# Comparison of Cloud Fractions from NASA MYD35 and NOAA AWG/NDE over the Entire MODIS/AQUA Record (2002-2015)

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## INTRODUCTION

- **NOAA has developed a cloud mask to meet the requirements of GOES-R and JPSS.**
- This mask can run on many sensors including the NASA AQUA MODIS
- NASA recently released a new version (C6) of the MYD35 MODIS Cloud Mask
- **MYD35 represents a mature and well analyzed mask that offers valuable reference to judge the performance of the NOAA mask.**
- The NOAA mask already runs in the NOAA Clouds from AVHRR Extended (CLAVR-x) system and will run in the NOAA AIT Framework.
- This mask is used in the Pathfinder Atmospheres Extended (PATMOS-x) climate data.
- Both MYD35 and PATMOS-x (on AVHRR) are available from the GEWEX Cloud Assessment. Both are developed at UW/CIMSS.
- **NASA MYD35: Group-Threshold Probabilistic Mask with manually derived thresholds**
- **NOAA: Naïve Bayesian Probabilistic Mask with CALIPSO derived lookup tables.**

## ANALYSIS

- Cloud fraction is computed by turning the NOAA and NASA mask into binary (cloud / no cloud) masks and calculating the cloud fraction over a $2.5^0$ x $2.5^o$ grid.
- **This analysis was done on the entire Aqua MODIS record of 5km subset level1b (MYD02SSH) spanning 2002 to 2015**
- CLAVR-x was modified to read the MYD35 mask from the ATML2 files from NASA GSFC.
- **Therefore, the NOAA and NASA analysis are comprised of the same pixels.**
- Data are first separated into ascending/descending nodes and combined.
- **We expect some difference due to algorithmic choices.**
- **Regions with differences that show high anomaly correlations, point to differences in algorithm sensitivity but not fundamental inconsistencies in algorithm performance. Definitions of clear/cloudy boundary may also contribute.**
- **Regions with differences that do not show high anomaly corrections would indicate significant performance differences.**
- **Similarity in trends also indicate general agreement in inter-annual performance**

## RESULTS

- **Snow covered land shows a large differences** with MYD35 > NOAA. Low anomaly correlations indicate the two approaches differ significantly.
- There is very little difference over the ice-free ocean except in regions with significant dust. MYD35 calls dust cloud but flags it. NOAA flags it too but calls it clear.
- **Differences over Antarctica are large at all seasons**. Sea-ice boundary behavior also differs (MYD35 boundary more distinct in Summer). Biggest difference over the East Antarctic Plateau.
- Arctic performance is similar at all seasons though Greenland is quite different.
- Trends show quite similar patterns (and the expected dominance of El Nino)

