

Occurrence of Ducts in ECMWF atmospheric Fields

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(work done at: NRL, Monterey, CA, USA)

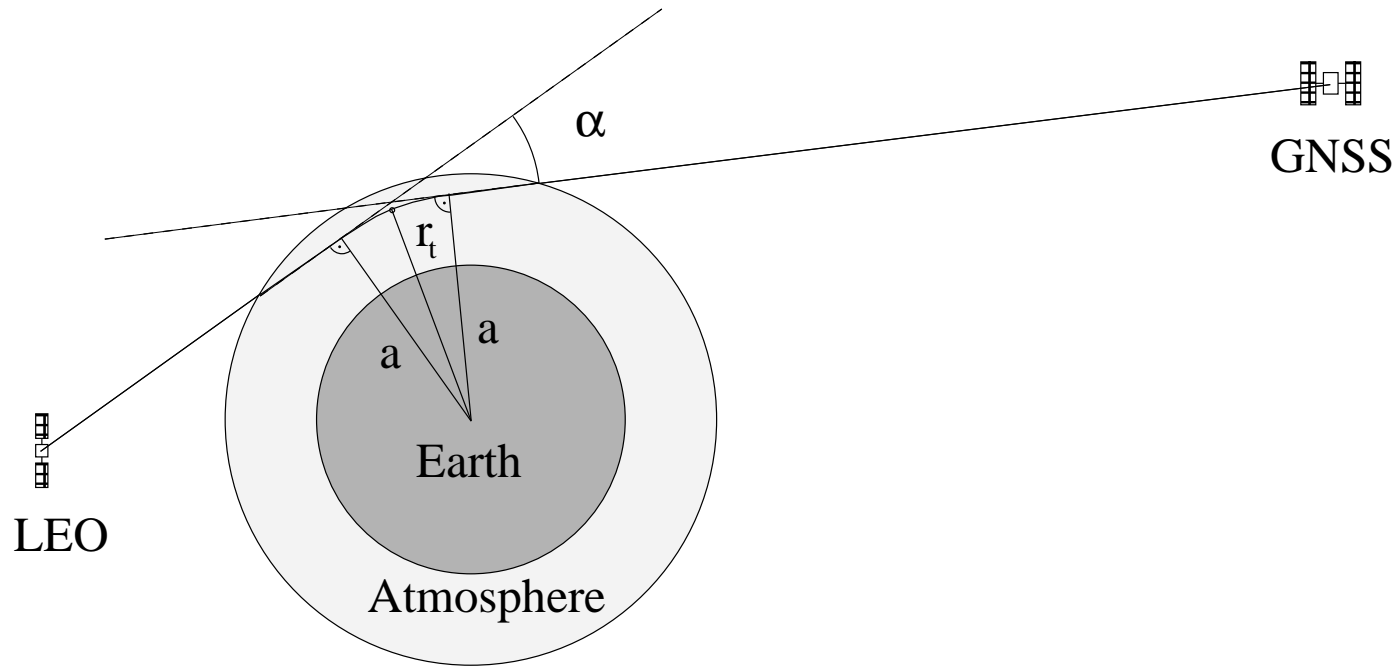
Bredbeck, July 2003



Overview

- Intro to Radio Occultation / Ducting
- Study Background / Setup
- Ducting Occurrence: Location, Altitude, Thickness
- Summary/Outlook

