NATIONAL WEATHER ASSOCIATION

1697 Capri Way
Charlottesville, Virginia 22911-3534
Tel/Fax: (434) 296-9966
NatWeaAsoc@aol.com
www.nwas.org

May 19, 2006

Ms. Mary Kicza
Deputy Assistant Administrator for Satellite and Information Services
National Environmental Satellite, Data, and Information Service, NOAA
1335 East-West Highway
SSMC1 Room 8338
Silver Spring, Maryland 20910-3226

Dear Ms. Kicza,

The National Weather Association (NWA) respectfully requests your support and advocacy for the development of a Geostationary Microwave Sensor (GOES-MWS).

Consistent with NWA's stature as a member-led, non-profit, professional organization supporting and promoting excellence in operational meteorology and related activities, we support initiatives to modernize observing platforms and take advantage of new technologies to continue excellence in daily weather observing and forecasting for the public good

I invite you to read the enclosed Letter of Support and hope you will enthusiastically advocate in all ways possible the inclusion of the GOES-MWS on GOES-R and, if possible, as a standalone demonstration on a geostationary platform as soon as feasible.

Thank you very much for your consideration of this request.

Sincerely,

Original Signed

David I. Knapp
President

Enclosure

NATIONAL WEATHER ASSOCIATION

Letter of Support (May 15, 2006)

GOES Microwave Sensor (GOES –MWS)

The National Weather Association (NWA) is a member-led, non-profit, professional organization promoting excellence in operational meteorology. Excellence in daily weather observing and forecasting can best be achieved by continual modernization of observing equipment to take advantage of new technologies as soon as possible. Therefore, on behalf of the over 3,000 NWA members from all sectors of the meteorological community, the NWA President--with the advice and consent of the NWA Council--requests the support of all concerned for the inclusion of a Microwave Sensor (MWS) on one of the satellites in the Geostationary Operational Environmental Satellite (GOES)-R series and/or, if possible, an earlier demonstration on a standalone geostationary platform. A MWS on GOES would allow for near-continuous monitoring and observation of precipitation (rate, phase), water vapor, and profiles of temperature and moisture (in both clear and cloudy environments) over the Continental United States (CONUS) and southern Canada, portions of the Atlantic and Pacific Ocean basins including Puerto Rico, Hawaii and other islands in the field of view, and Central and South America. National Aeronautics and Space Administration (NASA) and National Oceanic and Atmospheric Administration (NOAA) scientists have developed and researched the techniques, applications, and benefits of such microwave systems on Low Earth Orbiting (LEO) operational and research satellites over the last several years. Researchers and operational forecasters have used data and information from LEO microwave sensors in such high-profile events as the widespread catastrophic Mississippi River flood event of 1993 (Scofield and Achutuni 1996) and flooding associated with land falling tropical cyclones (Kidder et al. 2005; Ferraro et al. 2005; Hawkins et al. 2001).

The MWS observations of temperature, moisture and precipitation from geostationary orbit would provide a continuous "snapshot" of many key meteorological ingredients conducive to the formation, duration and intensity of precipitation. In addition, operations in cloudy regions, not possible with current GOES infrared (IR) sensors, would allow for important meteorological information to be made available continuously to field forecasters and be used as critical input into numerical weather prediction (NWP) models (e.g., continuously derived temperature and moisture profiles, continuous three-dimensional temperature retrievals revealing warm-core structure in tropical cyclones, timely radiances for NWP assimilation, etc.). The MWS-based precipitation observations would also complement the current U.S. radar and rain gauge network, in particular, over complex terrain and over adjacent coastal waters where ground based observations are lacking. Such observations are crucial in flash flood forecasting. Finally, the MWS would be a particularly important tool for observing the rainband structure of hurricanes which holds some promise in determining future changes in hurricane intensity.

