EXTENDED TIME – EXTENDED AREA

OPERATION PLAN

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1.0 INTRODUCTION

Extended Time - Extended Area (EA) observations are primarily satellite observations that for fixed periods during the course of a year are well sampled in time and nominally cover the portion of the western hemisphere from 70W-140W and from 50S - 50N as is shown in Figure 1. The analysis of this data is to extend the research objectives of FIRE in three essential ways. First, the observations will provide a bridge that will link the results of the Limited Area (LA) and Intensive Field Observations (IFO) to global-scale cloud properties. Second, the observations will provide further opportunities to test the physical interpretation of satellite-derived cloud properties and thereby add to the findings of the LA and IFO studies. Finally, the observations will serve as a test-bed for the development of cloud analysis schemes that will succeed the ISCCP analysis in future satellitebased global monitoring systems.

As Figure 1 shows, the region for EA observations encompasses a number of climatologically distinct regions. By making use of these distinct regions EA studies can extend the results of the LA and IFO studies to boundary conditions not found in the limited areas and also to whole cloud systems not normally found in those areas. While not global in extent, the area covered and the time-window of the observations will combine to provide an ensemble of cloud conditions that is likely to prove representative of the global ensemble. EA studies will thus be able to assess how well the findings of the LA and IFO studies represent those to be found on the global domain. The representativeness of the EA observations should permit the deve-lopment of analysis procedures for the majority of cloud systems found in the global set.

Owing to the extent of the observing area and to the large time-window for observations, EA studies can take advantage of the many opportunities for simultaneous views of individual cloud systems taken from different satellites. Such observations will provide additional tests of the physical models used to characterize cloud systems. The specific objectives of EA studies are listed in Section 2.0.

In EA work one recognizes the need to address two issues which are at the core of characterizing cloud properties from satellite observations. The first issue is the physical interpretation of the retrieved cloud properties such as cloud amount, cloud reflectivity, cloud emissivity, etc. The IFO and LA studies will devote considerable efforts to testing these interpretations. By comparing the spectral and di ectional signatures in the data with those predicted by the physical models used in the retrievals, EA studies will also test these interpretations. The second issue to be addressed by the EA/ET studies is the objective analysis of the retrieved cloud properties. Objective analyses use descriptive

