Short-term mobility 2011
Activity report

Title of the program: Soil moisture retrieval from microwave data
Host Institution: The Ohio State University, Department of Electrical and Computer Engineering, ElectroScience Laboratory (ESL), 1320 Kinnear Rd, Columbus, OH 43212, USA
Scientific responsible at The Ohio State University: Prof. Joel Johnson (ESL)
Italian visiting scientist: Dr. Francesco Mattia (CNR-ISSIA)
Period of the visit: June 7th - June 28th, 2011

In the following the scientific activity carried out during the visiting period of Dr. Francesco Mattia at The Ohio State University, in the framework of the CNR short mobility program 2011, is summarized.

Activity report

The objective of the visit has been to promote an extended technical interchange between CNR-ISSIA and ESL on themes related to the retrieval of soil moisture content from microwave remote sensing (MRS) data.

Robust and accurate estimates of spatial and temporal distribution of volumetric soil moisture content (m_v), at global scale and high spatial resolution (*100-1000m*), can play an important role in improving a number of land applications such as, for instance, numerical weather prediction, seasonal hydrologic forecasting and drought identification. Over the last decades, SAR systems have widely demonstrated their high sensitivity to m_v and therefore they have raised large expectations concerning their capability in providing m_v maps at high spatial resolution. However, despite the massive amount of data collected in the course of the various SAR space missions, operational algorithms retrieving m_v with sufficient accuracy and robustness are not yet available. As a consequence, a strong research effort is still required to develop algorithms retrieving soil moisture from SAR data with a good accuracy and stability. Such a kind of research requires a critical mass of interdisciplinary know-how (e.g. remote sensing, electromagnetic modeling, signal processing and land process modeling) and the access to time series of well documented ground and remote sensing data. In USA and in Europe, such a research is conducted with a view to the envisaged NASA SMAP mission (Prof. J. Johnson is member of the Science Definition Team for SMAP mission) and the forthcoming ESA Sentinel-1 mission (launch scheduled in 2013).

In this context, the visit of Dr. Mattia at ESL has paved the way for a long term collaboration with the following objectives:

1. Improve the current understanding of electromagnetic (em) scattering from bare and vegetated surfaces with a particular emphasis on the cross-polarized components;
2. build a common data base of in situ and microwave remote sensing data;
3. develop common tools to simulate the em scattering from natural surfaces which serve as basis for the numerical assessment of retrieval algorithms;
4. explore new approaches for the retrieval of surface bio-physical parameters, particularly based on the use of dense temporal series of remote sensing data.

On these themes, Dr. Francesco Mattia has been interacting with Prof. Joel Johnson's and his group and a link with other researchers at CNR-ISSIA has also been established.

More specifically, the outcome of the visit can be summarized as follows:

- three well documented data sets (one available at ESL and two at CNR-ISSIA) have been identified as basis for the development activity;
- a first set of surface (available at ESL) and volume (available at CNR-ISSIA) scattering models has been selected to be merged into a more complete scattering model which will be used by both Institutes for further analysis;

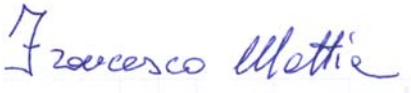
In addition,

- on June 16th, Dr. Mattia gave a seminar at the ElectroScience Laboratory on “On the Use of Dense Time Series of SAR data for Soil Moisture Retrieval over Agricultural Sites“;
- in September 2011, ESL and CNR-ISSIA will participate to a NASA SMAPEx-2 experimental campaign in Australia;
- in December 2011, CNR-ISSIA and ESL will participate to a Standard Grant Proposal to Natural Environment Research Council (NERC), United Kingdom, led by Cranfield University;

Further meetings, e.g. in coincidence of forthcoming remote sensing Symposia, have been planned and will be exploited to verify the progresses of the activity.

For the sake of completeness, the letter of Prof. Joel Johnson acknowledging the activity carried out during the visit of Dr. Mattia is attached as an appendix.

Bari, July 18th, 2011



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July 19th, 2011

SUBJECT: DECLARATION LETTER TO SHORT MOBILITY PROGRAM FOR DR. FRANCESCO MATTIA

Dear CNR:

I am writing to confirm the visit of Dr. Francesco Mattia of CNR/ISSIA to The Ohio State University from June 7-28, 2011 as part of the Short Mobility Program, and to express gratitude for CNR's sponsorship of Dr. Mattia's visit to our laboratory. Dr. Mattia's visit was hosted at the ElectroScience Laboratory of the Department of Electrical and Computer Engineering at Ohio State. The Laboratory provided office space and computer access for Dr. Mattia during his visit.

Dr. Mattia's visit was of great interest to my research group because of our common interests in the remote sensing of soil moisture using microwave sensors. Dr. Mattia is a well-known expert in this area, and we conducted an extended technical interchange during his visit. We have identified several future topics for continued collaboration, as detailed in Dr. Mattia's summary, including sharing datasets, improving scattering models, and a current joint collaborative proposal with a group in the UK. The involvement of my research group with NASA's Soil Moisture Active/Passive (SMAP) satellite mission and Dr. Mattia's continuing synthetic aperture radar soil moisture research will provide numerous continuing opportunities for collaboration.

Please feel free to contact me if you have any questions about Dr. Mattia's visit and our plans for future collaboration.

Sincerely,

Joel T. Johnson

Professor