Research continues to indicate that such MWS measurements would provide vital information that could help the operational weather, aviation, and disaster preparedness communities in their support of commerce, transportation, security and public safety:

- Passive microwave retrievals of precipitation rate are typically more accurate than those from visible and IR measurements due to their more direct connection to the precipitation process (Ebert et al. 1996).
- Improved precipitation retrievals can be obtained by merging radiances and physically derived cloud microphysical parameters from visible, IR and MW measurements (Kuligowski 2002; Scofield and Kuligowski 2003; Joyce et al. 2004).
- Large voids in the Next Generation Radar (NEXRAD) and rain gauge networks over mountainous terrain and U.S. coastal waters (Hunter 1996; Westrick et al. 1999) can be improved by accurate rain rate retrievals from satellites (Gourley et al. 2002).

- Passive microwave vertical temperature profiles retrieved in tropical cyclones indicate rapid warm core intensification 6-12 hours prior to surface pressure deepening (Brueske and Velden 2003).
- Significant improvements in tropical cyclone track forecasts have occurred in recent years, attributable in part to better initial positioning obtained from microwave observations (National Academy of Sciences 2004).
- By providing data in cloudy regions, improvements in the initialization of numerical weather prediction models have shown a remarkable increase in medium range forecast skill (Joint Center for Satellite Data Assimilation (JCSDA) Workshop on Clouds and Precipitation, May 2005).
- Passive microwave measurements would yield improved routing of commercial, military, and private aircraft over the CONUS (Seliga et al. 2002) and oceanic regions (Weber et al. 1998) where observations of thunderstorm intensity are currently scarce.
- A greater ability to monitor the intensification or weakening of storms during radar outages, or where radar coverage is poor, such as in mountainous areas (Weber et al. 1998), can be accomplished via complementary satellite rain rate retrievals.
- Passive microwave sensors have been operated successfully on LEO satellites for over two decades. Although technological constraints have previously prevented the deployment of such a microwave sensor on a geostationary satellite, recent engineering advances promise to overcome hardware issues such as antenna size, instrument weight, etc. Furthermore, optimal channel selection can produce useful spatial resolutions on the order of 10 – 30 km). For example:
  - The GOMAS (Geostationary Observatory for Microwave Atmospheric Sounding) (Bizzarri et al. 2002) is being proposed to the European Space Agency (ESA).
  - The GEM (Geostationary Microwave Observatory) (Staelin et al. 1998) is being considered by NOAA as a possible sensor for GOES-R.

Finally, several national and international organizations have strongly recommended that the MWS be pursued by satellite agencies. In particular:

- A 2002 report from an interdisciplinary workshop hosted by NOAA concluded that, "NOAA should encourage the development of passive microwave instruments for geostationary satellites in order to provide the kind of high-temporal-resolution precipitation measurements that are required for short-term storm forecasting. NOAA should consider establishing a program office or a sub-program within its current GOES program office to facilitate the development of such an instrument." (NOAA, May 2002).
- The WMO Coordinating Group on Meteorological Satellites (WMO/CGMS) strongly supports the International Geostationary Laboratory (IGeoLab), a prototype geostationary MWS mission led by EUMETSAT. (WMO, January 2005). The IGeoLab focus group has met as recently as October 2005 and continues to pursue the development of this concept.

We recommend that NOAA, NASA, Department of Defense, private industry, and international partners work together to help accelerate the development and deployment of a microwave sensor on a geostationary platform, either as a sensor of opportunity within the GOES-R era or as a standalone mission through international collaboration such as the IGeoLab. Even prior to a GOES-R era deployment, a demonstration geostationary MWS would constitute a valuable risk reduction activity, and could be used to assess data delivery, product development, and forecast potential.

References

"Assessment of the Benefits of Extending the Tropical Rainfall Measuring Mission: A Perspective from the Research and Operations Communities, Interim Report", National Academy of Sciences, 2004.

"NOAA Workshop on Requirements for Global Precipitation Data", Silver Spring, MD, May 2002.

"Proceedings of the 2nd International Precipitation Working Group (IPWG)", Monterey, CA, October 2004.

"Proceedings of the Joint Center for Satellite Data Assimilation (JCSDA) Workshop on Clouds and Precipitation", Lansdowne, VA, May 2005.

