

Atmosphere/ocean dealiasing and loading products and some effects

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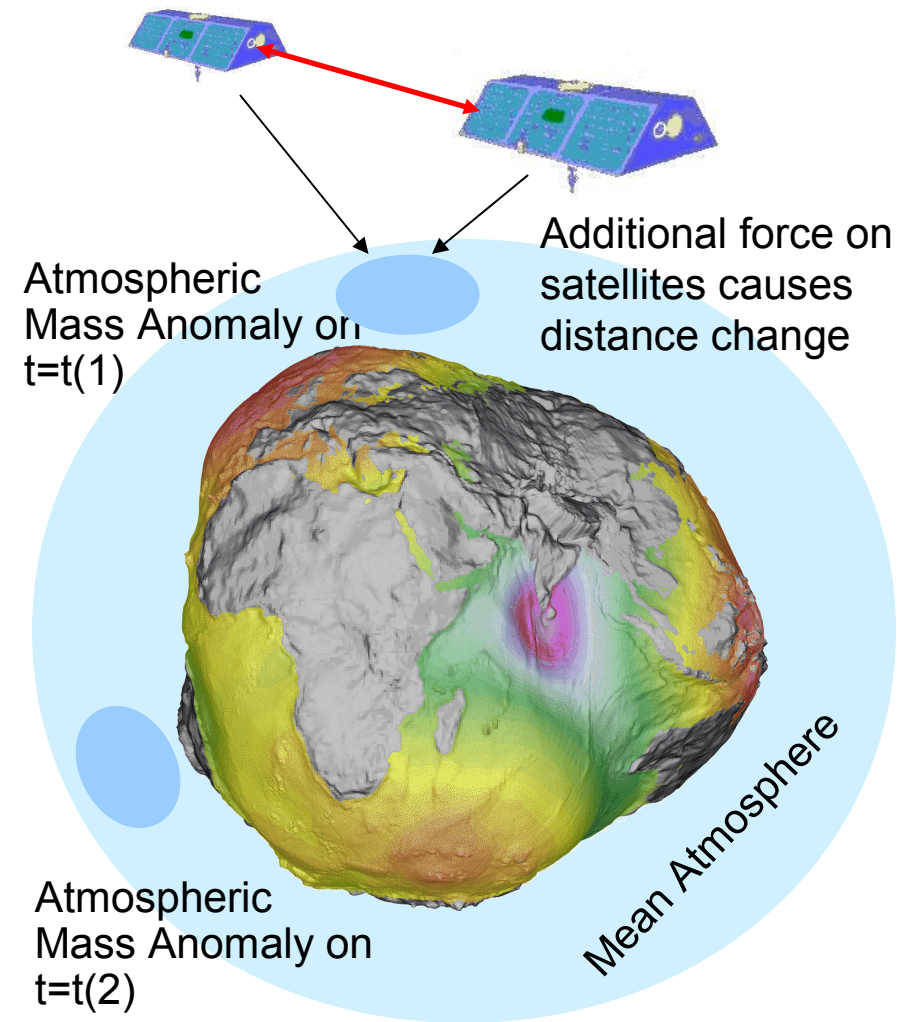
Content

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- Non-tidal atmosphere and ocean mass variations
- Non-tidal atmosphere loading
- New products?

Motivation

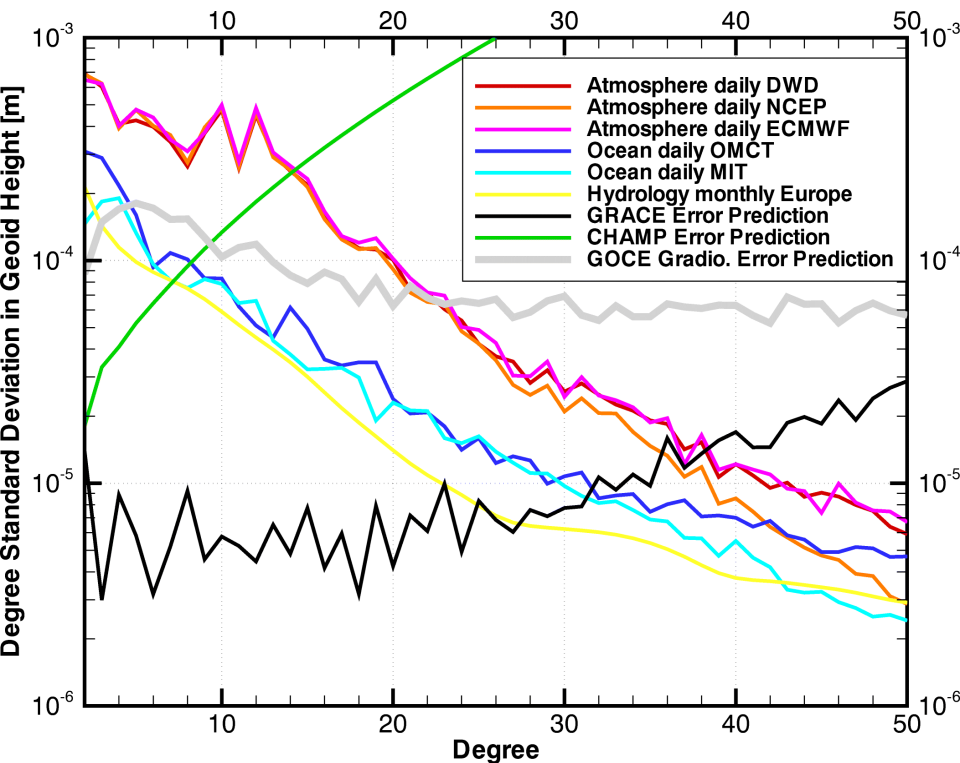
- AOD1B generated within the GRACE Science Data System (SDS)
 - Expanded back in time for the geodetic satellites (LAGEOS)
 - Also available for in-house use:
 - Ocean tide loading modeling
 - Non-tidal atmosphere loading modeling
 - Is there a demand for:
 - Atmosphere tide loading products
 - Non-tidal ocean loading products
- ?

