

# Sat Kumar

Department of Civil Engineering  
IISc, Bangalore, India – 560012

+91 9986568525

+91 8023600404

satkumartomer@gmail.com

www.ambhas.com



## Research Interests

---

- Retrieval of hydrological and vegetation variables from remote sensing
- Land surface modelling
- Data assimilation
- Inverse modelling

## Research Experience

---

### Indian Institute of Science

Research associate, Interdisciplinary Centre for Water Research (ICWaR)

**Bangalore, India**

July, 2015 – present

Supervisor: Prof. P. P. Mujumdar and Prof. Sekhar

Projects:

- Calibration/validation of COSMOS sensor for soil moisture retrieval
- Retrieval of soil moisture from RISAT over Karnataka state

### Centre d'Etudes Spatiales de la BIOSphère (CESBIO)

Research associate

**Toulouse, France**

May, 2012 – June, 2015

Supervisor: Dr. Yann Kerr

Projects:

- SMOS+Hydrology: Exploration of the potential and limits of SMOS data (brightness temperatures and soil moisture) for hydrological applications over large basins
- MAPSM: Merging active and passive soil moisture for a higher resolution soil moisture products

## Teaching Experience

---

### SMOS training course III

Gave lecture and practical session

**Madrid, Spain**

18-22 May 2015

### SMOS training course II

Gave lecture and practical session

**Toulouse, France**

27-31 May 2013

### SMOS training course I

Gave lecture and practical session

**Toulouse, France**

5-9 November 2012

## Education

---

### Indian Institute of Science

PhD, Faculty of Engineering

**Bangalore, India**

2008–2012

Thesis: Soil moisture modelling, retrieval from microwave remote sensing and assimilation in a tropical watershed

Supervisors: Prof. M. Sekhar and Prof. M. S. Mohan Kumar

**Indian Institute of Science**

*ME, Water Resources and Environmental Engineering*

Thesis: Soil moisture modelling and assimilation in experimental plots of South India

CGPA: 7/8, *First class with distinction*

Supervisors: Prof. M. Sekhar

**Bangalore, India**

*2006–2008*

**Kamla Nehru Institute of Technology**

*BTech, Civil Engineering*

Marks: 74.6%, *First division*

**Sultanpur, India**

*2003–2006*

**Government Polytechnic**

*Diploma, Civil Engineering*

Marks: 83%, *First division with honours*

**Bijnor, India**

*2000–2003*

**R J P Arya Inter College**

*High School*

Marks: 67%, *First division*

**Bijnor, India**

*2000*

## Teaching Interests

---

- Engineering Hydrology
- Ground Water Engineering
- Modelling and Analysis of Geospatial Data
- Thermal, Microwave and Hyperspectral Remote Sensing
- GIS and Remote Sensing
- Data Assimilation in Hydrology
- Applications of Remote Sensing in Hydrology

## Technical skills

---

Programming languages: Python, MATLAB, R and C

GIS: GRASS, QGIS, GDAL, ArcGIS and Surfer

Hydrological Models: VIC, Hydrus and TOPMODEL

Operating systems: Linux and Windows

Publishing: Latex, HTML and Wordpress

## Publications

---

Peer Reviewed Journals.....

1. Lievens, H., **Tomer, S. K.**, Al Bitar, A., De Lannoy, G. J. M., Drusch, M., Dumedah, G., Hendricks-Franssen, H.-J., Kerr, Y. H., Pan, M., Roundy, J. K., Vereecken, H., Walker, Wood, E. F., Verhoest N. E. C. and Pauwels, V. R. N. (2015). SMOS soil moisture assimilation for improved hydrologic simulation in the Murray Darling Basin, Australia. *Remote Sensing of Environment*,

168, 14–162.

