AN EXAMINATION OF OBSERVATION AGREEMENT WITH THE NCEP/NCAR 50 YEAR ANALYSIS

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1 INTRODUCTION

1.1 Objectives, Methodology, and Motivations of this Work

Comparison of observed data with the assimilation made from them, is a fundamental tool for understanding the reanalysis products, as well as possibly diagnosing problematic situations in the data or the assimilation process. Gathering these statistics from the enormous number of (just) radiosondes processed in the 50 year reanalysis (see Woollen and Zhu, 1997), presents a significant logistical challenge. Because of this, a major objective of this work became the creation of a compact yet comprehensive global set of radiosonde metadata, recorded in as high a resolution, in space and time, over the period of the reanalysis, as would permit portability and exchange of this data. A procedure was developed to create sets of "monthly mean metadata" files, containing the mean and mean square values of radiosonde mandatory level observations (1-1000 mb), interpolated six hour forecasts, and analyses, and respective increments, averaged within each month, and segregated by the observation hour (UTC), and the quality control status Shown within this report are a few specific examples of US radiosonde fit diagrams, which were derived from such a set of metadata files. Diagrams like these can be made from any combination of reporting locations and times (months), from a single station, up to averages over the entire set, as each fixed radiosonde location in the entire 50 year global dataset is represented for every month in which it appears.

Obviously, this approach is geared towards climatic rather than synoptic aspects of the reanalysis data, as the resolution of one month is suitable for displaying information on scales of 1- 50 years, or so. The condensation of the metadata thus achieved, however, makes it feasible to record, for the 600+ months of the reanalysis period, the complete global set of monthly mean radiosonde data at fixed locations and mandatory levels, on a single 650 megabyte compact disk. The files created in this work are written in compressed BUFR format which should enhance portability of the data.

Other types of fixed location observations, i.e. surface observations, can also be processed in this manner. Moving platforms, such as aircraft and ships, etc., could conceivable be "super-ob'd" into fixed locations, though it may be more practical, especially given higher density media (i.e. DVDs), to aim for consolidating the complete daily/hourly record from all these data. It is reasonable to anticipate doing this with the complete set of radiosonde metadata as well, a task which up to now would be, if not impossible, nearly so. One would hope that soon such complete sets of observations, and including metadata from multiple reanalysis projects, will be available for the consumption and benefit of the research community in general.

2. EXAMPLES OF MONTHLY MEAN FITS OF US RADIOSONDES IN THE REANALYSIS

2.1 Moisture Observation Minus Analysis (o-a) Mean Differences

Figure 1 illustrates a fairly typical annual pattern in the US, for the mean fit of radiosonde specific humidity (q) observations to the analysis (o-a), during the year 1990. Figure 2 looks at the distribution of monthly mean stations for the center of the dry analysis bias in July, 1990, at 850 mb. It appears that the dry analysis in the eastern US during the summer dominate this average. The rest of the year shows an overall wet bias in the US analysis below 850mb.

2.2 Observation Counts and Mean Temperature Differences (o-a) from Analyses

Average daily temperature observation counts over the US (Figure 3), are shown for July, spanning the entire period of the reanalysis. Several interesting features appear in this, illustrating the combination of data sources and epochs of data coverage, found in the radiosonde dataset over the US.These patterns are similar for other months, for the wind data, and for moisture reports below 300mb. Figure 4 shows mean (uncorrected) temperature fits of the radiosondes to the analysis over the US for the same set of data as in Figure 3. A notable feature in Figure 4 is the apparent warming of the analysis in the mid-to-upper troposphere, and stratosphere, as compared to radiosondes, starting in around 1980. This possibly indicates a warm bias in the TOVS retrieval data versus radiosondes, in these regions.

2.3. Annual Pattern of Vector Wind RMS differences from the Reanalysis over the US

The annual pattern of RMS vector wind differences of radiosondes versus the reanalysis, over the US, for the year 1990, is also fairly typical for all the years of the reanalysis period. Figure 5 shows this pattern, with observed wind vectors displayed at mandatory levels. For the most part the error is proportional to the observed wind speed, as one might expect. One exception is the close fit in the mid-stratosphere in summer, a region with observed westerly flow. Errors are larger for the same region in winter, and for the mid to upper troposphere in summer, where the observed wind speeds are smaller. The large errors at the top (10mb) during winter are partly due to varying amounts of data present at that level, and partly dependent on the season.

