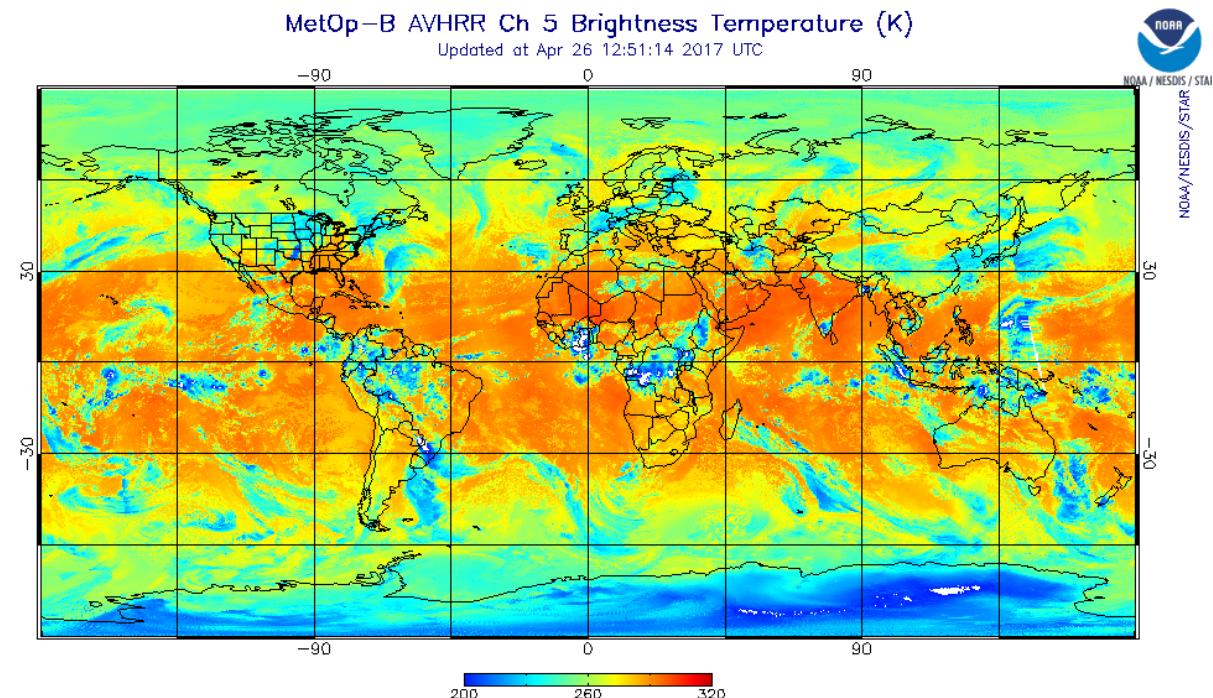
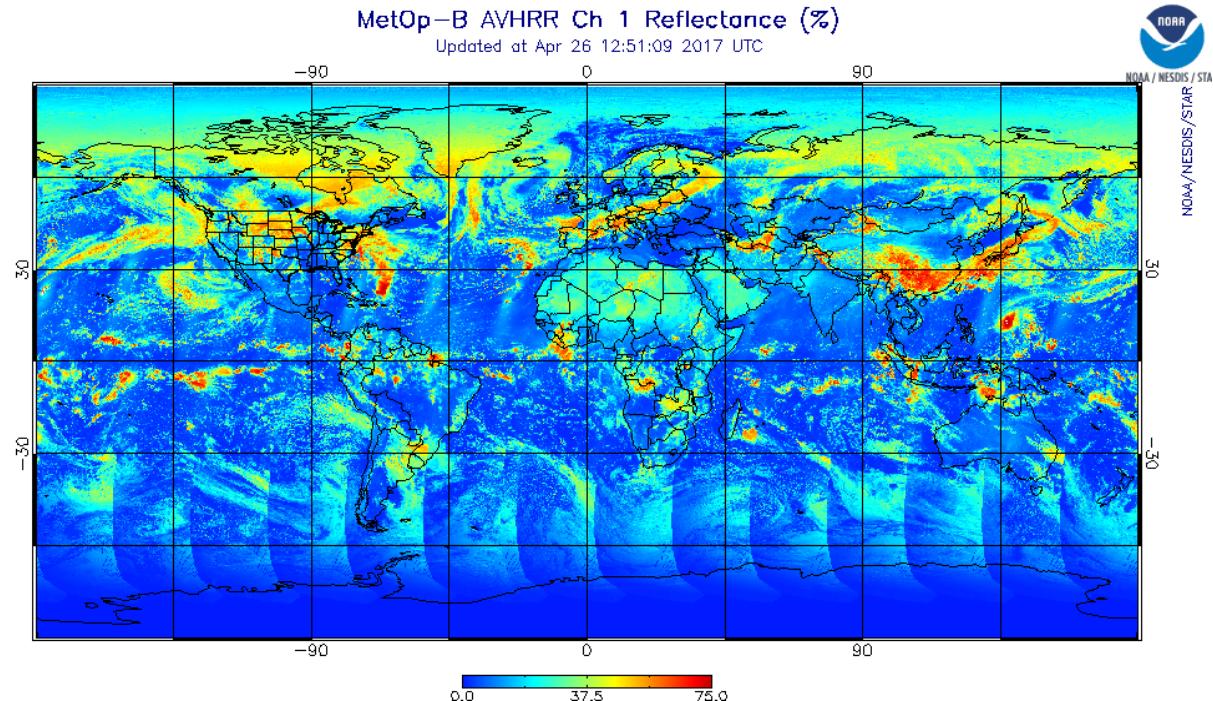
Fact File AVHRR