Non-tidal Short-term Mass Variations



- Short-term (hours to days) mass variations within the atmosphere, oceans and hydrosphere have to be taken into account for weekly or monthly (GRACE) gravity field determination
- Can not be cured by repeating measurements

Time Variable Gravity



Gravity variations in terms of geoid height variations

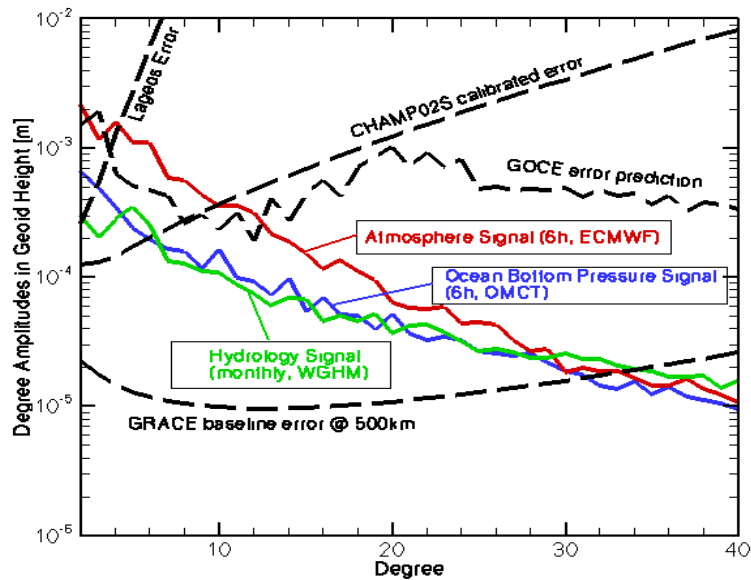
- High frequency variations (large impact on GRACE, minor on CHAMP/GOCE):
 - A/O tides
 - Non-tidal A/O
 - Hydrology
- GRACE results
 - Continental hydrological cycle
 - Ice mass loss
 - Surface and deep ocean currents

AOD1B RL04 Product

- Based on
 - 6h 0.5° ECMWF analysis data (2-3 d delay)
 - 6h 1.875° output from Ocean Model for Circulation and Tides (OMCT) forced by ECMWF
- 2001 – today 6h time series of spherical harmonics up to d/o 100 for 4 components:
 - Atmospheric variability
 - Oceanic variability
 - A/O combination
 - Ocean bottom pressure variability (OMCT + surface pressure)
- Extended back to 1976 based on ERA40 data and OMCT
- Product size:
 - ECMWF: 4 GB / month
 - AOD1B: 3 MB / month

