NASA WATER VAPOR PROJECT – MEASURES (NVAP-M) GLOBAL WATER VAPOR DATASET: EARLY RESULTS FOR CLIMATE STUDIES

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Abstract

The NASA Water Vapor Project (NVAP) dataset is a global (land and ocean) water vapor climate data record created by merging multiple measurements of atmospheric water vapor to form a global depiction of total and layered precipitable water vapor. Created under the NASA Making Earth Science Data Records for Research Environments (MEaSUREs) program, NVAP-MEaSUREs (NVAP-M) is now publicly available from the NASA Langley Atmospheric Science Data Center. NVAP-M spans the period from 1988-2009 with daily fields of total column and layered water vapor.

While consistent radiances and algorithms were used throughout NVAP-M, time-varying sampling still exists. Any results on trends derived from NVAP-M must be considered insignificant at this point, as the impact of this time-varying sampling is still being assessed. This includes the varying mixture of clear and cloudy scenes, as well as changing amounts of land and ocean sampling. Initial results showing the presence of time-varying sampling in NVAP-M are presented.

INTRODUCTION

The NVAP-M dataset is described in Vonder Haar et al. (2012) and is available at the NASA Langley Atmospheric Science Data Center (ASDC) at (https://eosweb.larc.nasa.gov/project/nvap/nvap-m_table). A User's Guide and Algorithm Theoretical Basis Document (ATBD) are also available at the ASDC. The data covers land and ocean so that it will be a truly global data set and meet the needs of many users in climate, weather and hydrology research. NVAP-M was produced in three processing streams (Weather, Climate and Ocean), each geared towards a variety of users. These three streams have slightly different inputs to either maximize spatial and temporal coverage of the data inputs or to make the result as time-consistent as possible. Typical types of uses of NVAP-M include model intercomparison, process studies such as of the MJO, and hydrological moisture budget and transport studies.

TIME-DEPENDENT SAMPLING

The NVAP-M project faced the challenge of creating a multisensor global water vapor record from a variety of satellite measurements supplemented by a relatively small number of globally – distributed, quality-controlled rawinsondes. The timeline of sensor inputs is shown in Figure 1. While NVAP-M used the same algorithms and the latest intercalibrated radiance records (Sapiano et al. 2013), there are fundamental sampling differences between the sensor inputs. Passive microwave sensors like the Special Sensor Microwave / Imager (SSM/I) used in NVAP-M retrieve TPW in clear and cloudy conditions, but do not sample in precipitation and over land. Infrared sensors like the High Resolution

Infrared Sounder (HIRS) and the Atmospheric Infrared Sounder (AIRS) sample clear or mostly clear skies over all land surfaces.

Figure 1 illustrates the changes through time in sensor sampling in NVAP-M. Both the number of SSM/I and HIRS observations have changed through time, with a particularly data-rich period from 2003- 2005. Our current research explores whether and how these changes in sampling affect calculated properties of the atmosphere such as global and regional means and trends in layered in TPW and layered water vapor.

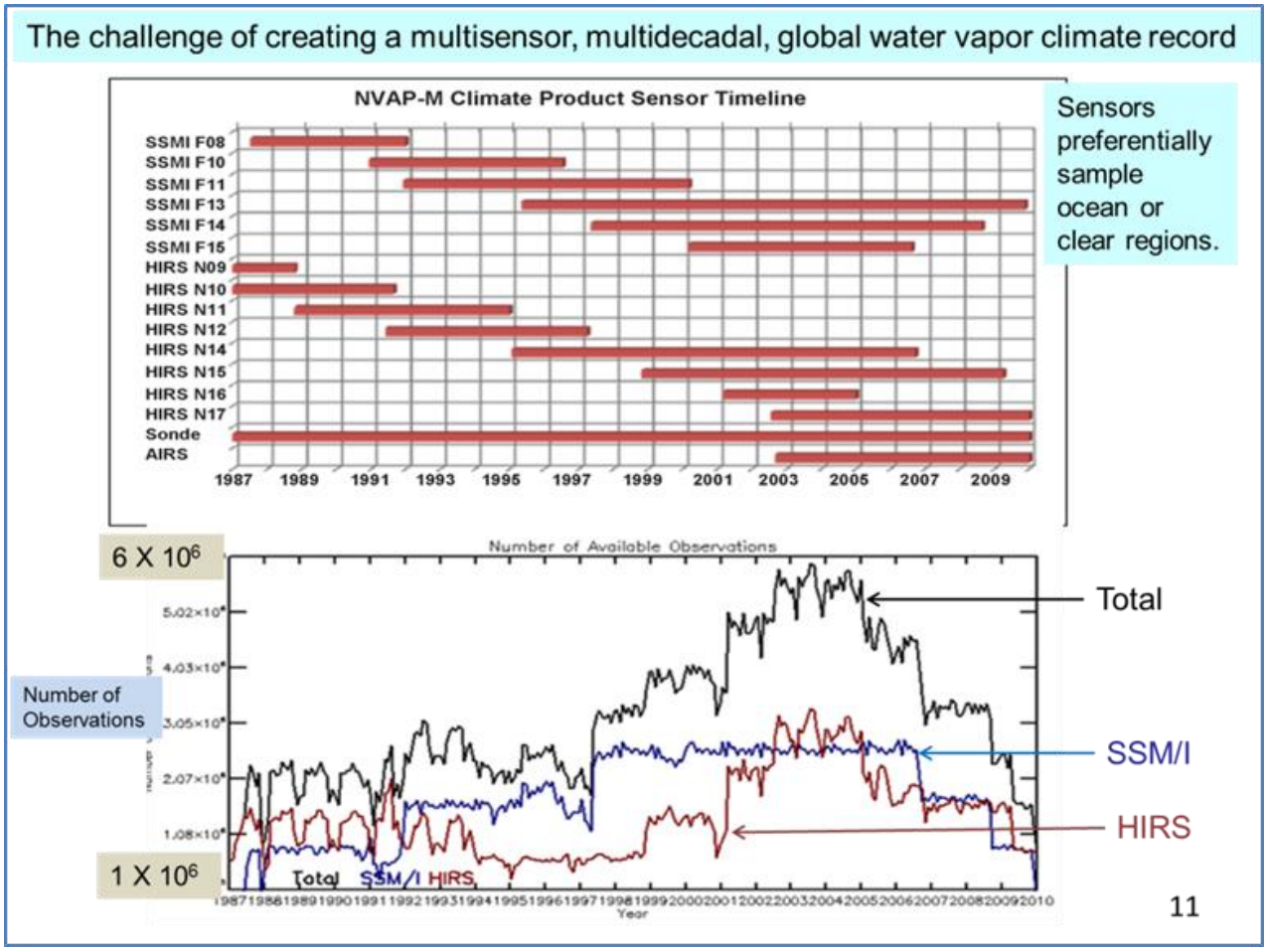

Figure 1: **NVAP-M sensor timeline, and time series of number of total, SSM / I and HIRS observations.**

SUMMARY

NVAP-M is a complex geophysical data set which depicts water vapor over land and ocean from 1988 – 2009. The sensor inputs to NVAP-M have their own biases in terms of sampling all geophysical states. Error bars associated with this sampling are still being determined, as illustrated by Yue et al. (2013) for AIRS. Since the error due to this time dependent geophysical sampling is still being quantified, no statement on existence or lack of existence of trends in NVAP-M has any basis at this time. The statement in Vonder Haar et al. (2012) “Therefore, at this time, we can neither prove nor disprove a robust trend in the global water vapor data” still stands.

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