- ✓ On NOAA 4th and 5th gen / Polar Operational Environmental Satellites and EUM Polar System
- ✓ Multi-purpose imagery
- ✓ 4 – 6 channel radiometer covering VIS, NIR, (SWIR,), MWIR and TIR
- ✓ Swath 2900 km
- ✓ Resolution 1.1 km s.s.p.
- ✓ Global coverage twice (IR) or once (VIS) per day
- ✓ AVHRR: 1979 to 2001-08
- ✓ AVHRR/2: 1981 to 2007-08
- ✓ AVHRR/3: 1998 to >2024



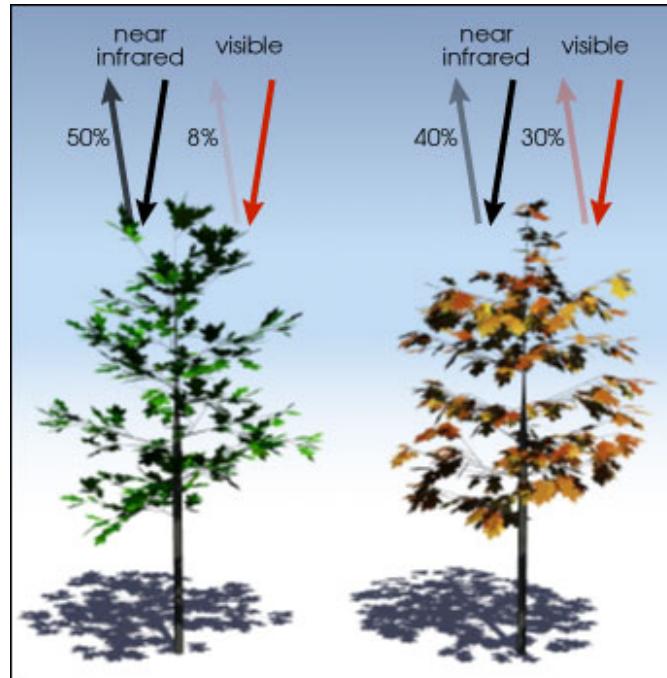
Measurements

- ✓ Radiance => Reflectance / Albedo in channels 1, 2, and 3a
- ✓ Brightness Temperature in channels 3b, 4, and 5