2. **Tomer, S. K.**, Al Bitar, A., Sekhar, M., Corgne, S., Bandyopadhyay, S., Sreelash, K., Sharma, A. K., Zribi, M. and Kerr, Y. (2015). Retrieval and multi-scale validation of soil moisture from multi-temporal SAR data in a tropical region. *Remote Sensing*, 7(6), 8128–8153.
3. H. Lievens, A. Al Bitar, N. E. C. Verhoest, F. Cabot, G. J. M. De Lannoy, M. Drusch, G. Dumedah, H.-J. Hendricks Franssen, Y. Kerr, **S. K. Tomer**, B. Martens, O. Merlin, M. Pan, M. J. van den Berg, H. Vereecken, J. P. Walker, E. F. Wood, and V. R. N. Pauwels (2015). Optimization of a radiative transfer forward operator for simulating multi-angular/polarization SMOS brightness temperatures over the Upper Mississippi Basin, USA. *Journal of Hydrometeorology*, 16, 1109–1134.
4. Verhoest, N. E., van den Berg, M. J., Martens, B., Lievens, H., Wood, E. F., Pan, M., Kerr, Y. H., Al Bitar, A., **Tomer, S. K.**, Drush, M., Vernieuwe, H., De Baets, B., Walker, J. P., Dumedah, G. and Pauwels, V. R. N (2015). Copula-based downscaling of coarse-scale soil moisture observations with implicit bias correction. *Geoscience and Remote Sensing, IEEE Transactions on*, 53(6), 3507-3521.
5. Orgogozo, L., Renon, N., Soulaire, C., Henon, F., **Tomer, S. K.**, Labat, D., Pokrovsky, O. S., Sekhar, M., Ababou, R. and Quintard, M. (2014). An open source massively parallel solver for Richards equation: Mechanistic modelling of water fluxes at the watershed scale. *Computer Physics Communications*, 185(12), 3358-3371.
6. Sekhar, M., Shindekar, M., **Tomer, S. K.** and Goswami, P. (2013). Modeling the vulnerability of an urban groundwater system due to the combined impacts of climate change and management scenarios. *Earth Interactions (AGU)*, 17(10), 1-25.
7. Sreelash, K., Sekhar, M., Ruiz, L., **Tomer, S. K.**, Guerif, M., Buis, S., Durand, P., and Gascuel-Oudou, C. (2012). Parameter estimation of a two-horizon soil profile by combining crop canopy and surface soil moisture observations using GLUE. *Journal of Hydrology*, 456, 57-67.
8. de Bruin, A., de Condappa, D., Mikhail, M., **Tomer, S. K.**, Sekhar, M. and Barron, J. (2012). Simulated water resource impacts and livelihood implications of stakeholder-developed scenarios in the Jaldhaka Basin, India. *Water International*, 37(4), 492-508.
9. **Kumar, S.**, Sekhar, M., Reddy, D. V. and Kumar, M. (2010). Estimation of soil hydraulic properties and their uncertainty: comparison between laboratory and field experiment. *Hydrological processes*, 24(23), 3426-3435.
10. Ruiz, L., Varma, M. R., Kumar, M. M., Sekhar, M., Marechal, J. C., Descloitres, M., Riotte, J., **Kumar, S.**, Kumar, C. and Braun, J. J. (2010). Water balance modelling in a tropical watershed under deciduous forest (Mule Hole, India): Regolith matric storage buffers the groundwater recharge process. *Journal of Hydrology*, 380(3), 460-472.
11. **Kumar, S.**, Sekhar, M. and Bandyopadhyay, S. (2009). Assimilation of remote sensing and hydrological data using adaptive filtering techniques for watershed modelling. *Current Science*, 97(8), 1196-1202.
12. **Kumar, S.**, Sekhar, M. and Reddy, D. V. (2009). Improving the disaggregation of daily rainfall into hourly rainfall using hourly soil moisture. *IAHS Publication*, 331, 236-244.

[Under revision/submitted](#).....

1. **Tomer, S. K.**, Al Bitar, A., Sekhar, M., Merlin, O., Corgne, S., Bandyopadhyay, S., Sreelash, K., Sharma, A. K., Zribi, M. and Kerr, Y. MAPSM: A Conceptual Spatio-temporal Algorithm to Merge Active and Passive Soil Moisture. *Remote Sensing of Environment*.

## Book.....

1. **Sat Kumar Tomer** (2011). Python in Hydrology. *Green Tea Press*, 1-114. (The book is translated into Persian by Mr. Moslem Heydari and is in print by Jihad Agriculture press of Shahrekord University, Iran)

## Book chapters.....

1. Subash, Y., Sekhar, M., **Tomer, S.K.** and Sharma, A. K. A framework for assessment of climate change impacts on the groundwater system. In: *Sustainable Water Resources Management*. C.S.P Ojha, S. Rao, T. Zhang and A. Bardossy (Eds). ASCE Book Chapter. (Accepted).

