

Waves and clouds in the atmosphere above the southern Andes as seen by the CORAL Rayleigh lidar

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Knowledge for Tomorrow



“Strange clouds”

- high altitude
- southern hemisphere mid-latitudes

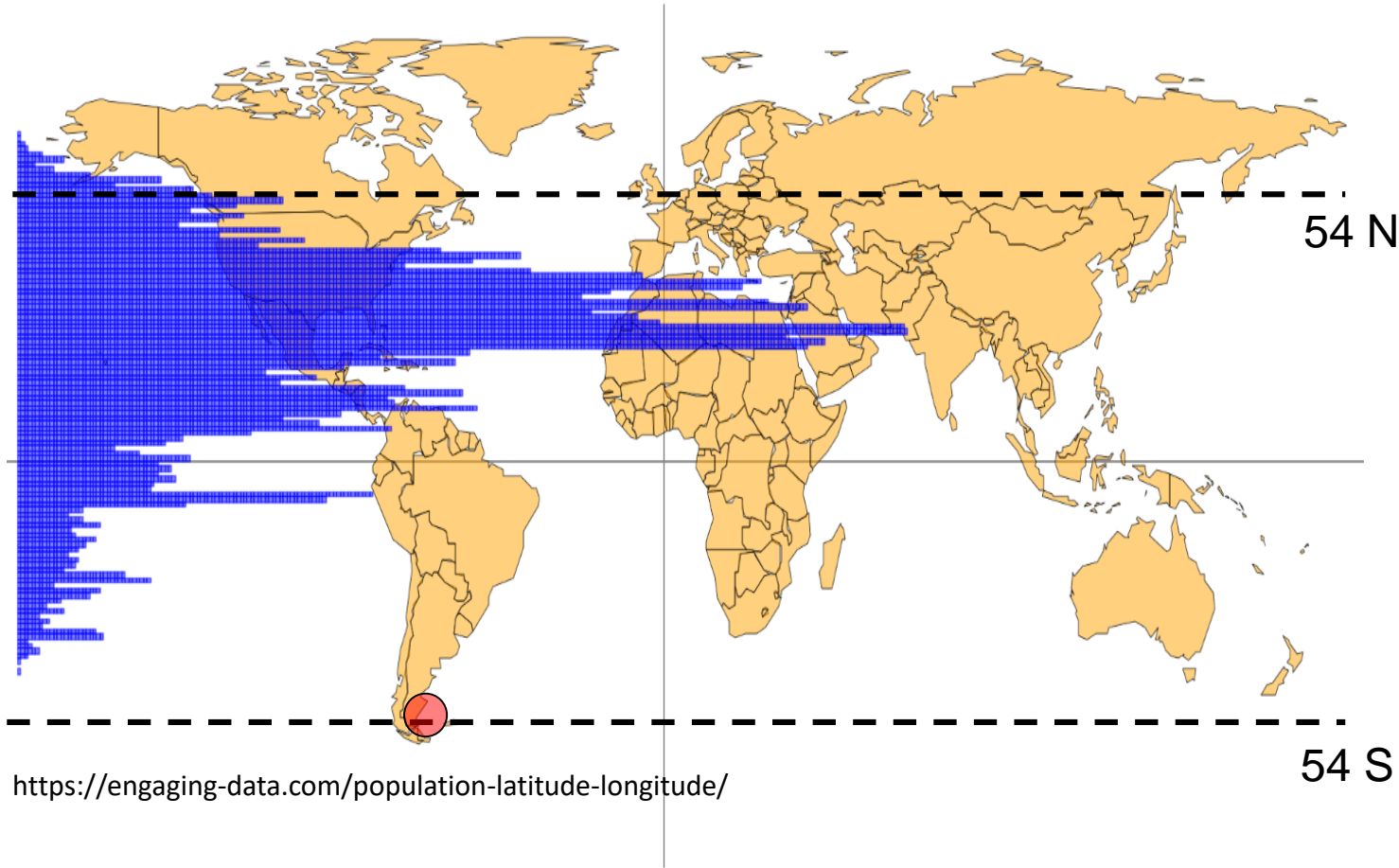


Polar stratospheric clouds, 11 Sep 2019, El Calafate, Dörnbrack et al., Weather, 2020