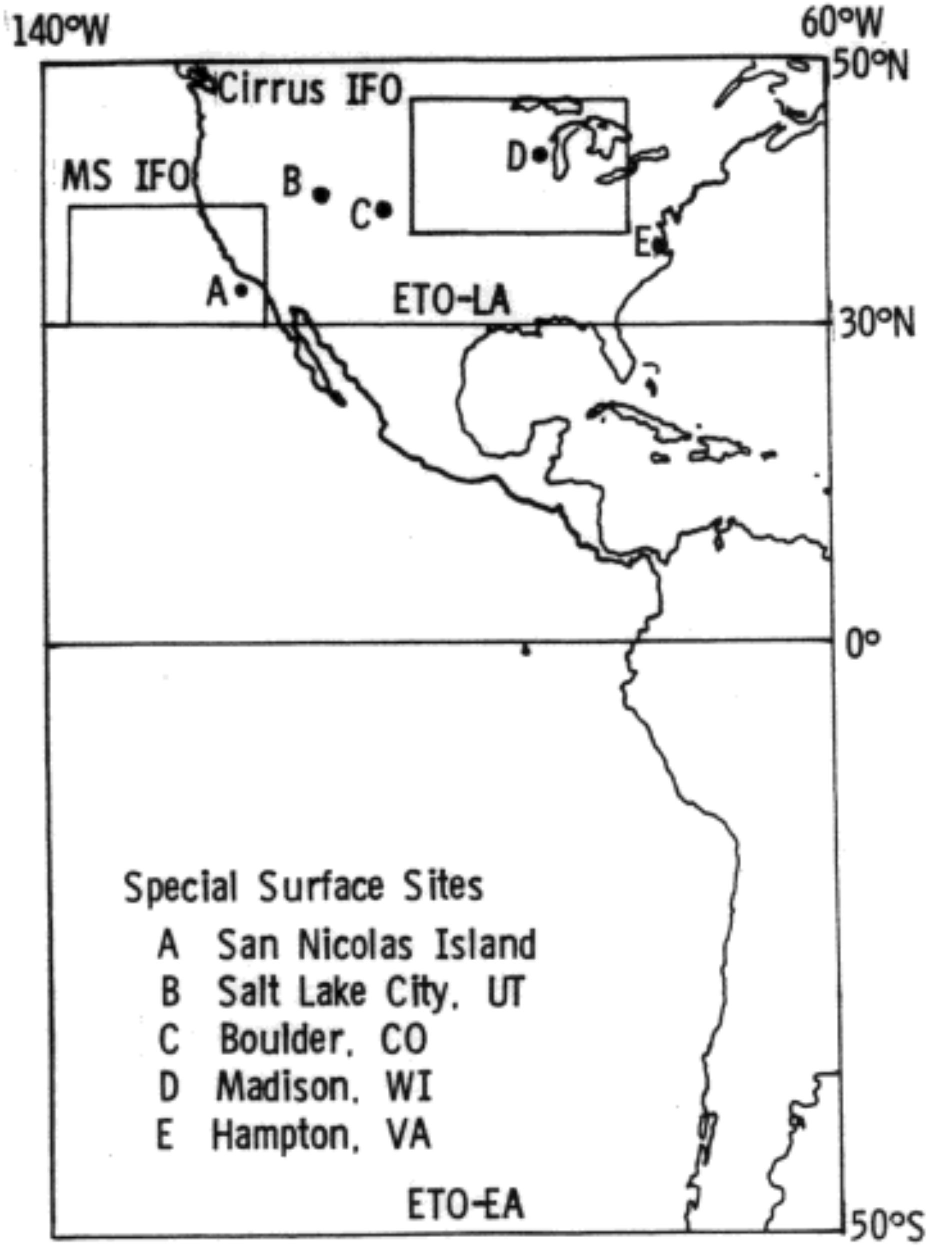

Figure – 1 – FIRE ETO and IFO Regions and Special Surface Sites models, which are often statistical, to interpolate cloud properties in space and time between observation points. From these models one derives estimates of diurnal sampling biases in monthly means and also regional means from composites of higher resolution statistics. Of course, in addressing these two issues of interpretation and objective analysis, FIRE has the specific obligation of testing the physical interpretations and analysis methods used in ISCCP.

While the EA studies promise considerable advances in the analysis of cloud properties from satellite observations, current budgetary constraints and current capabilities dictate the pursuit of less ambitious, exploratory pilot studies. The concept of the pilot studies is discussed in Section 3.0. One hopes that through these pilot studies researchers will develop considerable advances in capabilities. Furthermore, while the pilot studies make headway, one hopes that constraints on the budget for FIRE will shift to allow EA studies to reach their full potential.

Subsequent sections of this operations plan detail the scientific objectives, a typical experiment plan and data management for EA work. An Appendix provides outlines of specific experiment plans provided by individual investigators.

2.0 SCIENTIFIC OBJECTIVES

All EA studies fall under one of the following major objectives:

1. Test findings derived from LA and IFO studies to determine extent to which these findings apply to cloud systems found in different climatological regimes.

2. Test analyses for cloud systems not normally found in the FIRE designated limited areas.

3. Test cloud models using simultaneous multiple views from more than one satellite.

4. On limited but representative sample of data, quantify information gain in cloud climatology afforded by fullresolution (4-8 km, hourly), multispectral data over sampled data with limited spectral information.

As was mentioned earlier, there are two facets to be explored in the above objectives. First is the physical interpretation of the retrieved cloud properties and second is the objective analysis of those properties. Furthermore, FIRE carries the obligation of testing the specific interpretations and analysis methods used in ISCCP.

3.0 EXPERIMENT DESIGN

EA studies will generally have two parts: a pilot study, which if successful, is to be followed by a full-scale study. Owing to the size of the extended area and to the large number of observation days required to ensure statistically significant results, full-scale EA studies will undertake sizeable data processing efforts. As the cost of the data and its processing will be considerable, every effort must be made to ensure a reasonable expectation of success in the final outcome. As part of the insurance for success, each EA project will begin with a pilot study.

Pilot studies will use a rather limited (e.g., 10 days/season for one year) but typical data set. This data will be used to test and develop analysis methods that are to be used in the subseguent full-scale data processing task. The pilot study will also provide data from which one could estimate the size of the full-scale task.

Based on the results of the pilot study, the magnitude of the full-scale study is assessed; data for the full-scale study is acquired and placed in the FIRE archive for use by the investigators, and the study is performed. The results of the fullscale study are prepared by the investigators in a form that is suitable for archiving in the FIRE archive.

The Appendix contains outlines of specific experiment plans provided by individual investigators. -

4.0 DATA MANAGEMENT

Data for pilot and full-scale studies will be acquired by FIRE at the request of an investigator and placed in the FIRE archive for general use. As EA studies evolve, data will accumulate in the FIRE archive and the accumulation of this data will increase the likelihood that data already in the archive can serve a number of distinct studies performed by various investigators. The rate of data acquisition should, however, never exceed that outlined in the FIRE Implementation Plan.

Once the data is in the archive, copies are to be made for use by the investigators in their individual studies. Upon completion of the studies, the investigators will return to the archive the results of the full-scale study. Such results may be in the form of documented computer compatible tapes. The documentation should trace the path that leads from the original data to the final outcome. It should be sufficient to allow repeat studies as well as complimentary studies with the same data set.

APPENDIX

Outlines of EA/ET Experiments

Test of Procedures Used to Develop

Bidirectional Models

1. Investigators: J. Coakley and R. Davies

2. Objective: Use simultaneous multiple views from more than one satellite to evaluate bidirectional model based on single-satellite observations.

3. Pilot study 1: For 4 sets of 3 consectutive observation days, develop and test procedures for internavigating and intercalibrating polar orbiter and geosynchronous data.

4. Pilot study 2: For up to 10 sets of 3 consecutive observation days obtain results necessary to assess the magnitude of full-scale study.

5. Acquire and process data for full-scale study.

6. Intercompare multiple-view bidirectional characteristics with those derived using single-satellite methodology.

7. Prepare results for inclusion in FIRE archive.