3. ACKNOWLEDGMENTS

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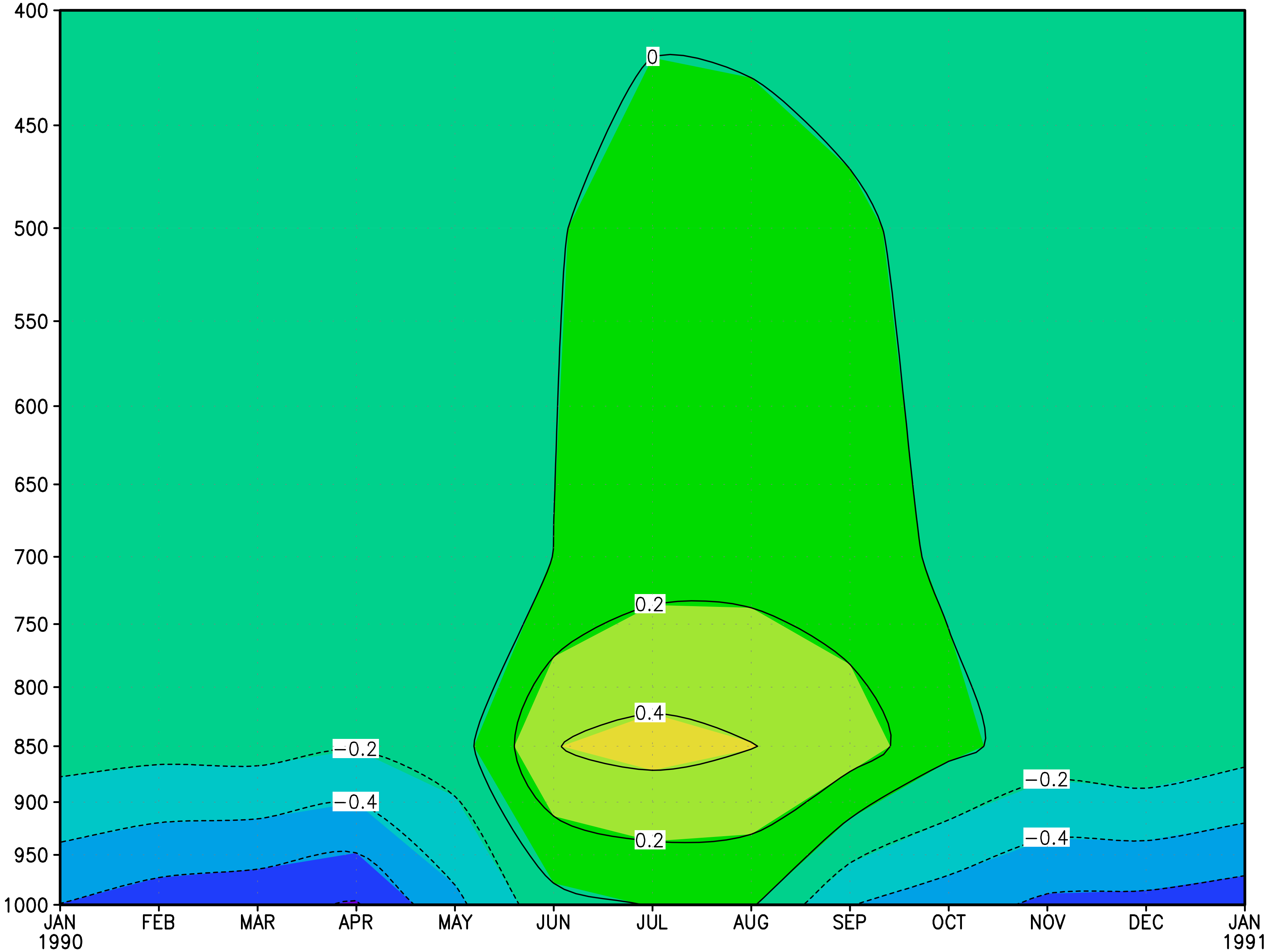
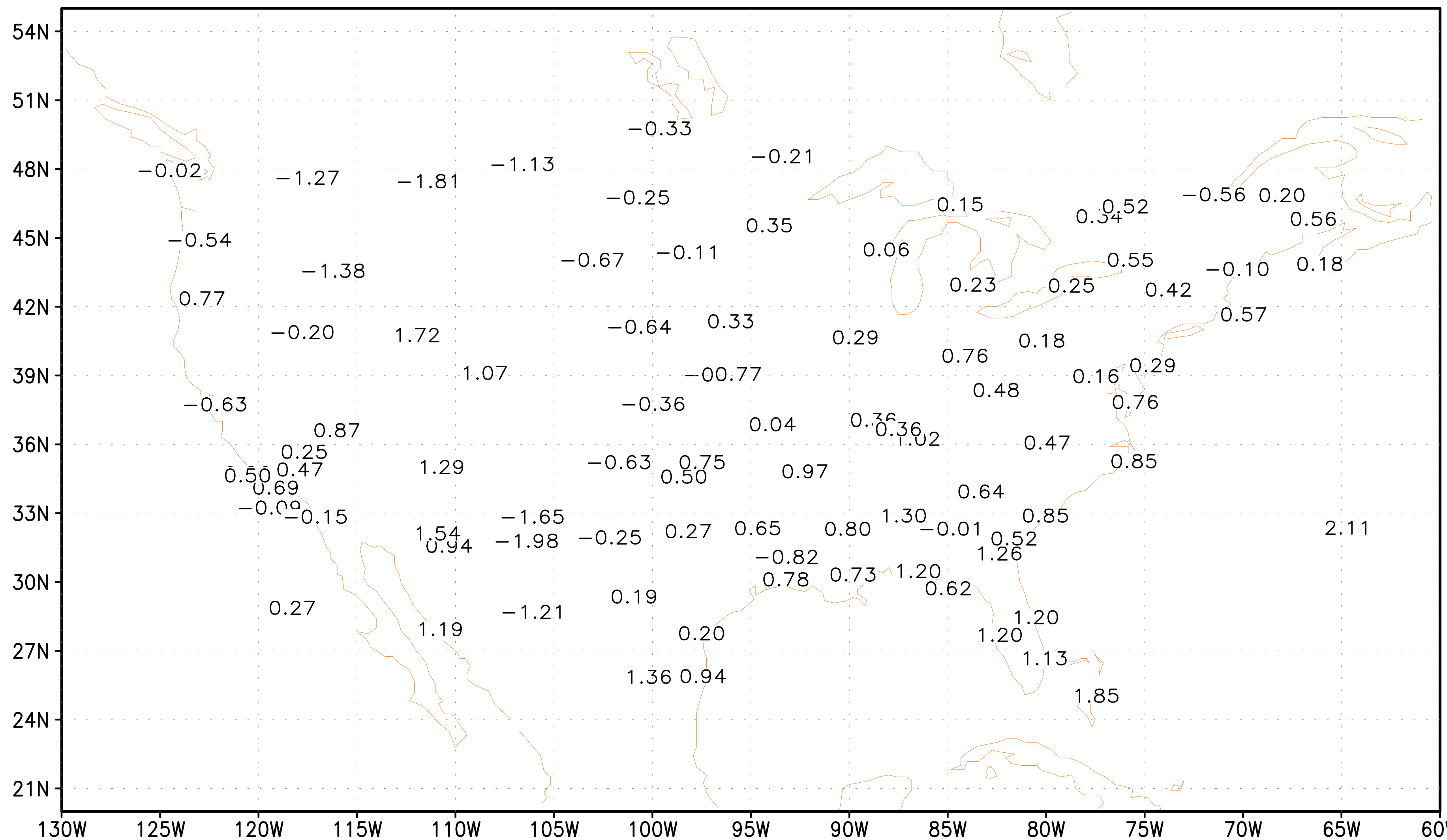
4. REFERENCES

Woollen, J. S., and Yuejian Zhu, 1997: The NCEP/NCAR Reanalysis Observation Archive, 1957-1997. Proc. of the First WCRP International Conference on Reanalyses, Silver Spring, MD, 27-31 October 1997. WCRP-104; WMO/TD-876. Pp 402-405.



