Comparison of Physically Consistent Cloud Products from CFSR and PATMOS-x

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Introducción

El análisis de campos de variables meteorológicas a gran escala ha probado ser útil para entender las dynamicas y las variaciones climáticas. No obstante, los métodos utilizados para construir estos campos de variables han cambiado con el paso del tiempo, y son cada vez más complejos. En este sentido, la comparación de varios campos de variables se ha convertido en una herramienta valiosa para entender las diferentes perspectivas. En este análisis, se comparan los campos de variables de CFSR y PATMOS-x para entender las diferencias y las similitudes en los productos de nube.

**INTRODUCTION**

Most NWP reanalysis data span more than 30 years. Satellite climate records (PATMOS-x, ISCCP) now also span more than 30 years. Both reanalyses and satellite climate data are dependent on each other. This poster attempts a physical comparison of the NOAA/NESDIS PATMOS-x data based on the MODIS sensor to cloud products derived from NOAA/CFSR CFSR. The goal is to see if analysis methods can be used to generate products that are compared meaningfully. The long term goal is to explore and motivate the use of satellite cloud records in future reanalysis efforts.

**PATMOS-x** (the satellite cloud data)

PATMOS-x is a NOAA/NESDIS Project developed at CIMSS. PATMOS-x AVHRR Radiometric and Cloud Data Records (CDR) are hosted at NCDC. PATMOS-x MODIS and GOES Data will be available via CIMSS Climate Data Portal. See SSEC booth exhibit!

**CFR** (the reanalysis data)

The National Centers for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR) is generated from 1979 to the present.

**ANALYSIS**

PATMOS-x run on AQUA/MODIS 5km data (MYD02SSH). 0.5° CFSR was temporally interpolated from each 6 hour cycle to the time of the MODIS observations. The Cloud Liquid Water Mixing Ratio (CLWMR) profiles from the CFSR are used for this analysis. PATMOS-x uses some CFST profiles for clear-sky radiative transfer (but not those compared in this study). The CLWMR profiles are vertically integrated to generate a cloud water path (CWP) that can be compared to PATMOS-x. Any CLWMR profiles with CWP values < 5 g/m^2 were considered clear. This corresponds with the suggested cloud detection threshold of PATMOS-x. To estimate cloud-top pressure (CPT), the effective emission level of the clouds were computed from CLWMR profiles to simulate what an Infrared retrieval (like that used in PATMOS-x) would generate. Therefore, the CFSR products are not those made available from the CFSR diagnostic schemes. These products are adjusted so as to be physically similar to the satellite products to allow for more meaningful comparisons.

**CFR**

-- **Cloud-top Pressure:** Cloud-top Pressure (CPT) is the pressure of the highest cloud in the column's, PATMOS-x and CFSR CPT are computed from the effective level of emission. The effective level of emission is 1 into the cloud or roughly 18 g/m^2 into the cloud. We computed the CPT using this definition for each CFSR CLWMR profile. CFSR results are as good as the CLWMR in this case. The histograms and zonal means are very similar. We used the CLWMR profiles to compute the CPT.

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**CONCLUSIONS**

**Comparison of PATMOS-x Cloud Fraction to that derived from CFSR CLWMR:** Images below show the cloud features in PATMOS-x (left) and CFSR (right) for the same day. It shows a clear transition from CFSR computed by applying a 6 g/m^2 threshold for cloudiness using the integrated CFSR Cloud Water Paths. 6 g/m^2 is an estimate of the cloud sensitivity threshold of the climatological CFSR. The CFSR threshold is applied for the 6 g/m^2 threshold and is computed as a function of the CLWMR profile. Zone fractions show good agreement at all latitudes.

**Comparison of Cloud Water Path:** Cloud water path is the integrated amount of cloud water in the column. This top two image is the CFR Cloud-water path (g/m^2) from PATMOS-x (left) and CFSR (right) for the same day. This analysis, all CFR and PATMOS-x values greater than 6g/m^2 are set to the upper limit of 6g/m^2, CFSR results are as good as the CLWMR in this case. The histograms and zonal means are very similar. We used the CLWMR profiles to compute the CPT.

**Comparison of Cloud-top Pressure:** Cloud-top Pressure (CPT) is the pressure of the highest cloud in the column, both have a resolution of 0.5°. PATMOS-x uses a simple batho level CPT, the CFSR pressure is derived from the CLWMR profile. Zone fractions show good agreement at all latitudes.

**Comparison of Surface Temperature:** Surface temperature differences over arid land are significant. By accounting for cloud detection sensitivity, cloud water path saturation and effective level of emission, the CFSR cloud products derived from the CLWMR profiles are very similar to those of PATMOS-x.

**Long-term Cloud Fraction Comparisons:**

For this analysis, we used the diagnosed cloud fraction from CFSR and PATMOS-x. The above aerosol to highlight the photochemical and topographic effects. We have two regions for this comparison. One in the North Pacific off the coast of California which is dominated by stratus clouds. The other, the Tropical Pacific is in the region of Persistent Stratus which is dominated by the California Current and the equatorial undercurrent. The surface temperature differences over arid land are significant. The histograms and zonal means are very similar. We used the CLWMR profiles to compute the CPT.

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**Data Used**

The data holdings of PATMOS-x and CFSR span many years. However, the systematic features of this analysis did not change dramatically with the passing of years. We found analysis from a single day provided the most easily explainable results. Therefore the examples shown here (except for the cloud fraction time-series) are daytime data from one day (June 28, 2013).

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**References**