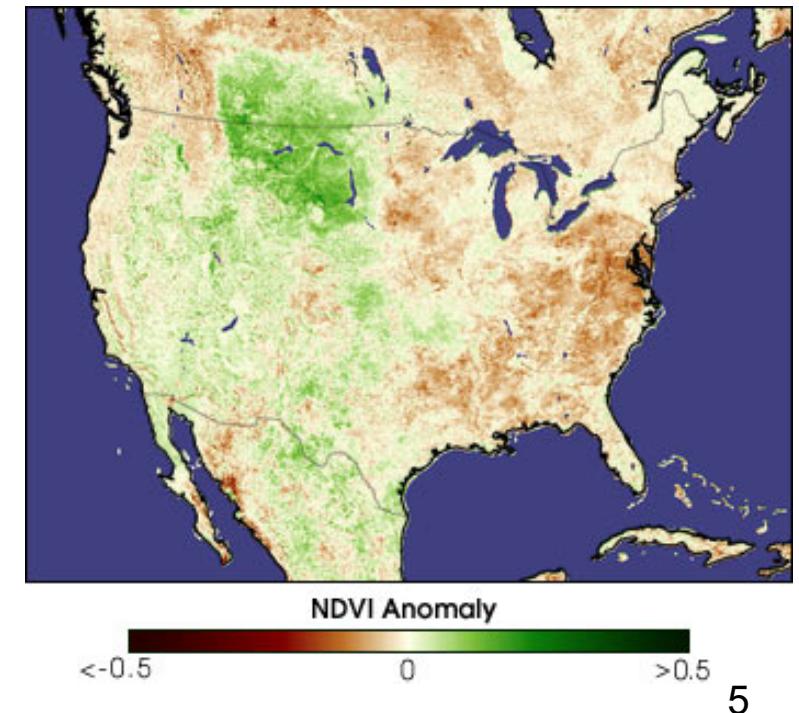
Scientific Applications AVHRR

- ✓ Cloud
 - cover
 - optical depth
 - top height
 - top temperature
 - type



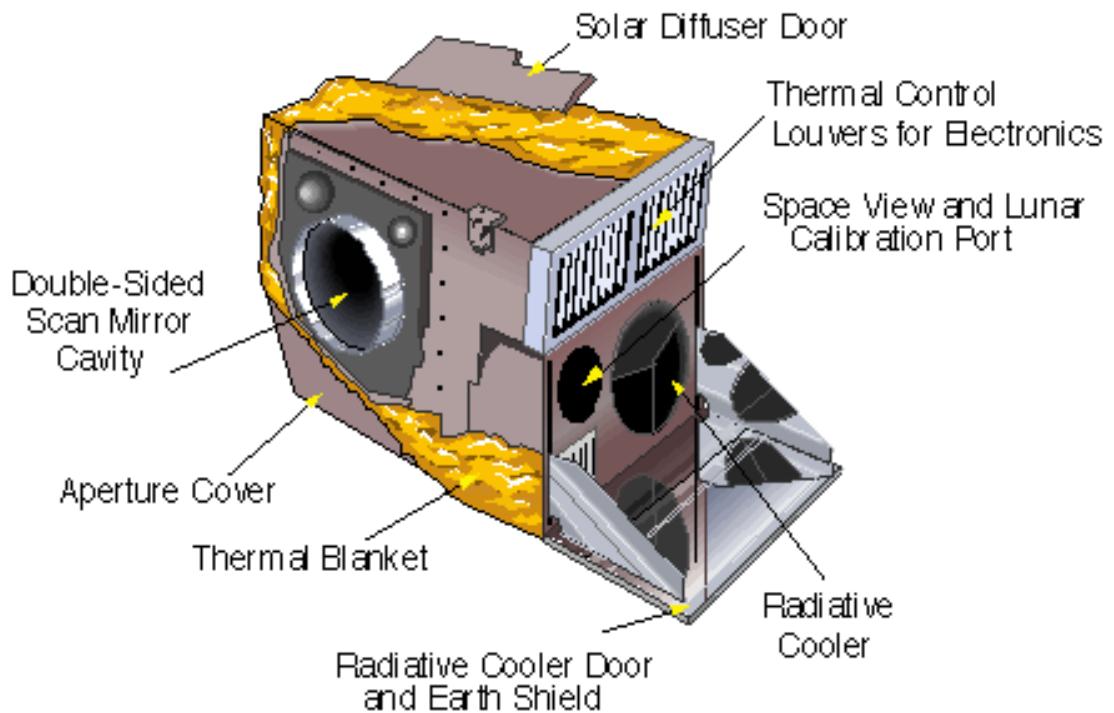
$$\frac{(0.50 - 0.08)}{(0.50 + 0.08)} = 0.72$$