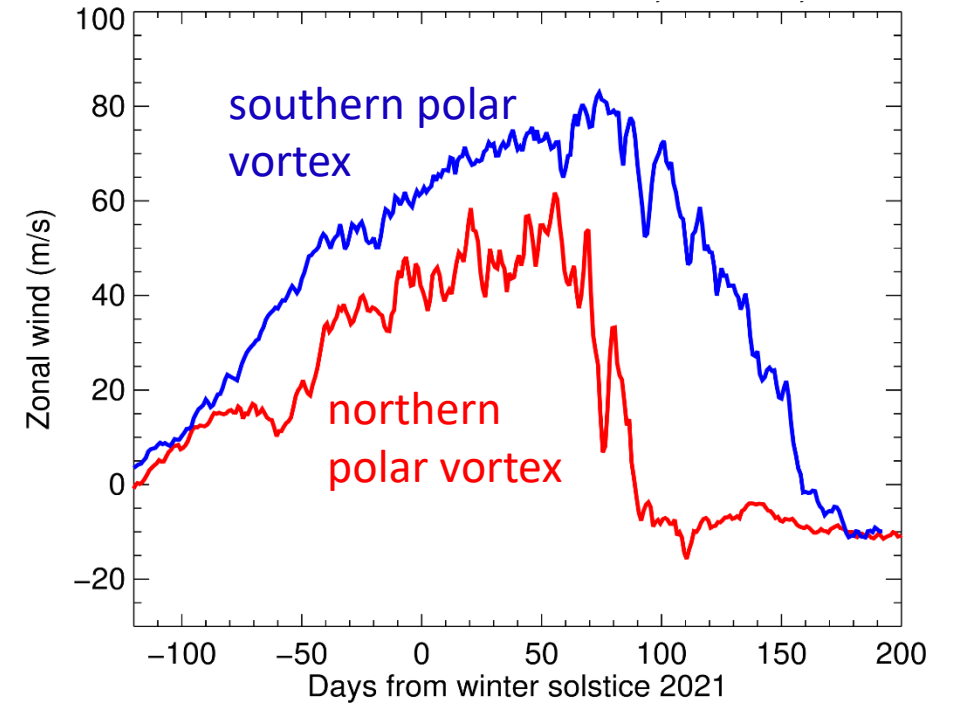
wildfire smoke, 6 Jan 2020, NASA

The southern hemisphere

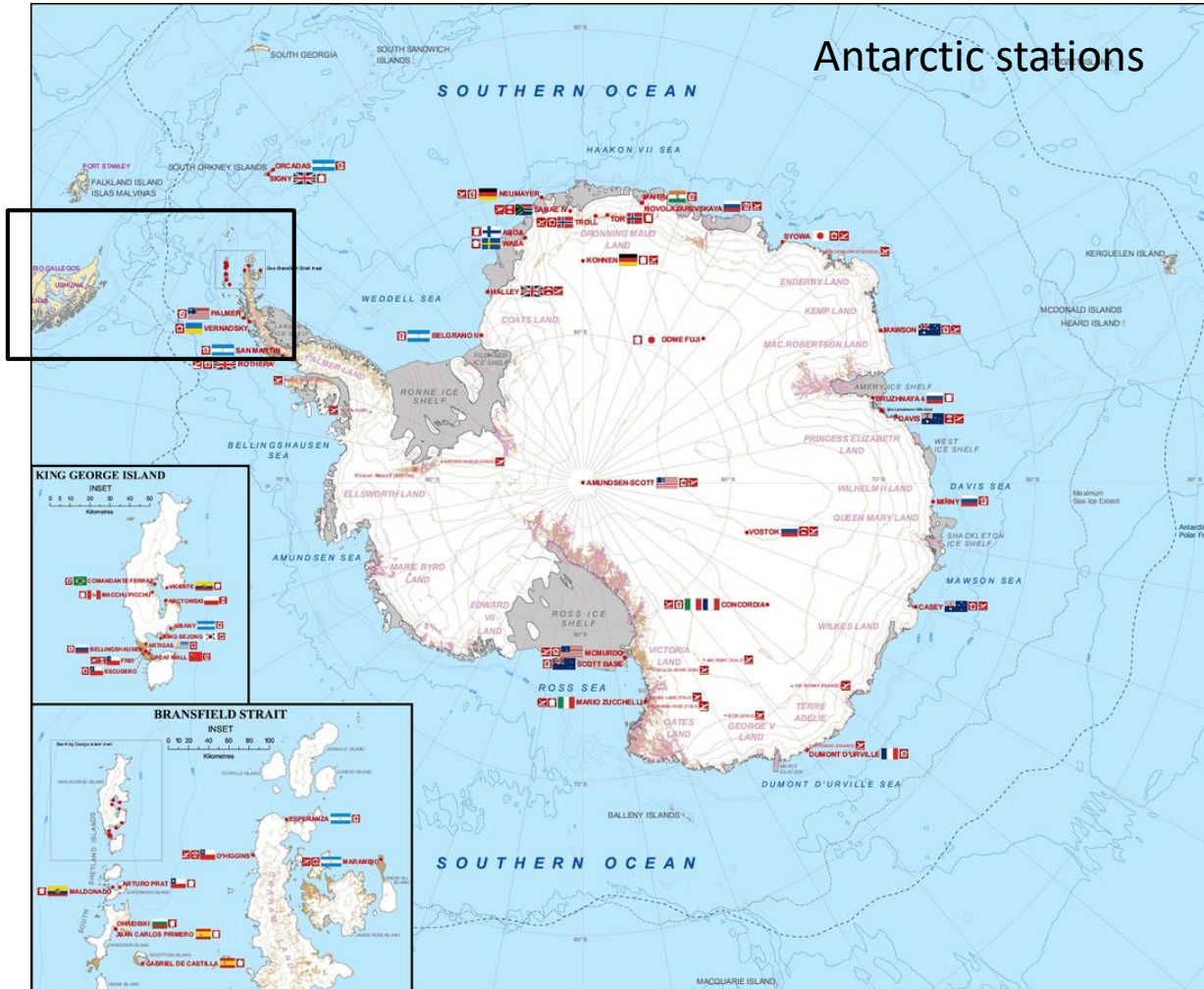


<https://engaging-data.com/population-latitude-longitude/>

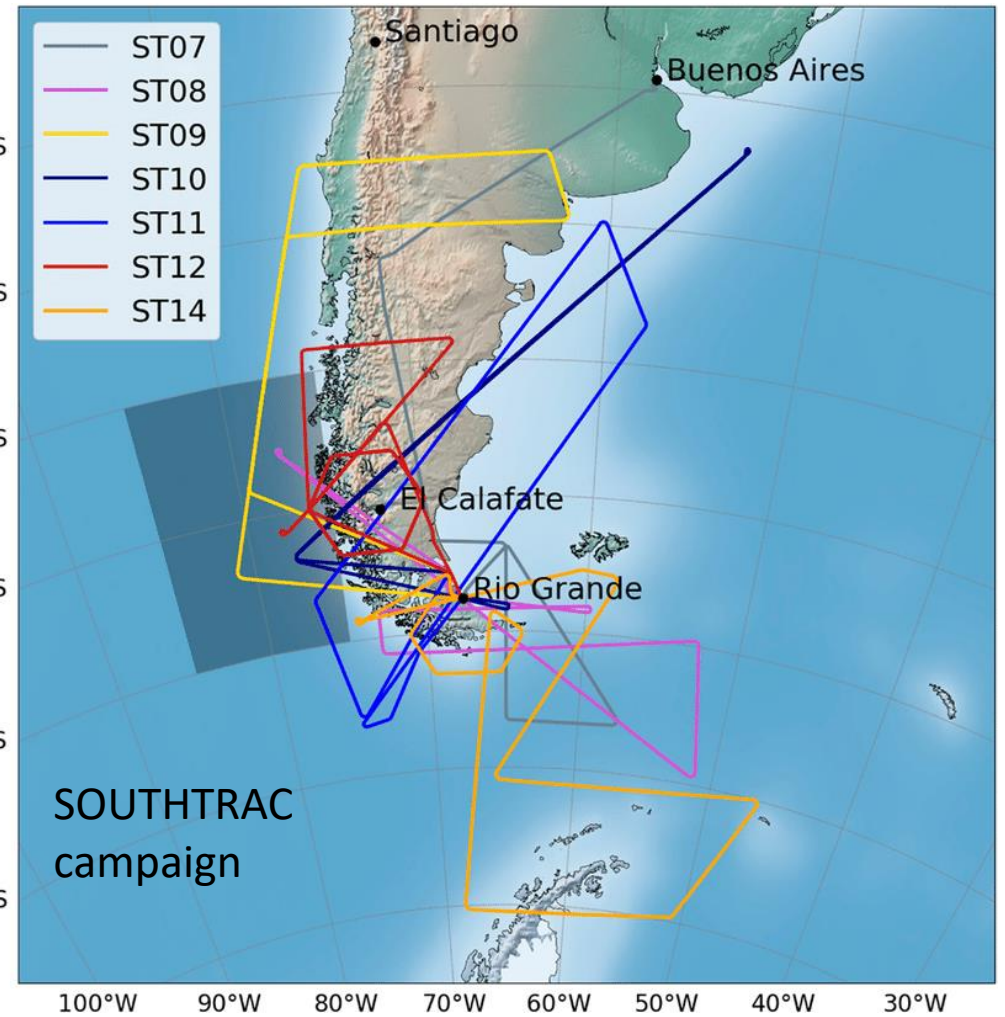
ERA5 zonal mean zonal wind, 10 hPa, 60 deg N/S