GrADS: COLA/IGES

FIG 1



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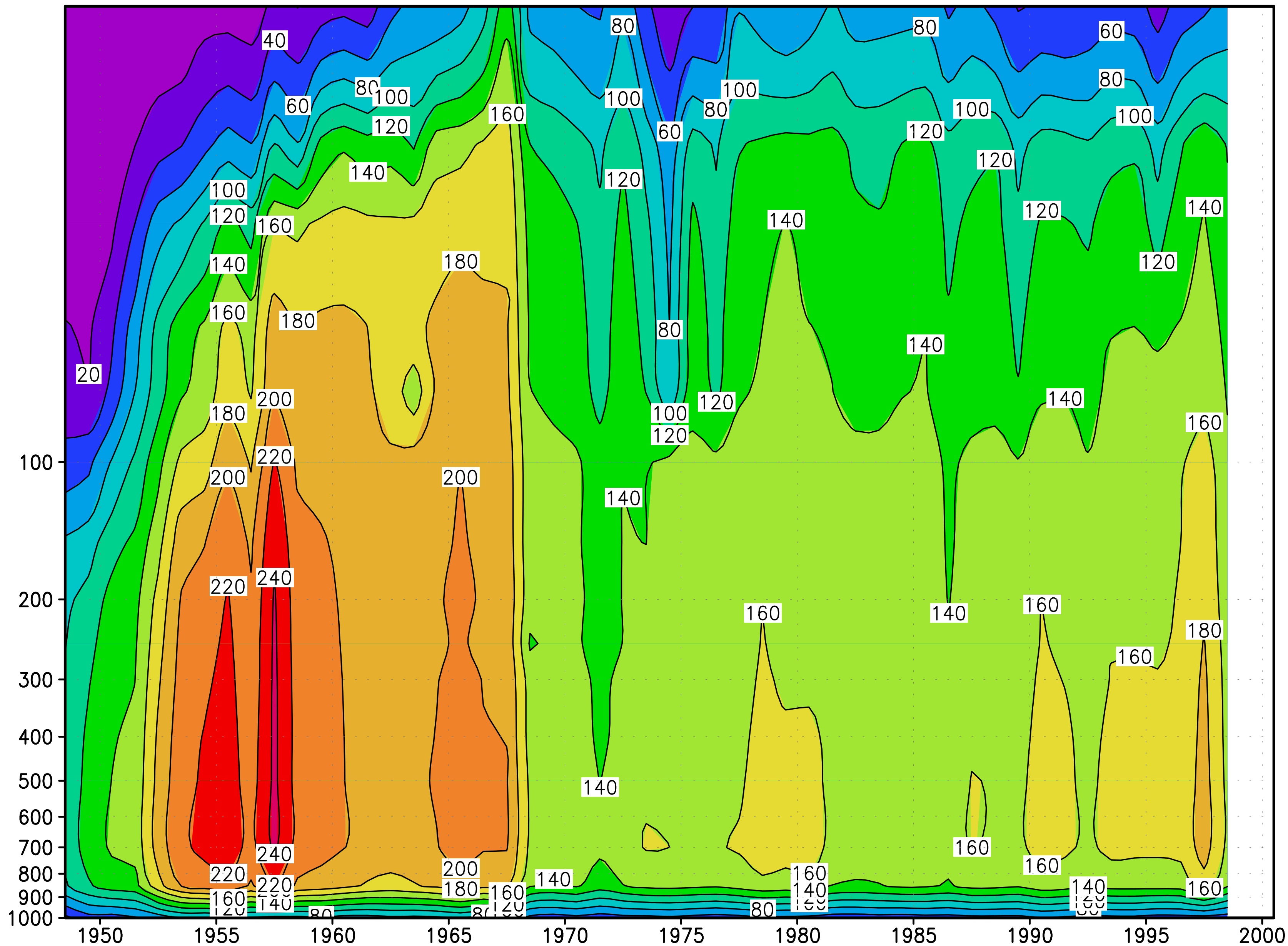