## Conferences/Seminar/Symposia.....

1. **Tomer, S. K.**, Al Bitar, A., Sekhar, M., Corgne, S. and Kerr, Y. H. (2014). Spatio-temporal merging of soil moisture from active and passive microwave. Understanding the Carbon and Water Cycles using SMOS Data and Models. CESBIO, Toulouse, France, 13-14 November 2014.
2. **Tomer, S. K.**, Al Bitar, A., Sekhar, M., Corgne, S. and Kerr, Y. H. (2014). Spatio-temporal downscaling of soil moisture from passive microwave using active microwave. Microrad-2014, 13th meeting on Microwave Radiometry and Remote Sensing of the Environment. 24-27 March, Pasadena, CA, USA.
3. Orgogozo, L., Renon, N., Soullaine, C., Henon, F., **Tomer, S. K.**, Labat, D., Pokrovsky, O.S., Sekhar, M., Abbaou, R. and Quintard, M. (2014). RichardsFOAM: A massively parallel solver for Richards equation. 9th OpenFOAM workshop, Zagreb, June 2014.
4. **Tomer, S. K.**, Al Bitar, A., Sekhar, M., Merlin, O., Bandyopadhyay, S. and Kerr, Y. H. (2013). Synergy between passive (SMOS) and active (RADARSAT-2) microwave soil moisture over Berambadi, India. EGU General Assembly Conference Abstracts 15, 9848.
5. Buis, S., Sreelash K., Guerif, M., Sekhar, M., Ruiz, L., **Tomer, S. K.**, Sharma, A.K. and Ruget, F. (2013). Estimation of multilayered soil properties by inversion of a crop model using surface soil moisture and LAI: evaluation on experimental datasets. 15th Annual Conference of the International Association for Mathematical Geosciences. Madrid, Spain, 2-6 September 2013.
6. Sreelash, K., Sekhar, M., Ruiz, L., **Tomer, S. K.**, Bandyopadhyay, S., Buis, S., Guerif, M. and Gascuel Odoux, C. (2012). Uncertainty in estimation of potential recharge in tropical and temperate catchments using a crop model and microwave remote sensing. In H24C session - Remote sensing, Modeling, and Ground-Based monitoring of groundwater resources. AGU Fall meeting, December 3-7, 2012, San Francisco, USA. AGU Fall Meeting Abstracts 1, 05.
7. **Tomer, S. K.**, Al Bitar, A., Sekhar, M., Merlin, O., Bandyopadhyay, S. and Kerr, Y. H. (2012). An Inter-comparison of RADARSAT-2, SMOS and Field Measured Soil Moisture in the Berambadi Watershed, South India. H13F: Pushing the Envelope in Remote Sensing for Hydrology: SMOS and Future Mission/Sensor Concepts, # 1425, AGU Fall meeting 2012, December 3-7, 2012, San Francisco, USA. AGU Fall Meeting Abstracts 1, 1425.
8. Sreelash, K., Sekhar, M., Ruiz, L., **Tomer, S. K.**, Bandyopadhyay, S. and Gascuel - Odoux, C. (2012). Agro-hydrological models combined with microwave remote sensing data for improved management of groundwater irrigation, 5th International Groundwater Conference, December 18-21, 2012, Aurangabad, India.
9. Sreelash, K., Sekhar, M., M., Ruiz, L., **Tomer, S. K.**, Bandyopadhyay, S., Buis, S., Guerif, M., Durand, P. and Gascuel Odoux, C. (2012). Estimation of multilayered soil properties using agro-hydrological models and microwave remote sensing. 2nd International Conference on Hydropedology, Leipzig, Germany, July 2012.