"World Meteorological Organization (WMO) Consultative Meetings on High-Level Policy on Satellite Matters – Fifth Session", Geneva, Switzerland, January 2005.Bizzarri B. et al. (40 partners of GOMAS), 2002: "Requirements and perspectives for MW/Sub-mm sounding from geostationary satellite". *Proceedings of "The 2002 EUMETSAT Meteorological Satellite Conference",* Dublin 2-6 September 2002, 97-105.

Bizzarri, B., A. Gasiewski, and D. Staelin, 2002: Frequent rain observation from geostationary satellite by millimetre-submillimetre-wave sounding. *Proceedings of the 1st Workshop of the International Precipitation Working Group,* Madrid, 23-27 September 2002, 101-111.

Brueske, K. F., and C. S. Velden, 2003: Satellite-Based Tropical Cyclone Intensity Estimation Using the NOAA-KLM Series Advanced Microwave Sounding Unit (AMSU), *Monthly Weather Review,* **131,** 687-697.

Ebert, E. E., M. J. Manton, P. A. Arkin, R. J. Allam, G. E. Holpin and A. Gruber, 1996: Results from the GPCP Algorithm Intercomparison Programme. *Bull. Amer. Met. Soc.*, **77,** 2875-2887.

Ferraro, R., P. Pellegrino, M. Turk, W. Chen, S. Qiu, R. Kuligowski, S. Kusselson, A. Irving, S. Kidder and J. Knaff, 2005: The Tropical Rainfall Potential. Part 2: Validation, *Weather and Forecasting,* **20,** 465-475.

Gourley, J. J., R. A. Maddox, K. W. Howard and D. W. Burgess, 2002: An exploratory multisensor technique for quantitative estimation of stratiform rainfall. *J. Hydrometeor.*, **3,** 166-180.

Hawkins, J. D., T. F. Lee, K. Richardson, C. Sampson, F. J. Turk and J. E. Kent, 2001: Satellite multi-sensor tropical cyclone structure monitoring. *Bull. Amer. Met. Soc.,* **82,** 567-578.

Hunter, S. M., 1996: WSR-88D radar rainfall estimation: capabilities, limitations and potential improvements. *Natl. Wea. Dig.,* **20,** 26-38.

Joyce, R. J., J. E. Janowiak, P. A. Arkin and P. Xie, 2004: CMORPH: A method that produces global precipitation estimates from passive microwave and infrared data at high spatial and temporal resolution. *J. Hydrometeor.,* **5,** 487-503.

Kidder, S., J. Knaff, S. Kusselson, R. Ferraro, R. Kuligowski and M. Turk, 2005: The Tropical Rainfall Potential. Part 1: Description and Examples. *Weather and Forecasting,* **20,** 456-464.

Kuligowski, R. J., 2002: A self-calibrating real-time GOES rainfall algorithm for short-term rainfall estimates. *J. Hydrometeor.,* **3,** 112-130.

Scofield, R. A., and Rao Achutuni, 1996: The Satellite Forecasting Funnel Approach for predicting flash floods, *Remote Sensing Reviews,* **14,** 251-282.

Scofield, R. A., and R. J. Kuligowski, 2003: Status and outlook of operational precipitation algorithms for extreme precipitation events. *Weather and Forecasting,* **18,** 1037-1051.

Staelin, D. H., A. J. Gasiewski, J. P. Kerekes, M. W. Shields and F. J. Solman III, 1998: *Concept proposal for a Geostationary Microwave (GEM) Observatory*. Prepared for the NASA/NOAA Advanced Geostationary Sensor (AGS) Program, MIT, Lexington, Massachusetts, pp. 23.

Weber, M. E., E. R. Williams, M. M. Wolfson and S. J. Goodman, 1998: An Assessment of the Operational Utility of a GOES Lightning Mapping Sensor. *Project Report NOAA-18,* Lincoln Laboratory, MIT, Lexington, Massachusetts, 13 February.

Westrick, K. J., C. F. Mass and B. A. Colle, 1999: The limitations of the WSR-88D radar network for quantitative precipitation measurement over the coastal Western United States. *Bull. Amer. Met. Soc.,* **80,** 2289-2298.