A “scientific hotspot”



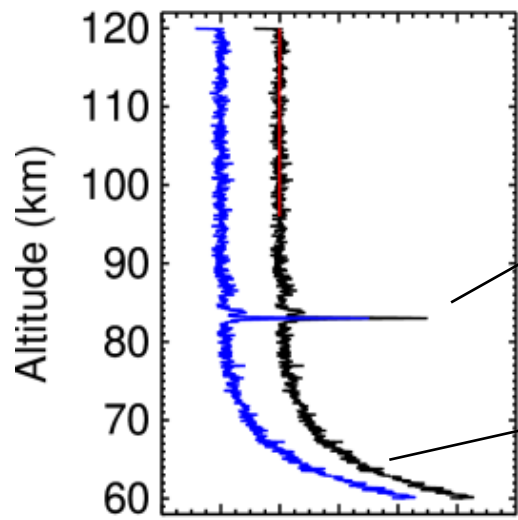
Wikimedia Commons



Rapp et al., BAMS, 2021



Light Detection and Ranging



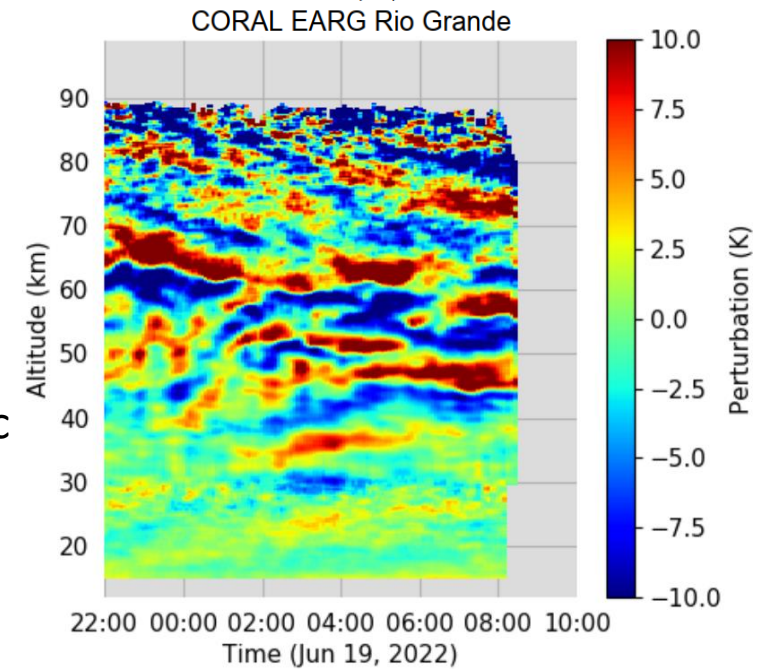
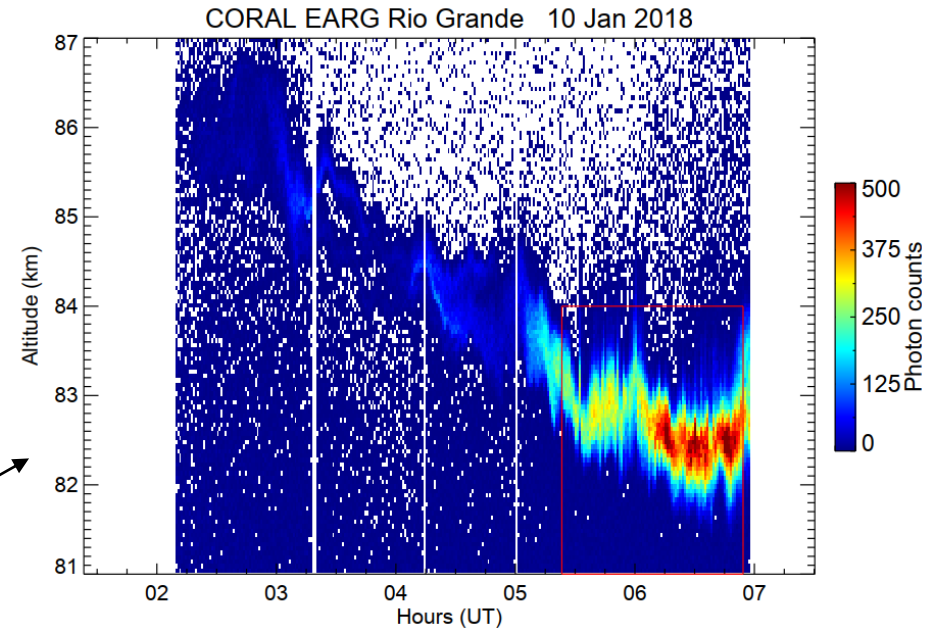
counts
Kaifler et al, ESSD, 2022