10. de Condappa, D., **Tomer, S. K.**, Sekhar, M., de Bruin, A., Mikhail, M. and Barron, J. (2011). Assessing the effects of agricultural changes on the surface and ground water resources in the Jaldhaka sub-basin of Brahmaputra river basin, India. Fourth International Groundwater Conference, Madurai, October 2011.
11. **Tomer, S. K.**, Sreelash, K., Sekhar, M., Ruiz, L. and Gascuel Odoux, C. (2011). Coupling agricultural and hydrological models for improved management of groundwater irrigation under climate change. Vol. 13, EGU General Assembly 2011.
12. de Condappa, D., de Bruin, A., Mikhail, M., Barron, J., **Tomer, S. K.** and Sekhar, M. (2011). The challenges and potential for improved agricultural water management in the Jaldhaka watershed. International Conference On Sustainable Water Resources Management And Climate Change Adaptation, 17 - 19 February 2011, Durgapur.
13. **Sat Kumar**, Javeed, Y. and Sekhar, M. (2010). An alternative approach for estimation of groundwater recharge and discharge in a hard rock aquifer. Workshop on Groundwater Resources Estimation, February 23-24, 2010, New Delhi.
14. **Sat Kumar**, Sekhar, M., Mohan Kumar, M. S. and Bandyopadhyay, S. (2010). Estimating soil moisture and its uncertainty by assimilating remote sensing data into a distributed hydrological model at the watershed scale. AOGS 2010, HS07-A008, July 5-9, 2010, Hyderabad.
15. Ruiz, L., Varma, R.M., Mohan Kumar, M. S., Sekhar, M., Molenat, J., Marechal, J.C., Descloitres, M., Riotte, J., **Tomer, S. K.** and Braun, J.J. (2010). Transpiration by tree roots in the deep unsaturated regolith buffers the recharge process in a tropical watershed under deciduous forest (Mule Hole, India). Vol. 12, EGU General Assembly 2010, May 2-7, 2010, Vienna.

#### Technical Reports.....

1. Lievens, H., Pauwels, V., Verhoest, N., van den Berg, M.-J., Al Bitar, A., **Tomer, S. K.**, Cabot, F., Merlin, O., Kerr, Y., Pan, M., Wood, E., Dumedah, G. and Walker, J. (2014). SMOS+Hydrology: summary report. Contrat ESA ITT AO/1-6733/11/NI/FvO, December, 2014, pp 1-33.
2. Sreelash, K., Sekhar, M., **Tomer, S. K.**, Bandyopadhyay, S., and Mohan Kumar, M. S. (2014). Estimation of soil hydraulic properties in a catchment using agro-hydrological models and microwave remote sensing. Summary technical report for the project no. ISTC/MCV/MSE/302, November 2014, pp. 1-6.
3. **Tomer, S. K.**, Sekhar, M., Mohan Kumar, M. S., Mougine, E., Bandyopadhyay, S., Maity, S. and Shiv Mohan (2013). Near surface soil moisture retrieval using RISAT SAR data at watershed scale – technique development towards operational drought assessment. Technical report for the ISRO/MCV/MSE/098 project, January 2013, pp.1-35.
4. **Tomer, S. K.**, Sekhar, M., Bandyopadhyay, S., Maity, S., Sreelash, K., Sharma, A.K., Al Bitar, A., Kerr, Y. (2013). A Preliminary Report on Retrieval of Surface Soil Moisture using RISAT-1. Technical report for the ISRO/MCV/MSE/098 project, September 2013, pp.1-14.
5. de Condappa, D., Barron, J., **Tomer, S. K.**, Sekhar, M. (2012). Application of SWAT and a Groundwater Model for Impact Assessment of Agricultural Water Management Interventions in Jaldhaka Watershed: Data and Set Up of Models. Stockholm Environment Institute, Technical Report - 2012, (<http://awmsolutions.iwmi.org/Data/Sites/3/Documents/PDF/publication-outputs/learning-anddiscussion-briefs/application-of-swat.pdf>), 72pp.
6. **Tomer, S. K.**, Sekhar, M., Mohan Kumar, M. S., Bandyopadhyay, S., Maity, S. and Shiv Mohan (2012). Near surface soil moisture retrieval using RISAT SAR data at watershed scale – technique development towards operational drought assessment. Technical report for the ISRO/MCV/MSE/098 project, January 2012, pp.1-16.

