OPTIMAL DETECTION OF CHAMP AND COSMIC RADIO OCCULTATION DATA

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We have performed an optimal detection study on GPS radio occultation data obtained by CHAMP and COSMIC. The CHAMP RO data begins in 2002 and ends in 2008; COSMIC data begins in 2007 and runs to the present. In order to account for nonuniform spatial sampling, we have incorporated a Bayesian interpolation scheme which maps RO data to spherical harmonics without overfitting the data. The scheme reveals that the precision of climate averages is nearly independent of binning time for binning times greater than approximately 2 days. The data fields for optimal detection were maps of log-dry pressure at 10 and 20 km geopotential height. In formulating the optimal fingerprints, we scaled the outputs of the CMIP3 models subjected to SRES A1B forcing to global averages of log-dry pressure. The resulting scalar trend can then be interpreted as thermal expansion of the troposphere. Over the period of CHAMP and COSMIC, we have found no statistically significant trend. Moreover, we have found that substantially less advantage is to be gained from optimization than predicted by optimal detection. We conclude that the CMIP3 models contain incorrect physics for two reasons: 1) statistically significant trends in tropospheric expansion should have been detected over the time frame of CHAMP and COSMIC but were not, and 2) natural variability produced by CMIP3 models is quite different than that observed by GPS radio occultation.