The lidar measures:

backscatter from clouds

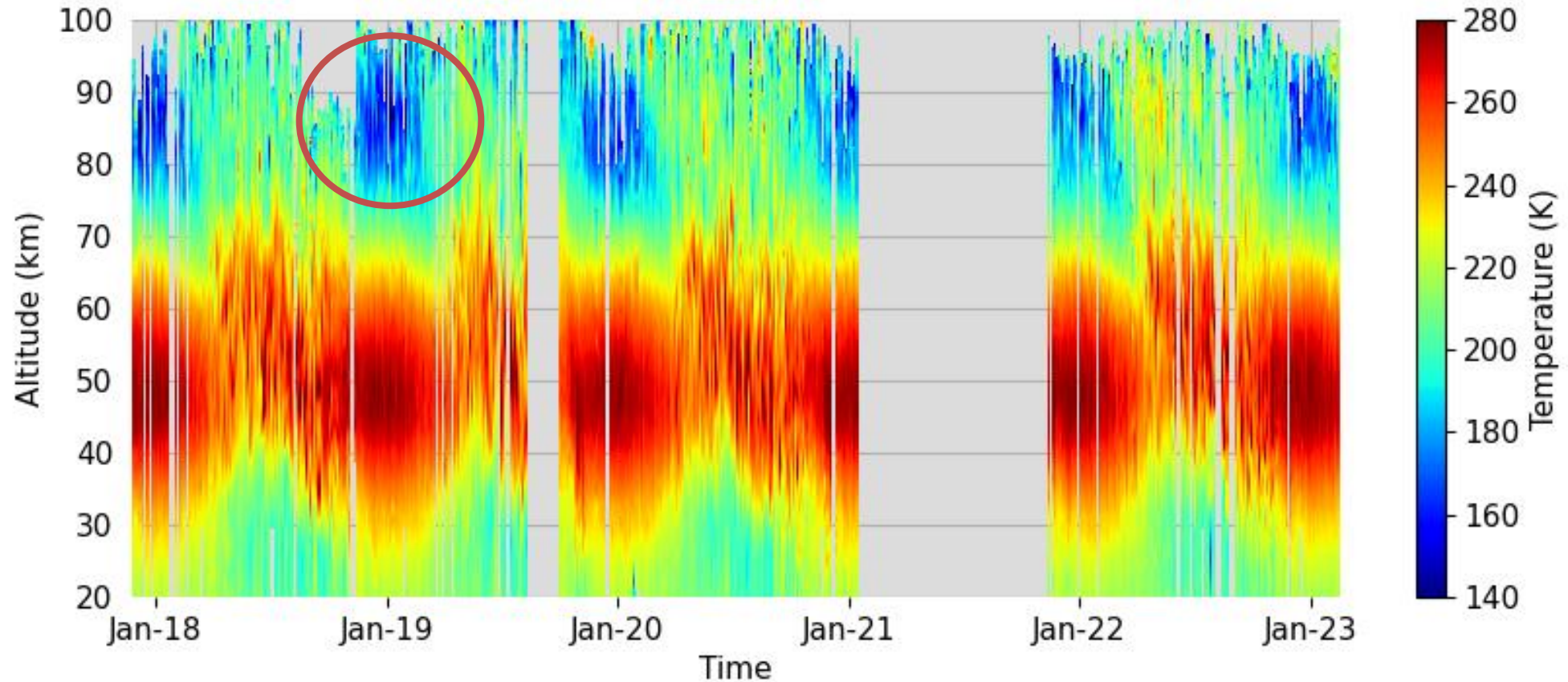
density and temperature

atmospheric waves



Regular temperature soundings at Rio Grande

German Aerospace Center (DLR) - Nightly mean temperature profiles
CORAL, Rio Grande