$$\frac{(0.4 - 0.30)}{(0.4 + 0.30)} = 0.14$$



Fact File MODIS

- ✓ On Terra and Aqua (NASA)
- ✓ Multi-purpose imagery
- ✓ 36 channel VIS/IR spectroradiometer
- ✓ Swath 2230 km
- ✓ Resolution 0.25 - 1 km at s.s.p.
- ✓ Global coverage twice (long-wave) or once (short-wave channels) per day
- ✓ 2000-02-23 to >2017

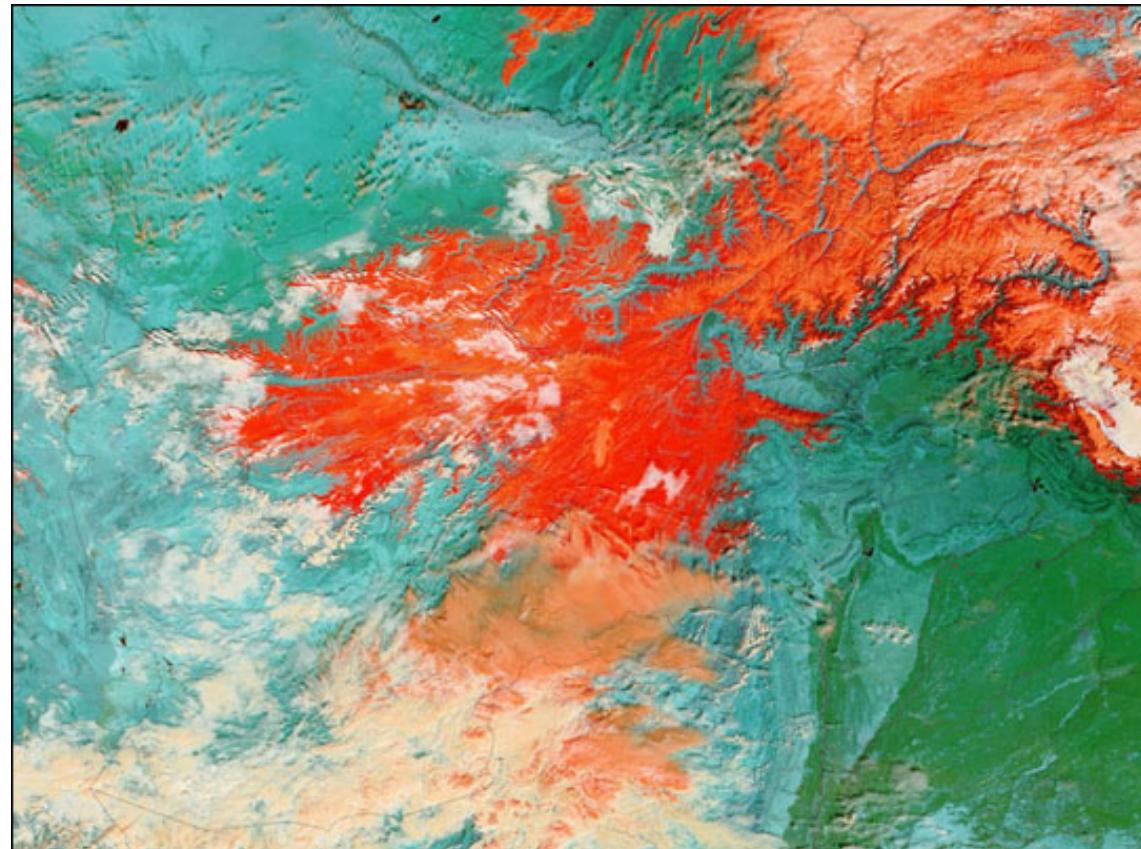


Von National Aeronautics and Space Administration Goddard Space Flight Center -
National Aeronautics and Space Administration Goddard Space Flight Center,
Gemeinfrei, <https://commons.wikimedia.org/w/index.php?curid=14970856>