7. **Tomer, S. K.**, Sekhar, M., Mohan Kumar, M.S., Bandhyopadhyay, S. (2012). Estimation of evapotranspiration using only Satellite data at AMBHAS site. Summary technical report for the Project no. ISTC/MCV/MSE/248, January 2012, pp. 1-5.
8. **Tomer, S. K.**, Sekhar, M., Mohan Kumar, M.S., Bandhyopadhyay, S. (2010). Root zone soil moisture retrieval by assimilation of near surface measurements. Summary technical report for the Project no. ISTC/CCE/MS/214, January 2010, pp. 1-8.

## Sponsored Research Projects

---

<b>SMOS+Hydrology</b>	<b>ESA</b>
<i>PI: Niko Verhoest, Funding: 350,000 Euros</i>	2012-2014
In collaboration with ESA, CESBIO, Princeton university, Ghent university and Monash university	
<b>SMOS flood risk index</b>	<b>CapGemini and CNRS</b>
<i>PI: Yann Kerr, Funding: 30,000 Euros</i>	2014-2015
<b>The CATDS L3/L4 products development</b>	<b>CNES</b>
<i>PI: Yann Kerr, Funding: 30,000 Euros</i>	2014-2015

## Awards/Honours/Recognitions

---

<b>ISPRS</b>	
<i>Secretary, Working Group on Water Resources (WGVIII/4)</i>	2012-2016
Commission VIII (Remote Sensing Applications & Policies) of the International Society of Photogrammetry and Remote Sensing (ISPRS)	
<b>Ghent university</b>	<b>Ghent, Belgium</b>
<i>Visiting research fellow</i>	December, 2012
<b>University of Paul Sabatier</b>	<b>Toulouse, France</b>
<i>Visiting research fellow</i>	May, 2010 - July, 2010
<b>Ministry of Human Resources Development of India</b>	
<i>Fellowship to pursue PhD in Indian Institute of Science</i>	2008
<b>Ministry of Human Resources Development of India</b>	
<i>Fellowship to pursue master's degree in Indian Institute of Science</i>	2006
<b>Graduate Aptitude Test in Engineering (GATE)</b>	
<i>Achieved all India rank 57 in GATE examination for postgraduate education</i>	2006
<b>Graduate Aptitude Test in Engineering (GATE)</b>	
<i>Achieved all India rank 481 in GATE examination for postgraduate education</i>	2005
<b>Board of Technical Education, UP</b>	
<i>Achieved 4<sup>th</sup> rank in the civil engineering in the state of Uttar Pradesh</i>	2003

## Personal

---

Sex: Male  
 Date of birth: 30/08/1985  
 Place of birth: Bijnor, U.P., India  
 Languages: Hindi and English  
 Marital status: Married

Citizenship: India

## References

---

### **Prof. M. Sekhar**

Associate Professor, Department of Civil Engineering,  
Indian Institute of Science, Bangalore - 560012, India  
Email: [muddu@civil.iisc.ernet.in](mailto:muddu@civil.iisc.ernet.in)  
Webpage: <http://civil.iisc.ernet.in/~muddu/>  
Phone: +91 80 2293 2245

### **Prof. M. S. Mohan Kumar**

Secretary, Karnataka State Council for Science and Technology (KSCST)  
Professor, Department of Civil Engineering,  
Indian Institute of Science, Bangalore - 560012, India  
Email: [mismk@civil.iisc.ernet.in](mailto:mismk@civil.iisc.ernet.in)  
Phone: +91 80 2293 2814

### **Dr. Y. Kerr**

Director of Centre d'Etudes Spatiales de la Biosphère (CESBIO),  
and Principal Investigator of SMOS project,  
18, avenue Edouard Belin, 31401 Toulouse Cedex 9, France  
Email: [yann.kerr@cesbio.cnes.fr](mailto:yann.kerr@cesbio.cnes.fr)  
Webpage: [http://www.cesbio.ups-tlse.fr/data\\_all/annuaire/kerr/HP\\_kerr.html](http://www.cesbio.ups-tlse.fr/data_all/annuaire/kerr/HP_kerr.html)  
Phone: +33 561558522

## Declaration

---

I hereby certify that all the information furnished above is true to the best of my knowledge and belief.

Date: September 22, 2015

Place: Bangalore, India

(Sat Kumar)