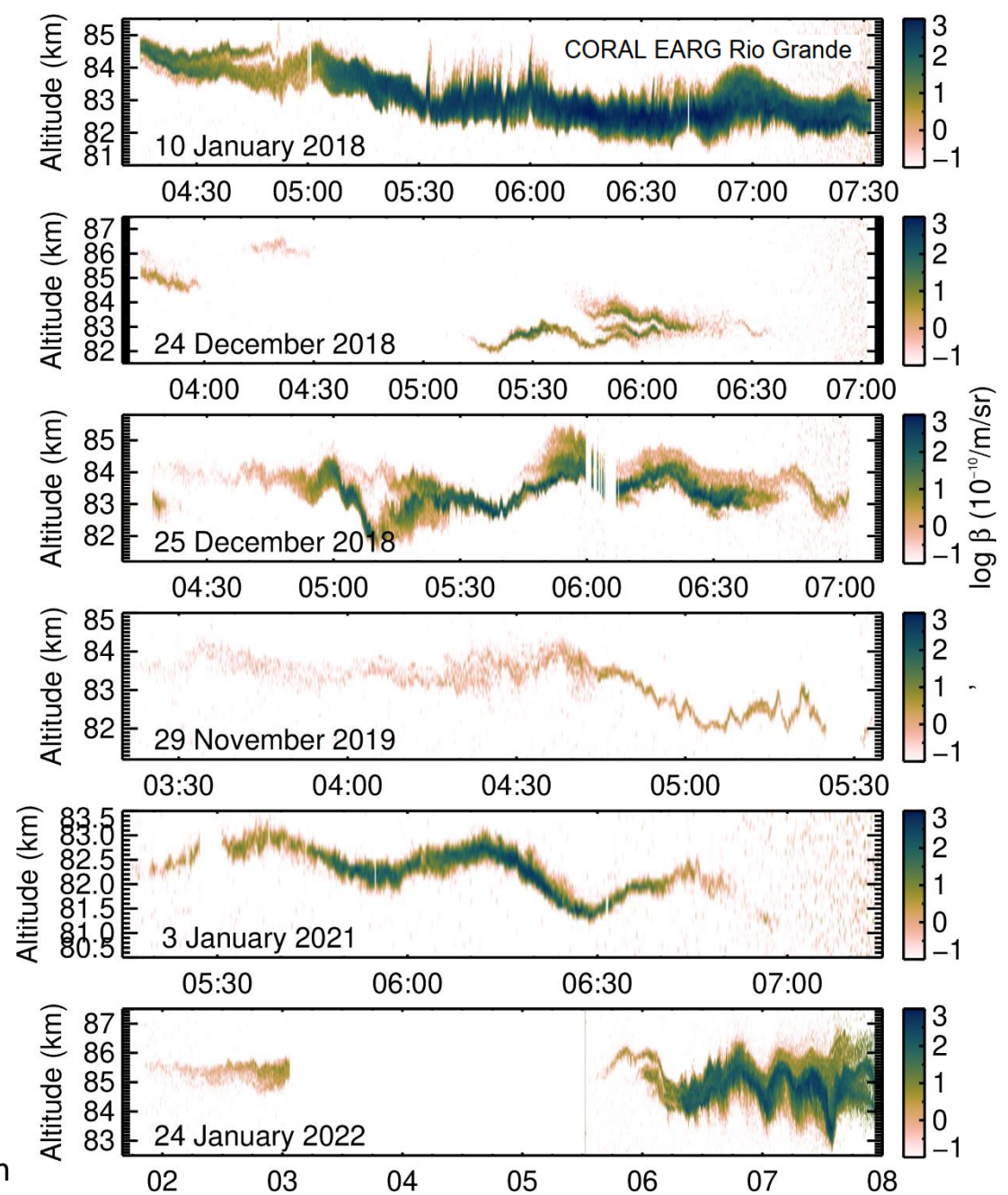


Noctilucent clouds



noctilucent clouds, 24 Jan 2022, Rio Gallegos, Gerd Baumgarten/IAP

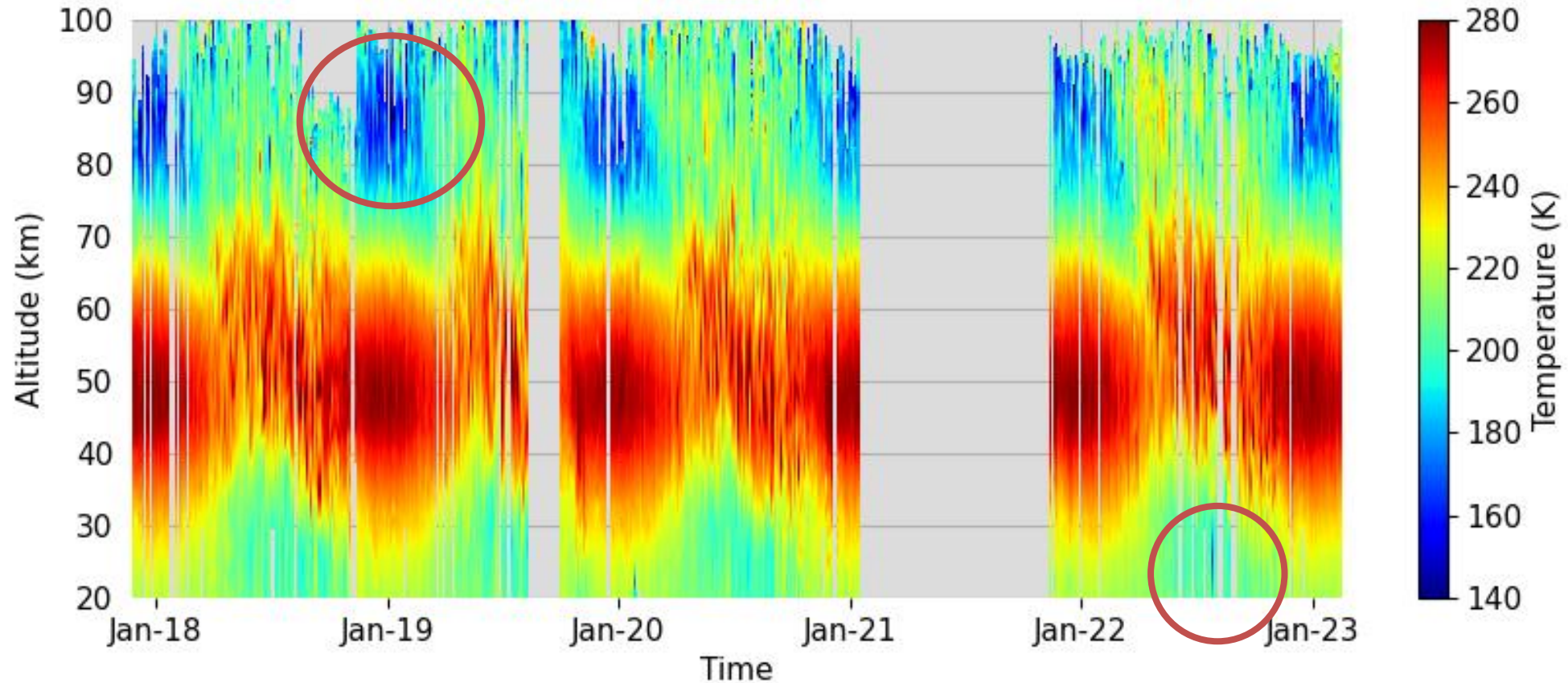
- warmer than at conjugate northern latitude
- occurrence in morning hours
- relation to tidal winds