Occultation of GNSS satellite signals



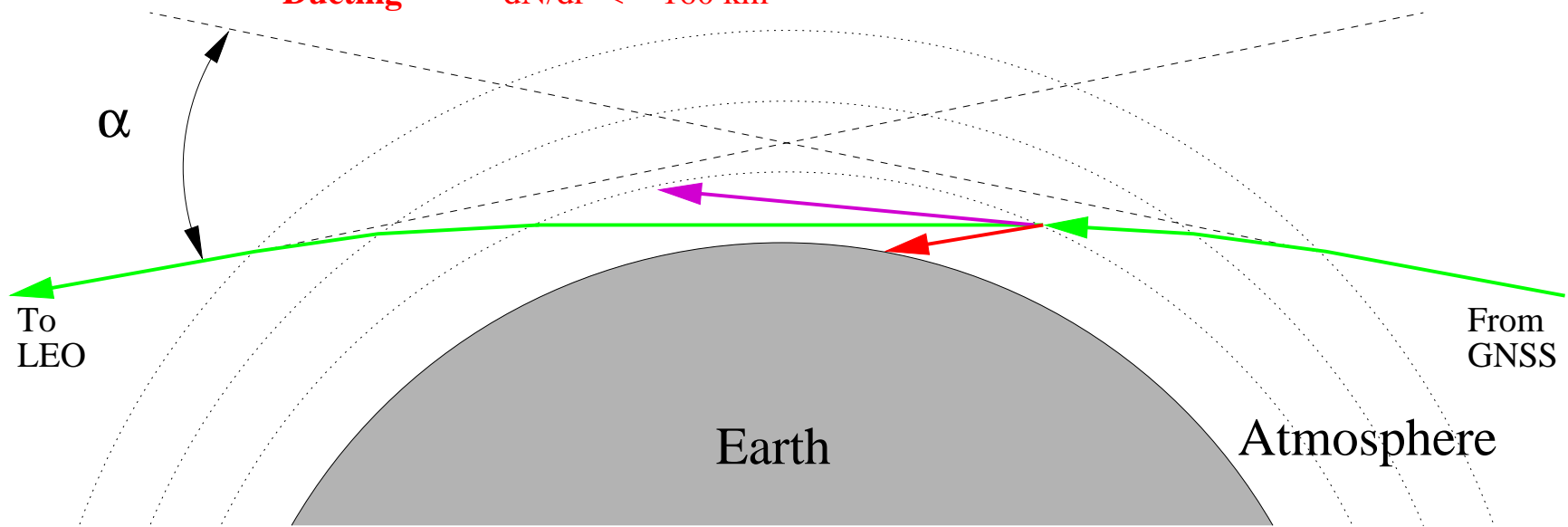
$$N = 77.6 \frac{p}{T} + 3.73E5 \frac{e}{T^2}$$