Scientific Applications

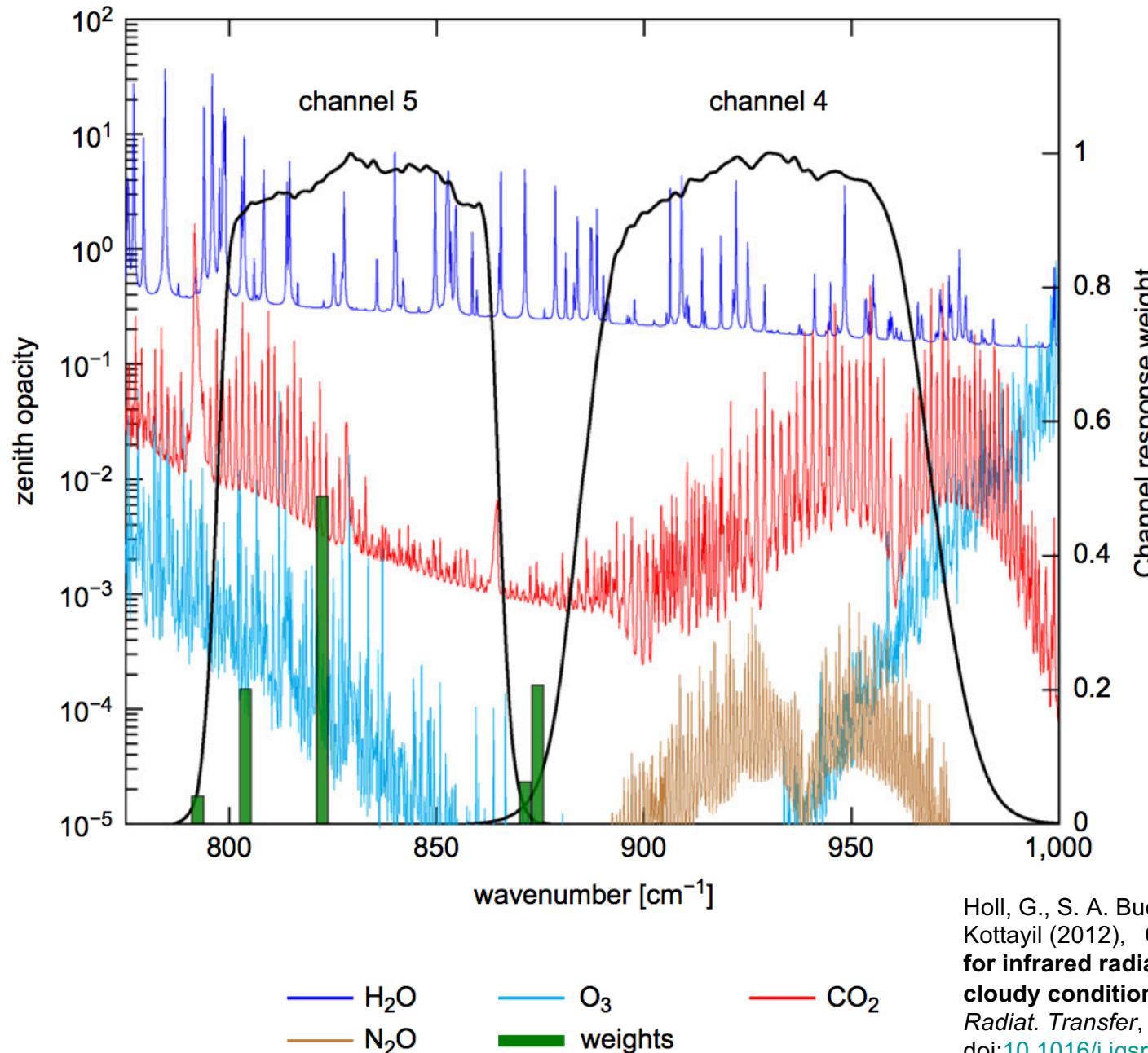
MODIS

- ✓ Cloud
 - cover
 - optical depth
 - top height
 - top temperature
 - type
- ✓ Integrated Water Vapor