Kaifler et al., in preparation

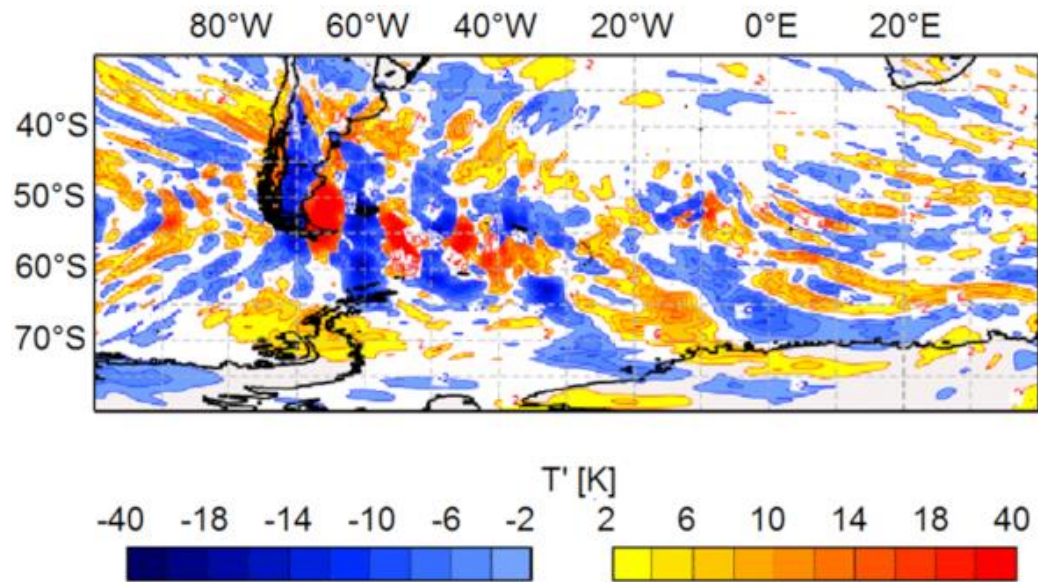
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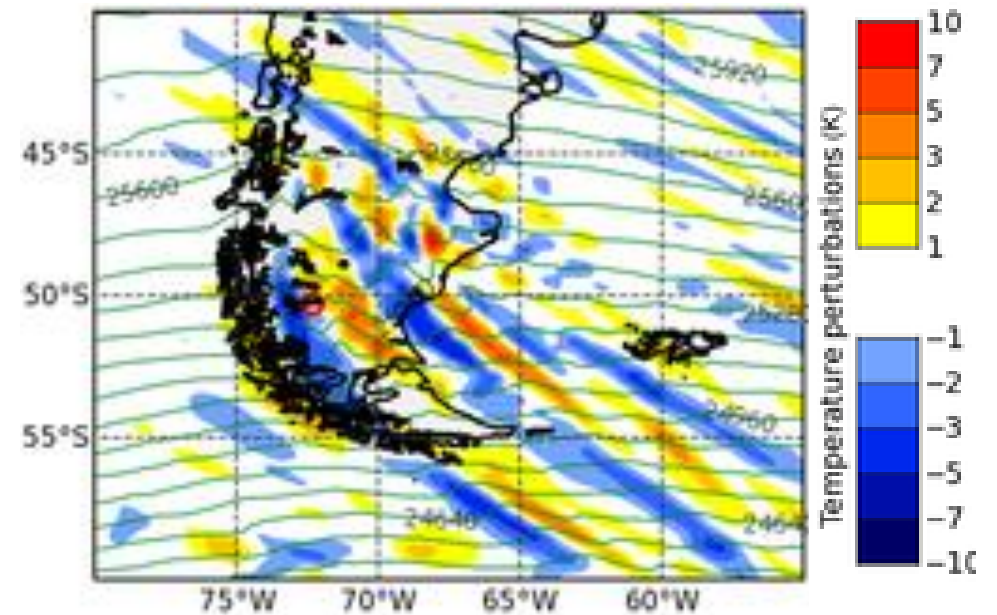


Strong mountain waves

- propagate into the mesosphere and likely thermosphere
- transport energy and momentum