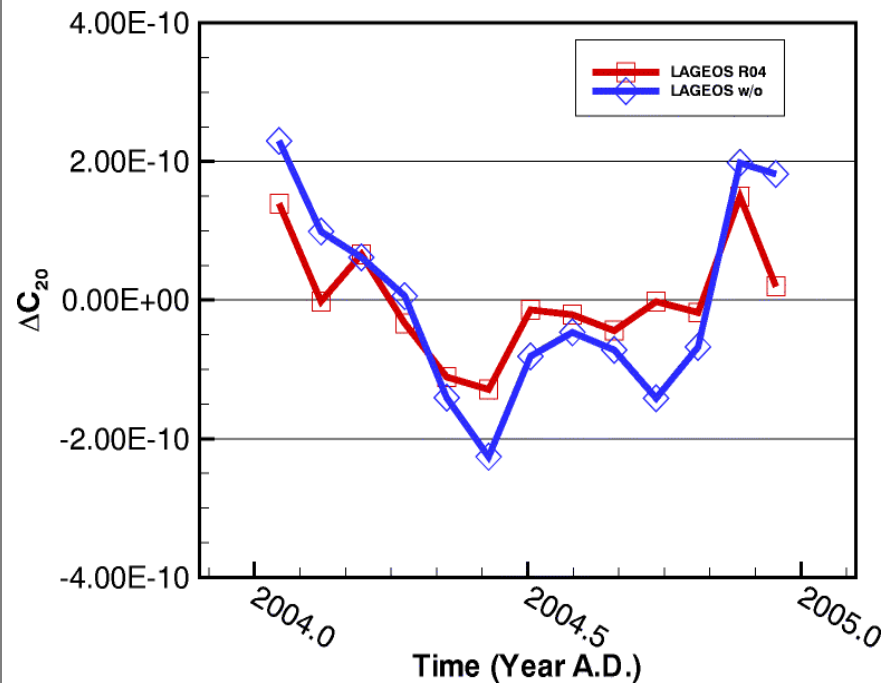
LAGEOS

- Sensitive up to $d=4$ for the atmosphere



Gravity variations in terms of geoid height variations

- AOD effect on C_{20}



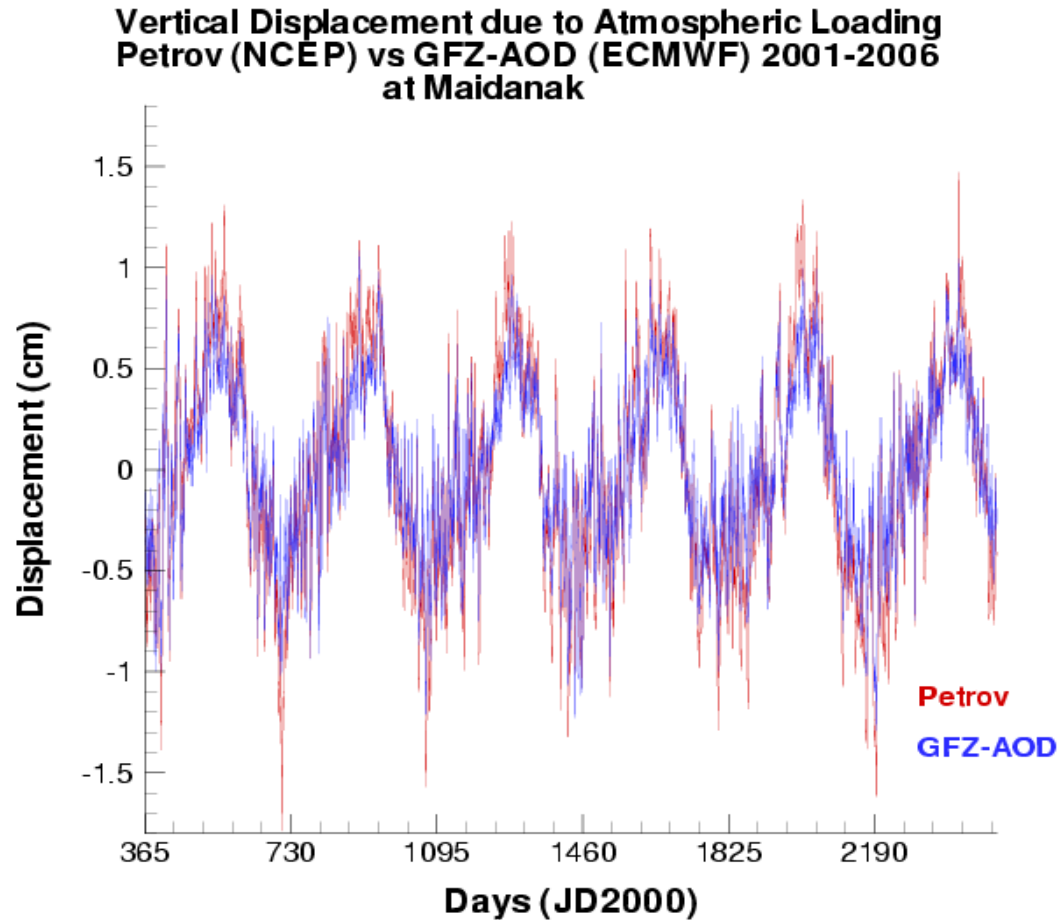
Effect on Precise Orbit Determination Accuracy

- ERS-1/-2: improved fit to SLR and SXO in the sub-millimeter
- LAGEOS: SLR fit changes very marginal

Non-tidal Atmospheric Loading

- Software originated from GRGS in 1997
- Theory: FARRELL, W.E., 1972
- Input: ECMWF surface pressure data from AOD processing
 - Could be ocean data from OMCT as well
 - >>> Non-tidal ocean loading

Non-tidal Atmospheric Loading



Conclusions

- AOD1B available within the GRACE SDS from
 - isdc.gfz-potsdam.de → GGFC
- AOD1B indispensable for applications like hydrological cycle
- Non-tidal atmospheric loading should also become standard at the services
- Non-tidal ocean loading could become a product
- Atmospheric tide loading could become a product