- ✓ Oil spill cover
- ✓ Sea surface temperature
- ✓ Sea-ice cover
- ✓ Biomass
- ✓ Snow cover



AVHRR

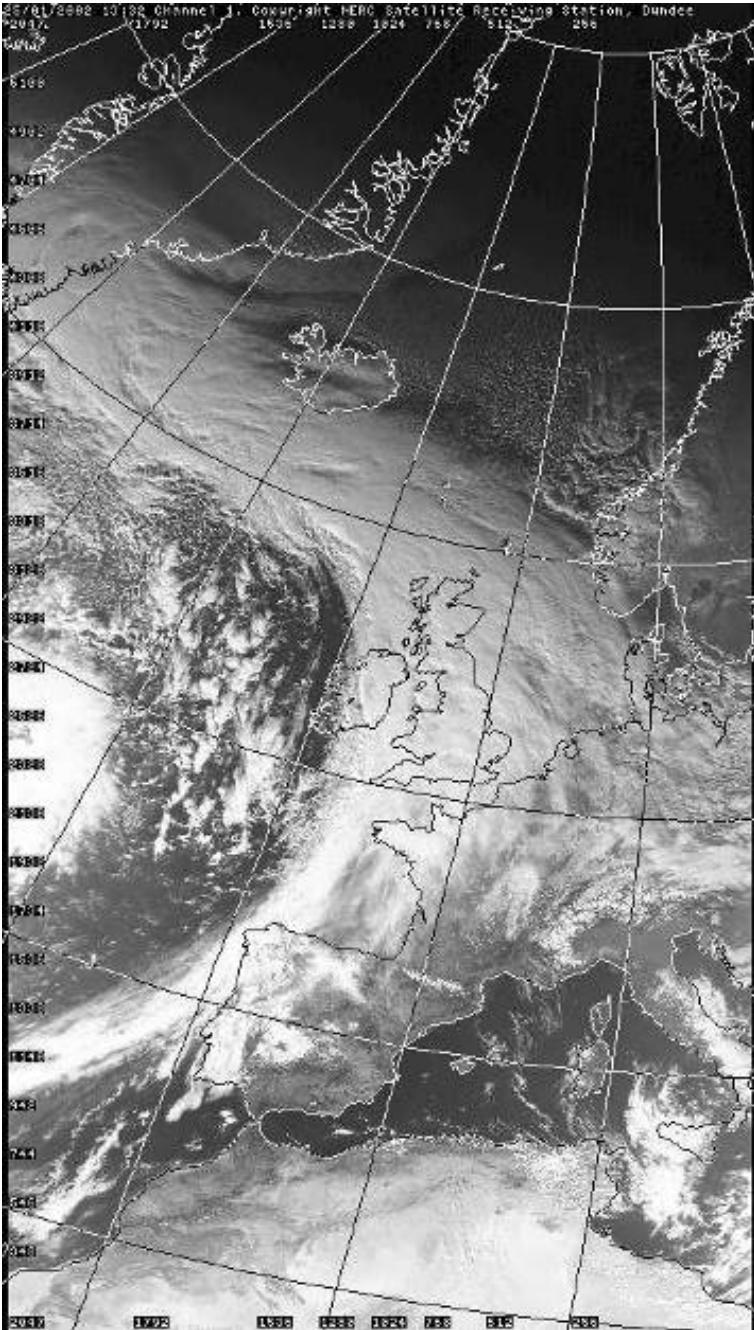
NOAA-19 AVHRR SRFs and ARTS-simulated opacity