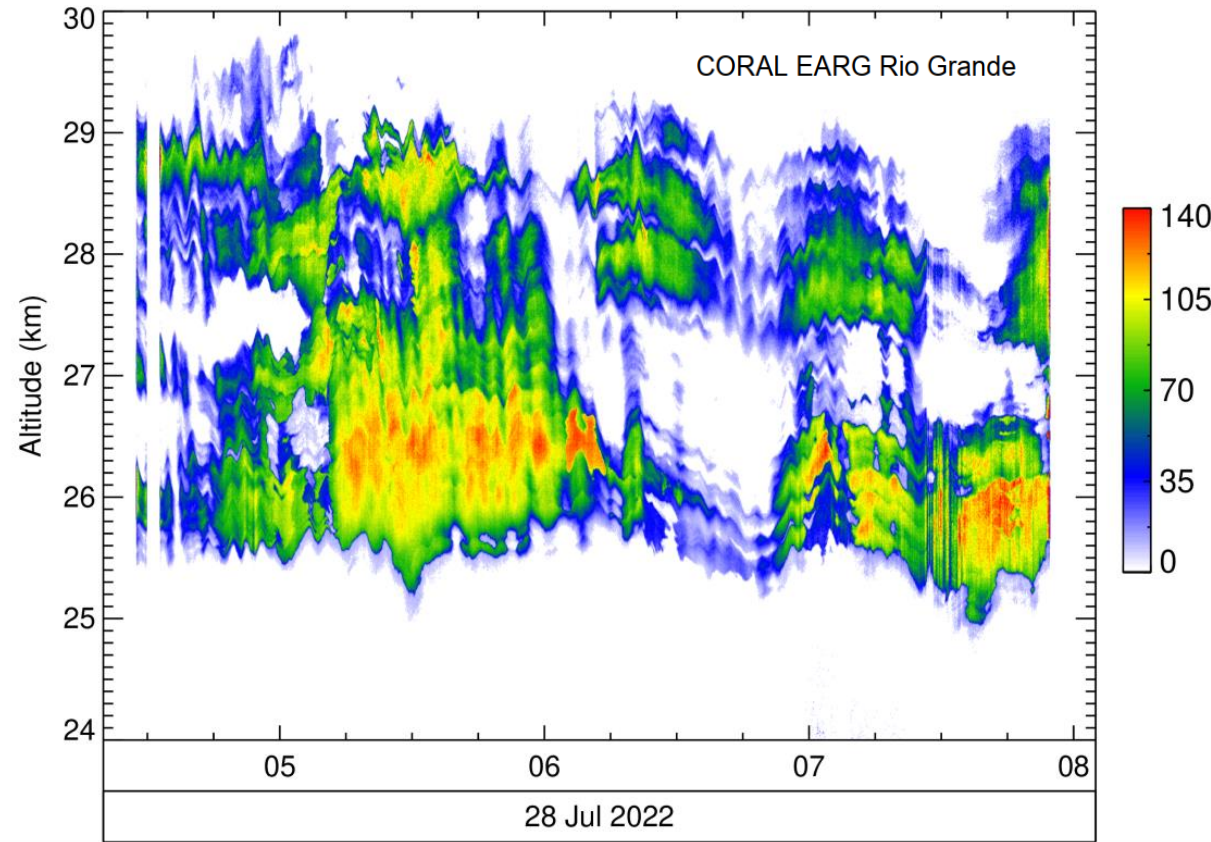


Kaifler et al., Scientific reports, 2019

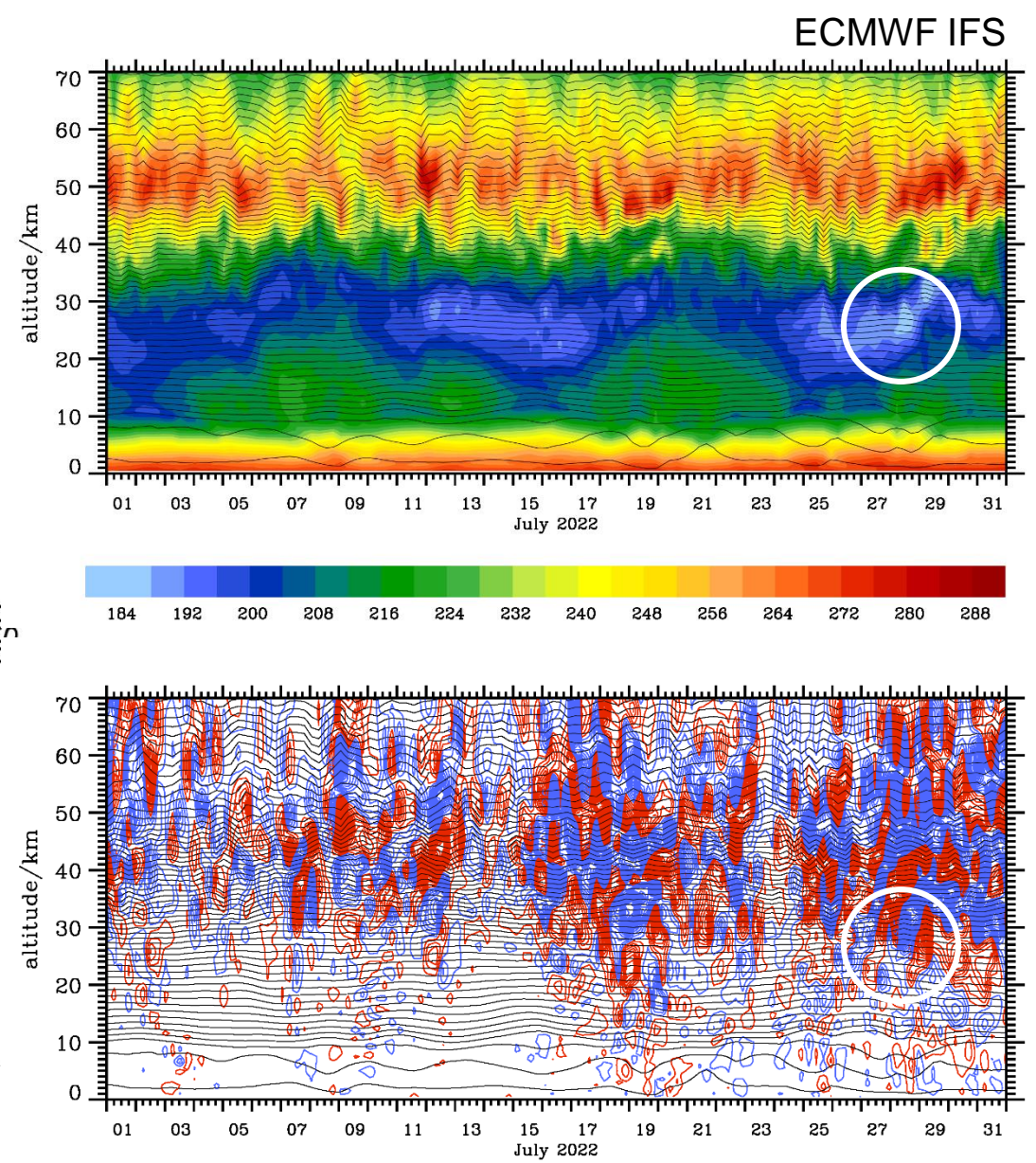


Dörnbrack et al., Weather, 2020

Polar stratospheric clouds



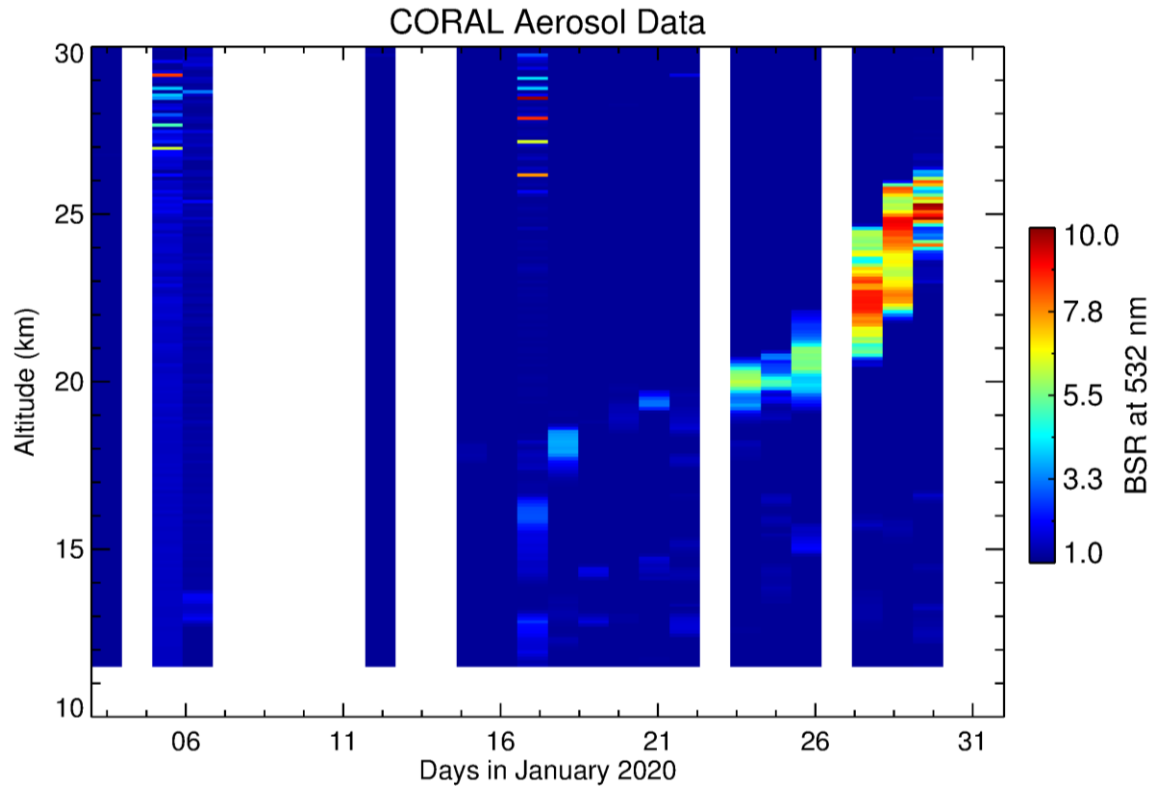
- only PSC seen by CORAL
- unusually high altitude



