MICROWAVE MEASUREMENTS ON NPP AND NPOESS WITH THE ADVANCED TECHNOLOGY MICROWAVE SOUNDER AND THE MICROWAVE IMAGER/SOUNDER

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The first Advanced Technology Microwave Sounder (ATMS) is currently manifested on NASA's National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) and scheduled for launch in 2010. ATMS is also planned to fly on the first NPOESS flight, C1 planned for 2013. However, for NPOESS C2 planned for 2016, the Microwave Imager/Sounder (MIS) will provide Atmospheric Temperature and Moisture Sounding Environmental Data Records (EDRs) as part of this NPOESS mission and ATMS is not currently included in the manifest for C2.

The ATMS sensor is a cross-track scanning multi-channel radiometer with a swath width of 2503 km sampled in 96 beam positions using a 1.1 degree sampling interval. The swath width allows contiguous coverage at the equator in the NPOESS orbit. It has nadir footprints of ~74.8, 31.6, 15.8 km for its surface (23 and 31 GHz), temperature sounding (50 – 60 and 89 GHz) and moisture sounding (166 and 183 GHz) channels respectively. Calibration is achieved using an onboard hot calibration target and cold space calibration observation. The instrument mass is ~75 kg and requires ~120 W of power.

The ATMS provides atmospheric vertical temperature sounding profiles up to ~45 km (~1 mb) using several channels near the 11^{-} and 13^{-} rotational line of the 50 GHz O_2 absorption complex along with additional measurements near 89-GHz and in the more transparent regions of the 50 GHz O_2 complex. The ATMS channel selection contained in the original sensor specification for the NPP will be the same for the NPOESS ATMS and is also being considered in selection of the NPOESS MIS Lower Atmospheric Sounding (LAS) and Upper Atmospheric Sounding (UAS) channels. If the ATMS channel set or a subset of the ATMS channels are adopted for MIS, a common set of measurements may be available across the currently planned set of missions albeit with differences of scan geometry.

The first MIS is currently under development by the U.S. Naval Research Laboratory (NRL) and will include channels from 6.2- through 183.31 GHz. The MIS LAS capability for FM1 on NPOESS C2 is based on heritage capability of Special Sensor Microwave Imager/Sounder (SSMIS) up to 10 mb altitude; however, the MIS second flight unit will include UAS capability to ~80 km altitude (0.01 mb).

For moisture sounding, the ATMS includes 5 channels in a double sideband configuration near the 183.31-GHz water absorption line and an additional channel at 166.3 GHz window to support the moisture retrievals. The current MIS design includes only 3 channels near the 183 GHz water line and a 166 GHz channel and these channels are expected to be the same for all MIS flight models.

This paper will provide an overview of the NPP and NPOESS microwave measurements from ATMS and MIS and contrast the microwave sounding measurements available from each mission. This

comparison will include channel selection, atmospheric temperature and moisture weighting functions, sensor calibration and perspectives on the impact of heritage cross-track and conical scanning sensors [Advanced Microwave Sounding Unit (AMSU) for ATMS and SSMIS for MIS] to numerical weather forecasts.