Hohe
horizontale
Auflösung
(1 km statt
HIRS 50 km)

Dafür
schlechter
kalibriert

Holl, G., S. A. Buehler, J. Mendrok, and A. Kottayil (2012), **Optimised frequency grids for infrared radiative transfer simulations in cloudy conditions**, *J. Quant. Spectrosc. Radiat. Transfer*, **113**, 2124–2134, doi:[10.1016/j.jqsrt.2012.05.022](https://doi.org/10.1016/j.jqsrt.2012.05.022).



AVHRR Bild im sichtbaren Spektralbereich

Wolken reflektieren
Sonnenlicht und sind deshalb
hell.

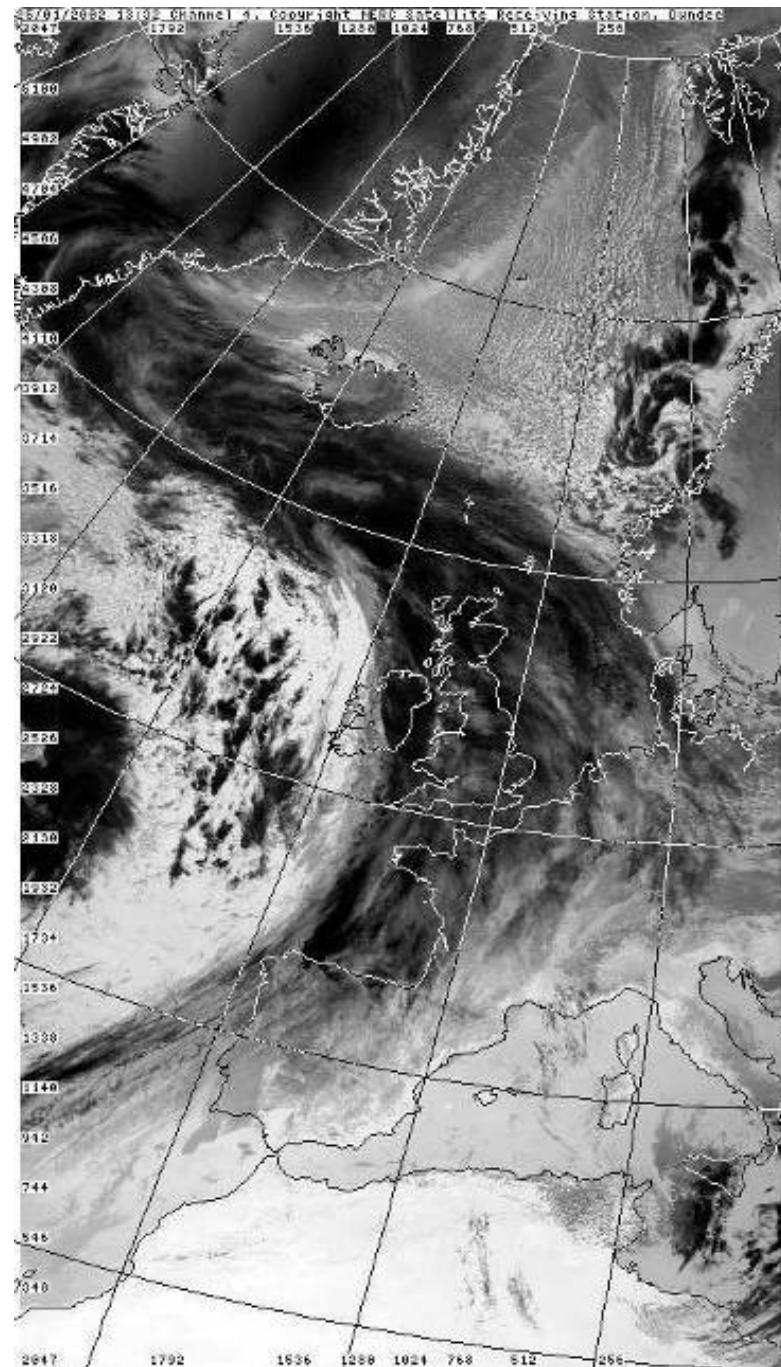
(AVHRR, Channel 1, 580-680nm,
25.1.2002, 13:30 UTC, Data
Source: Met Office / Dundee
Receiving Station)