Ducting

Nominal Case dN/dr 0 to -76 km^{-1}

Subrefraction $dN/dr > 0 \text{ km}^{-1}$

Ducting $dN/dr < -160 \text{ km}^{-1}$



Study Background/Setup

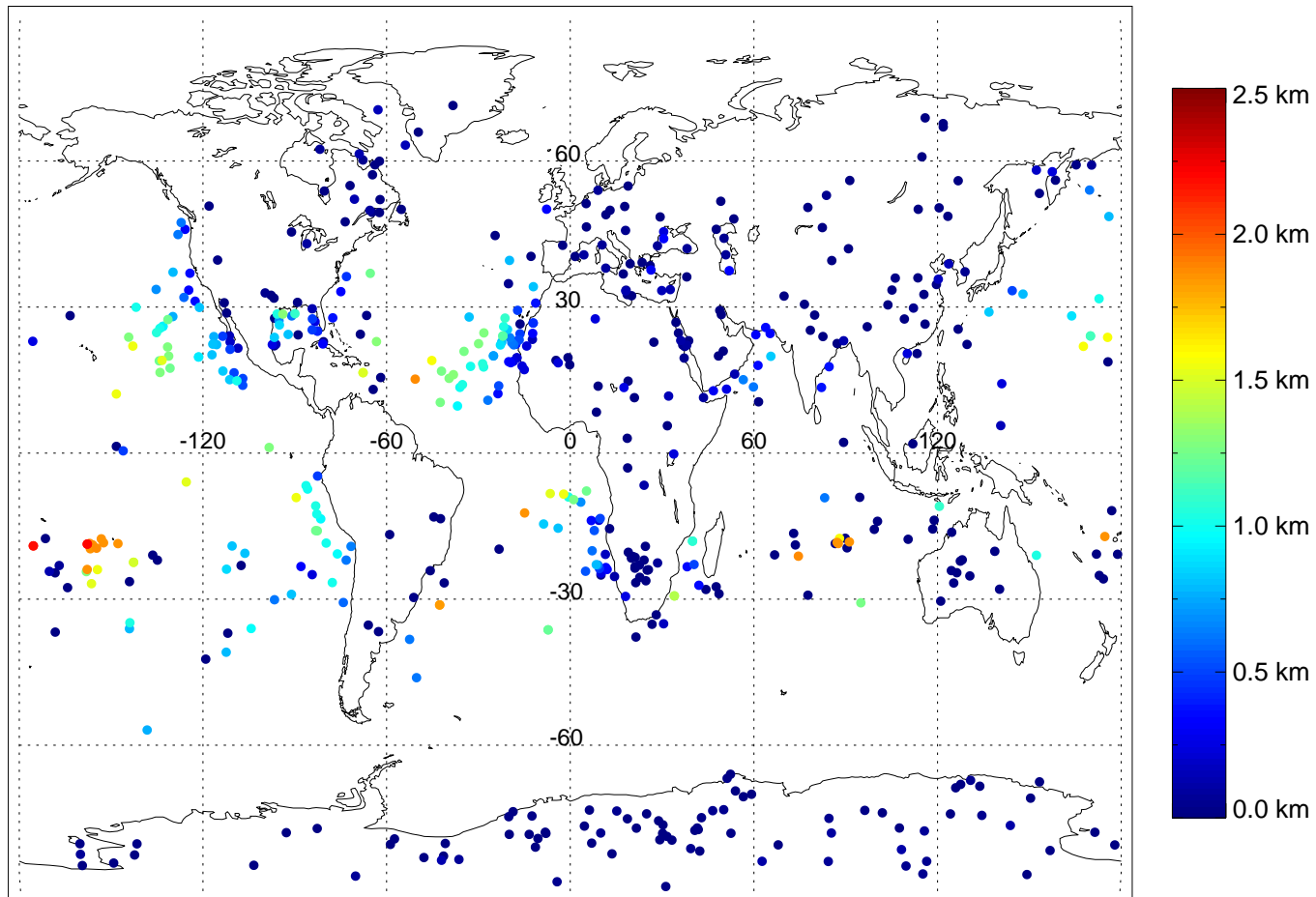
● Focus:

- Limitations at lower Altitudes
- Negative N Bias

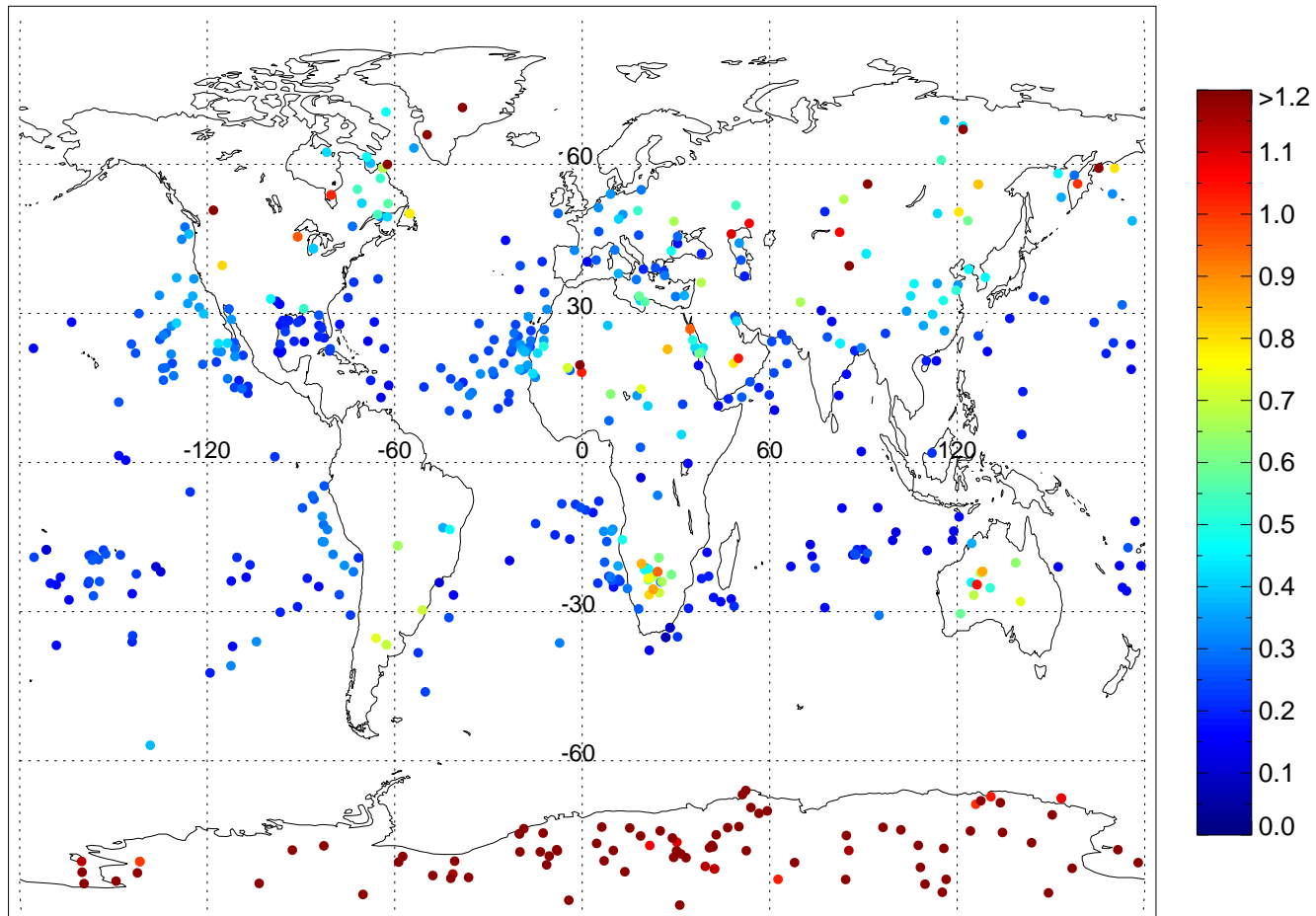
● Setup:

- 10 Days in May 2001
- ECMWF atmospheric fields (T 511, 60 levels, 4 time steps)
- Simplified Calculations using Radio Occultation Simulator EGOPS
- 24 GPS Satellites
- 1 LEO observing setting/rising Events (MetOp 1, GRAS)
- Total: 5348, Ducting: 536