## CONCLUSIONS

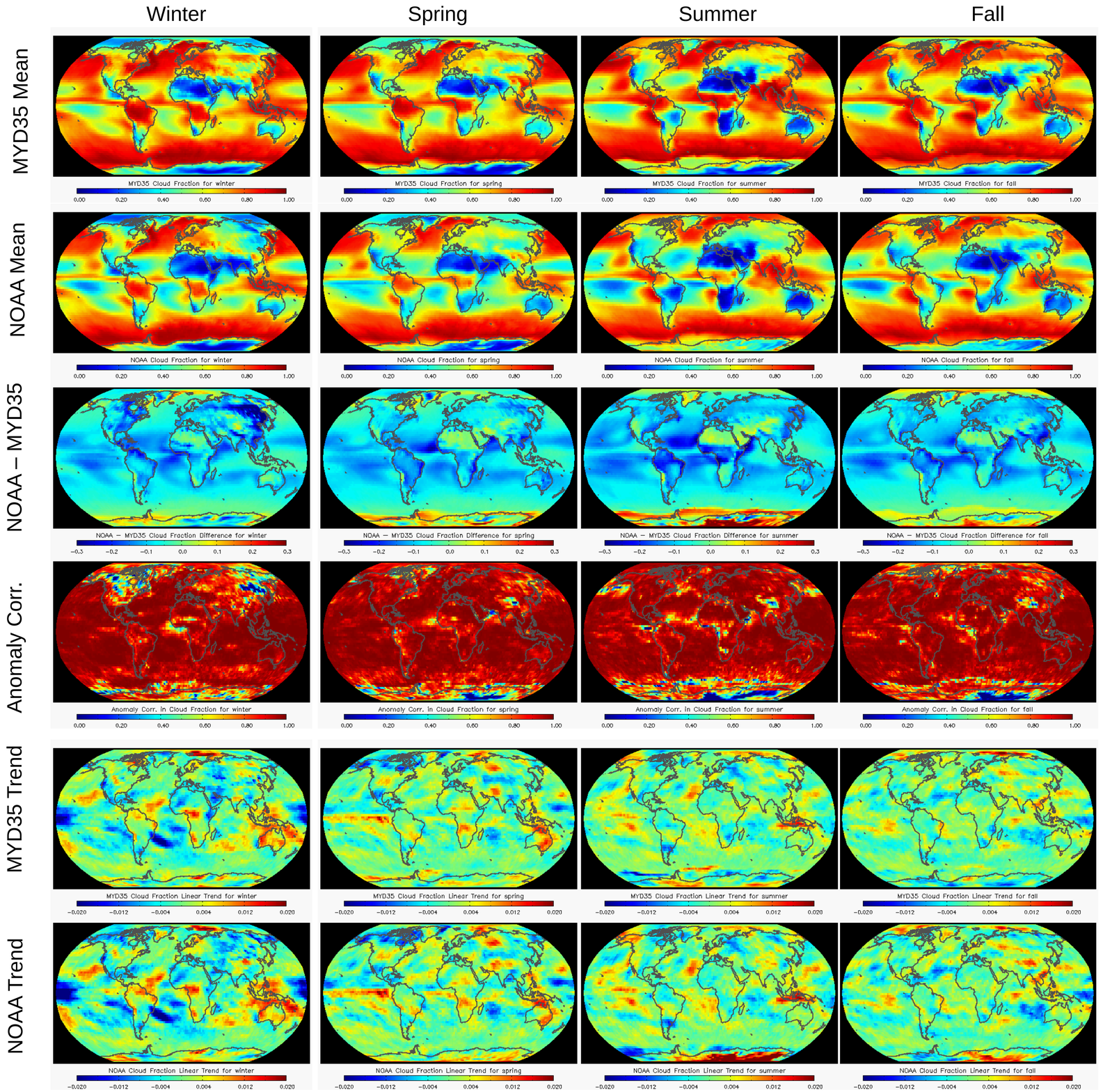
- **The global and seasonal performance is quite similar between these two masks.**
- Given the success of MYD35, this is a major accomplishment for the NOAA mask.
- **Given the enterprise design of the NOAA algorithm, we expect the NOAA mask to perform similarly on the JPSS VIIRS and GOES-R ABI**.
- Success of the NOAA mask will ultimately be judged by the other NOAA applications that depend on it.

## COMPARISON WITH CALIPSO/CALIOP

- CALIOP is a LIDAR and offers a very direct detection of cloud.
- Very similar performance and quantitatively confirms the patterns seen in global maps

*Tabulated Probability of Correct Detection computed for 2013 CALIPSO/MODIS Matchups over the 7 surface types used in the NOAA mask*

| | NOAA Cloud Mask Surface Type | | | | | | |
|---|---|---|---|---|---|---|---|
| | Deep Ocean | Other Water | Land | Land with Snow | Arctic | Antarctic | Desert |
| MYD35 | 0.927 | 0.926 | 0.906 | 0.827 | 0.846 | 0.835 | 0.911 |
| NOAA/MODIS | 0.924 | 0.927 | 0.891 | 0.846 | 0.860 | 0.856 | 0.928 |
| NOAA/VIIRS | 0.930 | 0.933 | 0.894 | 0.825 | 0.852 | 0.817 | 0.928 |




- **Frey, RA, Ackerman, SA, Liu, YH, Strabala, KI, Zhang, H, Key, JR, Wang, XG (2008). Cloud detection with MODIS. Part I: Improvements in the MODIS cloud mask for collection 5. JOURNAL OF ATMOSPHERIC AND OCEANIC TECHNOLOGY, 25(7), 1057-1072.**
- **Heidinger, AK; Evan, AT; Foster, MJ; Walther, A (2012). A Naive Bayesian Cloud-Detection Scheme Derived from CALIPSO and Applied within PATMOS-x. JOURNAL OF APPLIED METEOROLOGY AND CLIMATOLOGY, 51(6), 1129-1144.**
- **The data used in this study were acquired as part of the NASA's Earth-Sun System Division and archived and distributed by the MODIS Adaptive Processing System (MODAPS).**