AVHRR Bild im thermisch-infraroten Spektralbereich

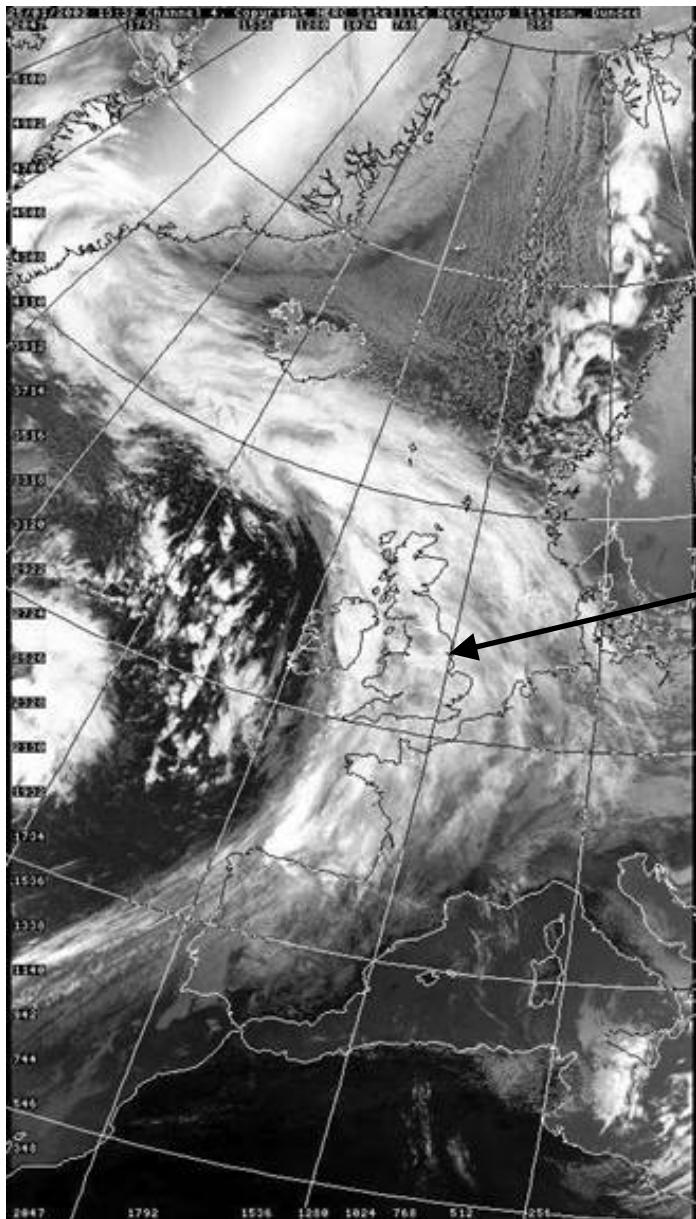
Wolken sind kälter als der Erdboden und reduzieren daher die IR Abstrahlung

- ① So sehen Satellitenbilder aber nie aus, warum?

(AVHRR, Channel 4, 10.3-11.3μm,
25.1.2002, 13:30 UTC, Data source: Met Office / Dundee Receiving Station)



AVHRR Infrarot Bild



Bei Infrot-Kanälen wird die grau-Farbskala einfach umgedreht, so dass die Wolken wieder hell erscheinen.

Wolken,
heller = kälter
= höher