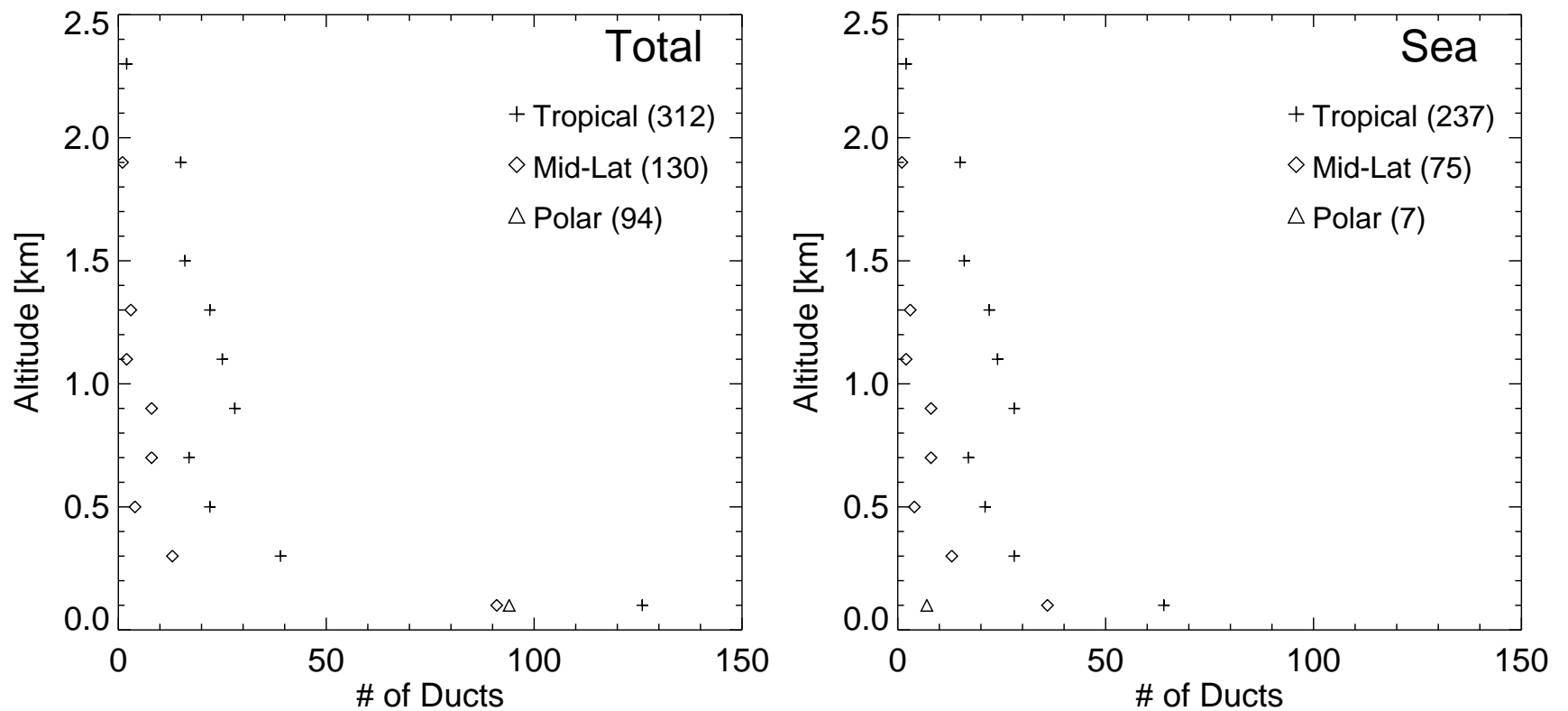
Location/Altitude of Ducts



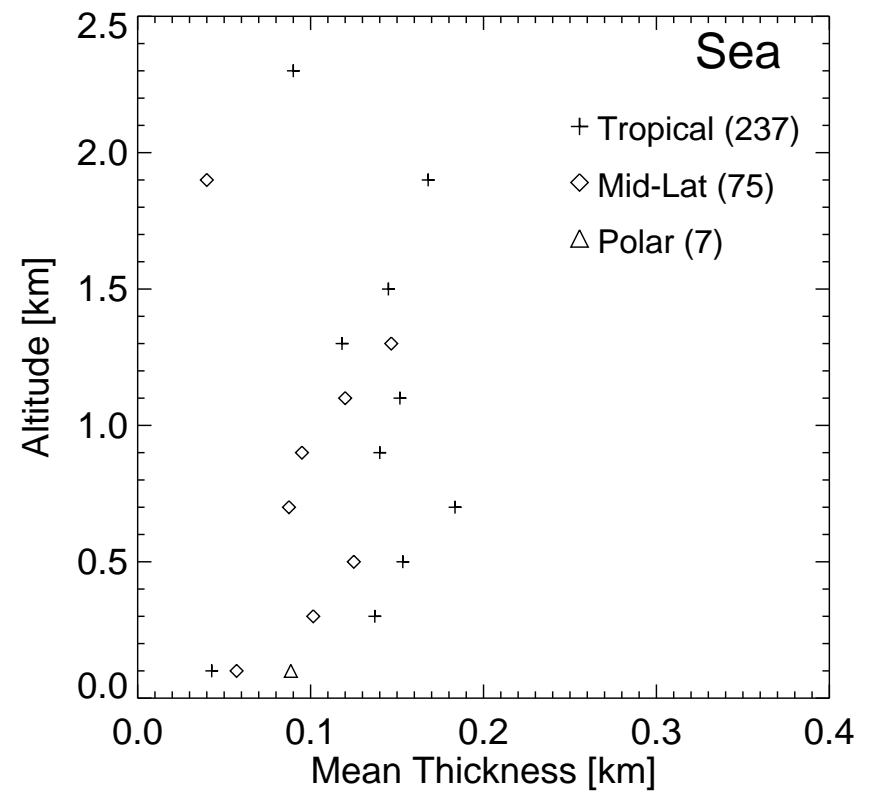
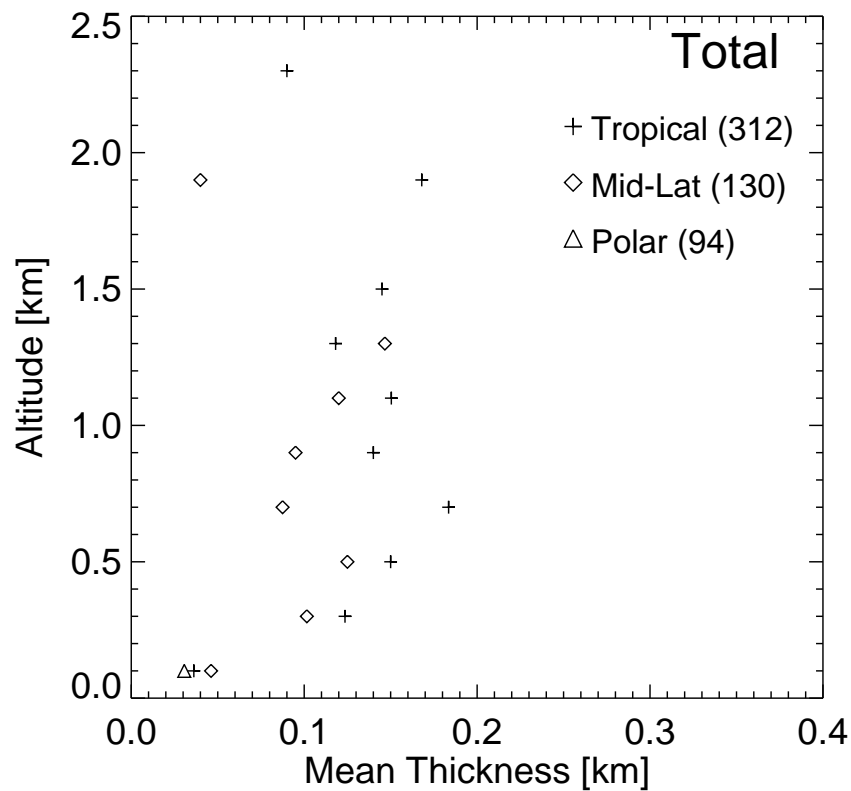
Strength of Dry Ducting



Altitude of Ducts



Thickness of Ducts



Summary/Outlook

- Summary:
 - ECMWF data proves to be a very useful tool for ducting studies
 - Temperature profile can introduce dry ducting over land
 - Ducting relevant for RO appears mainly over sea
 - RO data could give valuable information on ducting (top of PBL)
- Outlook:
 - Potential for further ECMWF processing (e.g. climatology, horizontal extend)
 - Project together with Potsdam/Monterey to find and characterize ducting events in CHAMP data