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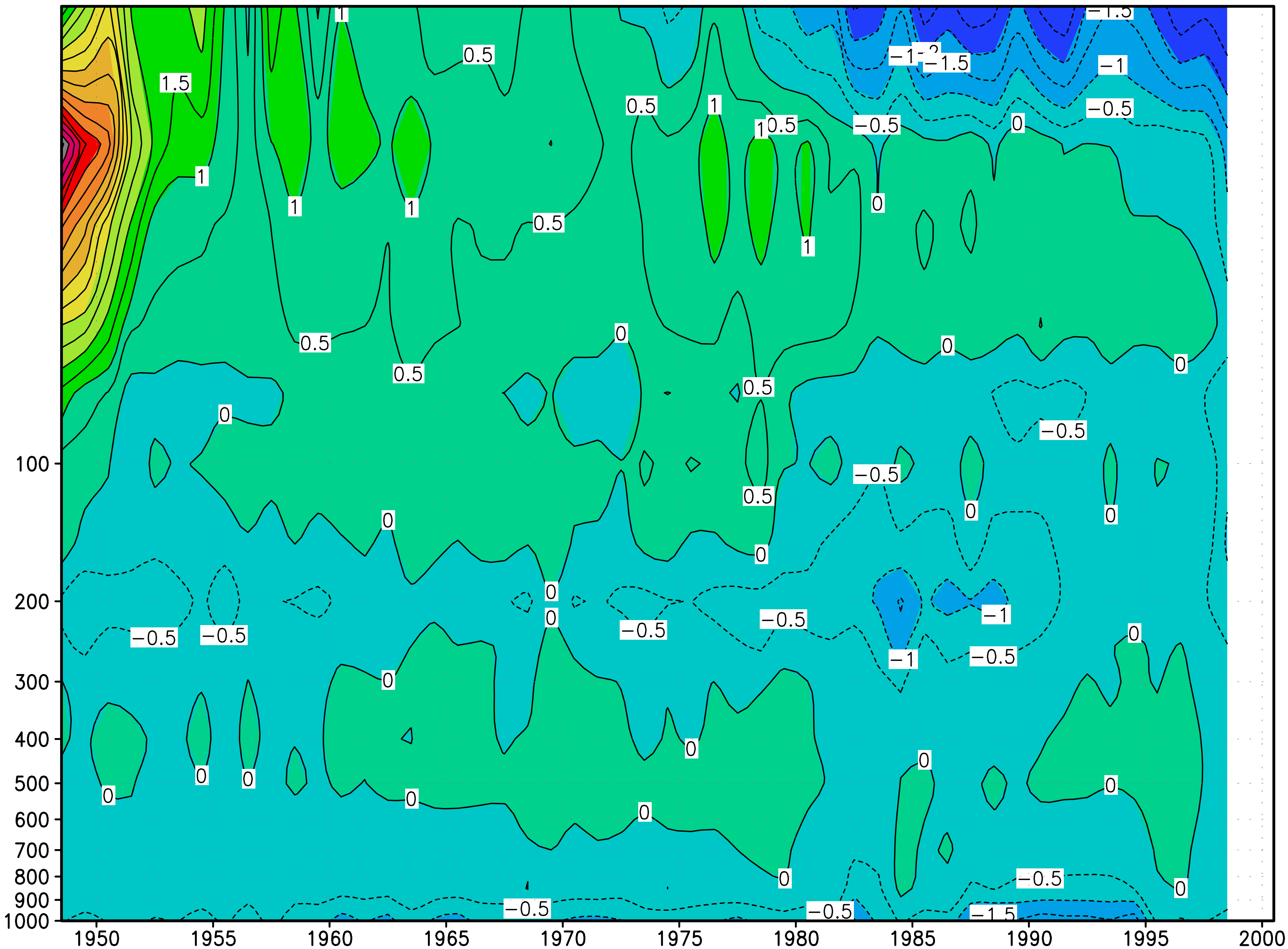