min/max w (z > 15 km): -94.6 cms⁻¹, 117.7 cms⁻¹

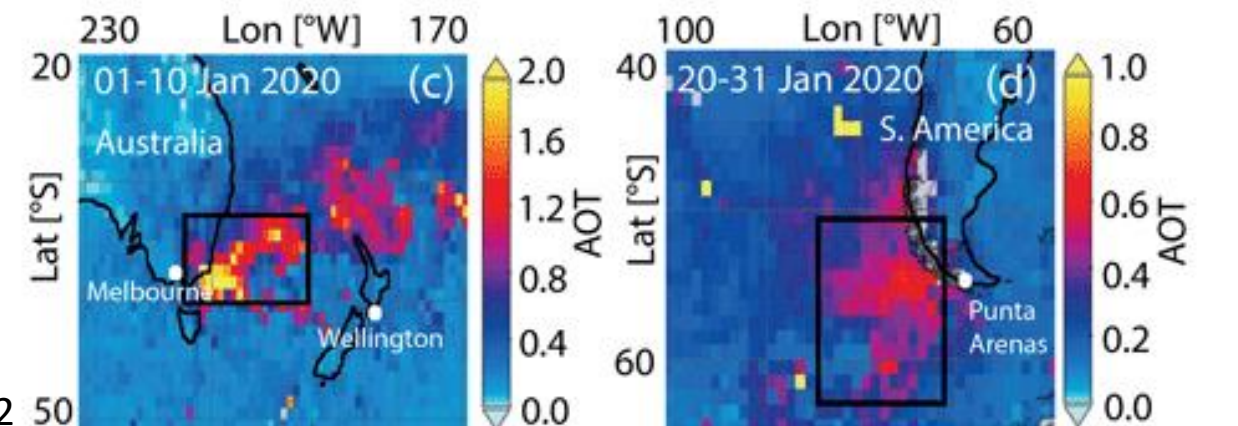
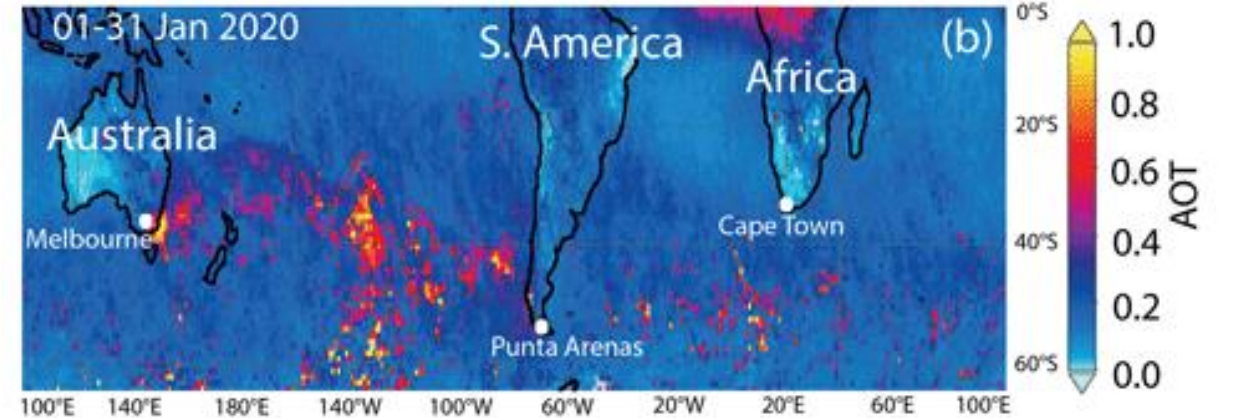
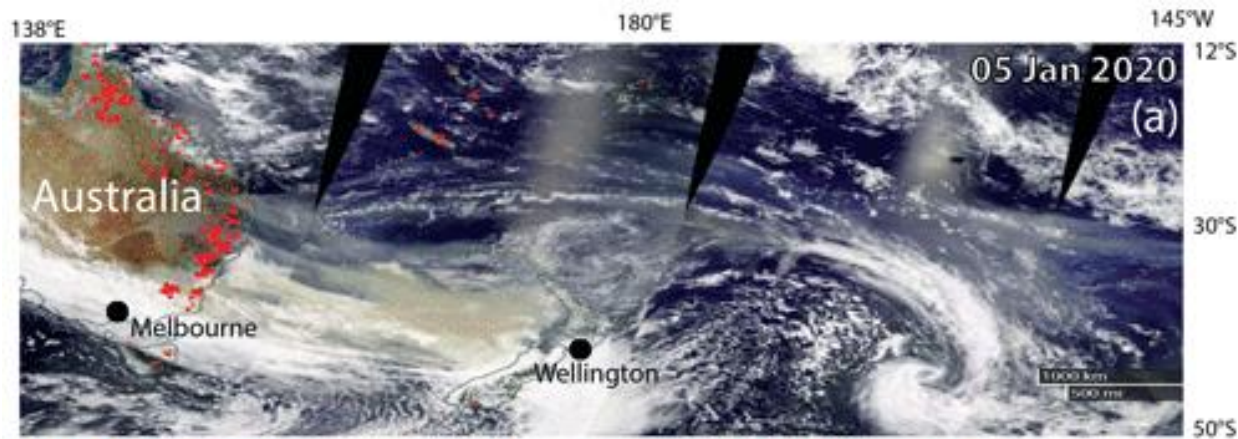


Smoke from Australian wild fires



- smoke-filled vortex with 1000 km horizontal extent
- significant ozone reduction

Ohneiser et al., ACP, 2022



Summary

- Clouds at unexpected altitudes and locations
- First lidar detections of NLC and PSC at southern hemisphere mid-latitudes
- Strong mountain wave activity
 - effects atmospheric winds
 - induces low temperatures, where ice clouds can form
- Long-range transport of aerosols



CORAL at Sodankylä, Finland



New Zealand South Island, DEEPWAVE