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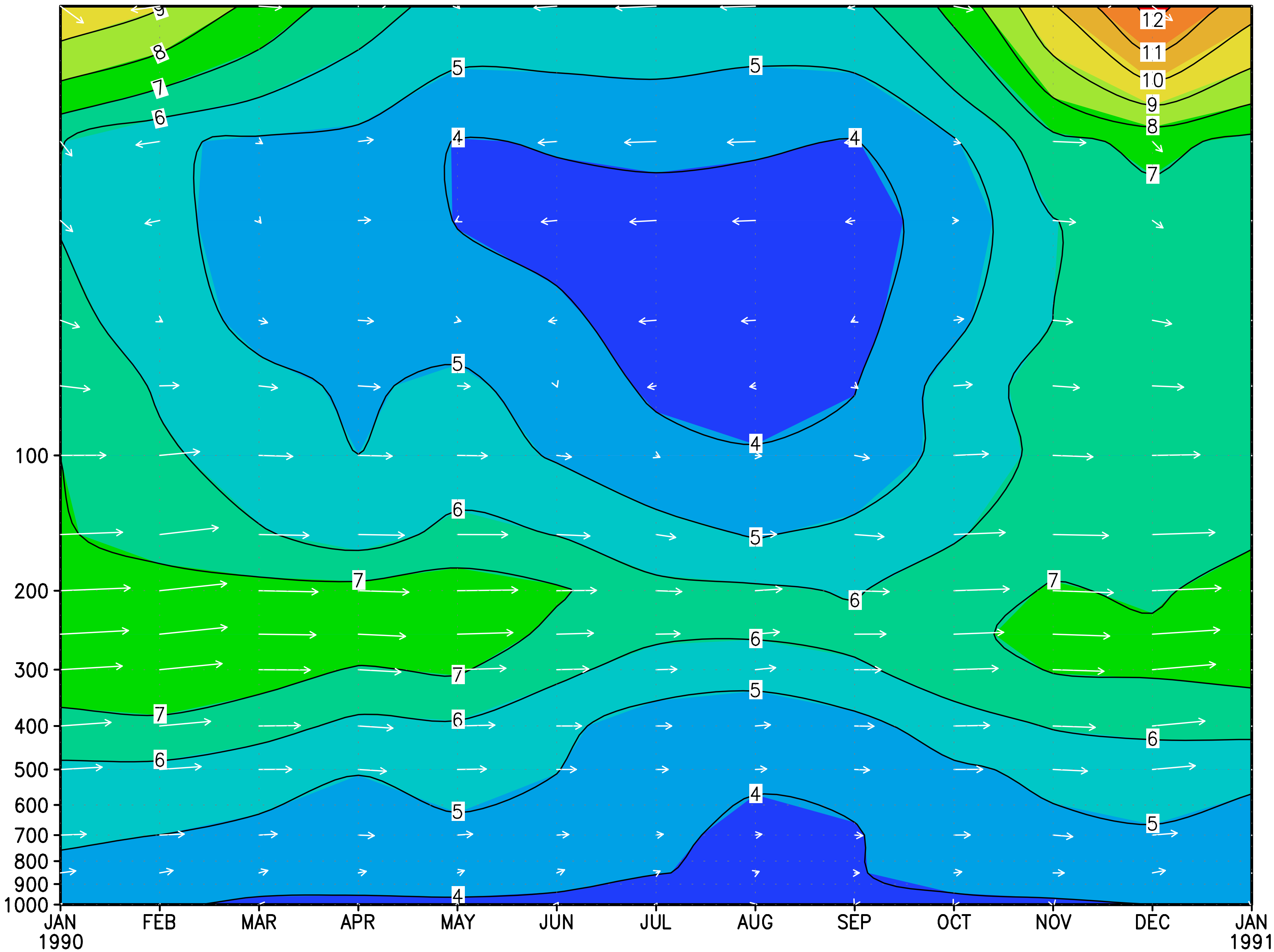

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