DUE GLOBTEMPERATURE PROJECT

International Land Surface Temperature and Emissivity Working Group (ILSTE-WG) Progress Report

WP2.1 – DEL-16

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Organisation: ULeic

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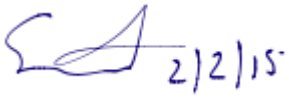
Accepted and authorized for public release by	Simon Pinnock	ESA	

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0. Executive Summary

The International Land Surface Temperature and Emissivity Working Group (ILSTE-WG) Progress Report provides an account of the activities and events of the first year in the lifetime of this new initiative. From the original concept of a science team to provide independent advice and review of GlobTemperature deliverable, the Group has become a truly international body with much interest generated within the community of LST experts and users.

A Steering Committee was established within the first few months, with initial invitations sent out to individuals identified as being key to providing the advice and expertise required to give the Group a strong foundation. Since then the General Membership has grown considerably, particularly following the successful, and well attended, 1st General Meeting in Karlsruhe. Indeed, this success has illustrated how important it is that the Group maintains good links with existing initiatives and Projects to be able to collocate meetings. The 2nd General Meeting is planned to take place during the American Geophysical Union (AGU) Fall Meeting 2014 in conjunction with a scheduled NASA MEaSUREs science meeting.

In addition to the regular Steering Committee teleconferences and the General Meeting, much activity has taken place to promote the ILSTE-WG within the LST data provider and user communities, with an objective to build a solid base from which to grow and become self-sustaining. An Action Plan has been formulated to address the key Recommendations (detailed below) made so far with reference to the Implementation Action Plan IDs from [AD-1].

ID	Recommendation	Implementation Action Plan ID
IG-REC-1	To formalise a short-to-medium term (3-months to 1-year) list of priorities to focus on	IG-IAP-8
IG-REC-2	To construct a Web presence for the ILSTE-WG as a medium to share documents and data, and to publicise the Group among the LST community	IG-IAP-3
IG-REC-3	To agree and disseminate a Common LST Nomenclature for the community to adopt	IG-IAP-2
IG-REC-4	To continue collocation with other associated events, and to assess potential for branching out further – AGU, GlobTemperature UCM / EarthTemp, NASA MEaSUREs, EGU	IG-IAP-1
IG-REC-5	To increase promotion of the ILSTE-WG General Meetings amongst the General Membership of the ILSTE-WG, the and GlobTemperature User Group, the EarthTemp community, and affiliated Projects such as NASA MEaSUREs so as to increase face-to-face engagement	IG-IAP-4

IG-REC-6	To continue liaising with data providers and agencies to promote the concept of a Harmonised Format across all LST and LSE Products	IG-IAP-2
IG-REC-7	To engage with new /existing projects / initiatives, as has happened with ECOSTRESS, S3VT and S3MPC	IG-IAP-9
IG-REC-8	To build tangible partnerships with international agencies and external groups	IG-IAP-9
IG-REC-9	To assess user needs for operational LST and LSE products and to formulate a responsive strategy which can underpin operational provision of these data and support breakthrough research missions	IG-IAP-10
IG-REC-10	To promote LST and LSE data in the public domain, and to increase public engagement	IG-IAP-5
IG-REC-11	To facilitate better engagement with the user community and to better understand their needs in terms of what data they use and how they use it	IG-IAP-5
IG-REC-12	To encourage the adoption of a standardised LST and LSE Validation Protocol through interaction with the CEOS LPV Group; and ensuring this protocol is compatible with Quality Assurance for Earth Observation (QA4EO) guidelines [RD-1], with an intention to work towards Quality Assurance for Essential Climate Variables (QA4ECV) guidelines [RD-2]	IG-IAP-7
IG-REC-13	To open communication with experts tasked by GCOS in the current review of ECVs to recognise the value of LST and LSE climate data much more strongly	IG-IAP-6

1. Introduction

The International Land Surface Temperature and Emissivity Working Group (ILSTE-WG) was founded to provide advice and recommendations to the Land Surface Temperature (LST), Ice Surface Temperature (IST), Lake Surface Water Temperature (LSWT), and Land Surface Emissivity (LSE) data providers and application users. With financial support from the European Space Agency (ESA) through the GlobTemperature to support the foundation of the ILSTE-WG and its activities during the first three years of its existence, the Group has built a solid basis to continue to thrive and expand.

The objectives of the Group which are detailed in [AD-1] can be summarised briefly here:

- To represent the best available expertise in LST and LSE data techniques and LST-related science, sharing best practice amongst data providers and data experts.
- To provide a forum for linking LST data provision from different sources, raising the profile of LST and LSE data with user communities.
- To be a natural conduit for interactions with operational agencies.
- To provide a platform for a co-ordinated validation programme based on individual project plans.
- To achieve breakthroughs in the provision and exploitation of LST data to a growing community of users
- To provide an additional international dimension for interactions with users, delivering easy access to LST and LSE information, enabling users to build expertise and strengthening feedbacks between users and data providers.
- To work collectively with major international bodies to increase the profiles of LST and LSE.

The scope and purpose of this document is report on the activities of the ILSTE-WG that have taken place during Phase-1 of the GlobTemperature Project. It will assess the current status of the Group – including membership, and how activities and event are managed (Section 2); present brief synopses of the meetings that have taken place (Section 3); and summarise the actions and recommendations that have emerged (Sections 4 and 5).

1.1. Applicable documents

Table 1: List of applicable documents

Reference Number	Document	Reference
[AD-1]	ILSTE-WG Implementation Plan	GlobTemp-WP2-DEL-15
[AD-2]	GlobTemperature User Consultation Meeting (UCM) Report	GlobTemp-WP2-DEL-20
[AD-3]	LST Common Nomenclature Technical Note	GlobTemp-WP2-DEL-10
[AD-4]	GlobTemperature Technical Specification	GlobTemp-WP1-DEL-06
[AD-5]	ILSTE-WG Terms of Reference	GlobTemp-WP2-DEL-14
[AD-6]	GlobTemperature Data Portal	GlobTemp-WP3

1.2. Reference documents

Table 2: List of reference documents

Reference Number	Reference
[RD-1]	ECOSTRESS, http://science.nasa.gov/missions/ecostress/.
[RD-2]	Atmospheric Observation Panel for Climate (AOPC), http://www.wmo.int/pages/prog/gcos/index.php?name=AOPC.
[RD-3]	EarthTemp Network, http://www.earthtemp.net/.
[RD-4]	S3VT, ESA Sentinel-3 Validation Team http://congrexprojects.com/2013-events/13m56/introduction.
[RD-5]	Schneider, P., et al., Land Surface Temperature Validation Protocol (Report to European Space Agency). 2012(UL-NILU-ESA-LST-LVP).
[RD-6]	Quality Assurance framework for Earth Observation (QA4EO), http://www.qa4eo.org/.
[RD-7]	Quality Assurance for Essential Climate Variables (QA4ECV), http://www.qa4ecv.eu/.

1.3. Glossary

(A)ATSR---------- (Advanced) Along Track Scanning Radiometer
AGU---------- American Geophysical Union
AOPC---------- Atmospheric Observation Panel for Climate
ASTER ---------- Advanced Spaceborne Thermal Emission and Reflection Radiometer
CDR---------- Climate Data Record
CEH---------- Centre from Ecology and Hydrology
CEOS ---------- Committee on Earth Observation Satellites
DAAC---------- Distributed Active Archive Center
DUE---------- Data user Element
ECMWF---------- European Centre for Medium Wave Forecasting
ECOSTRESS----- ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station
ECV ---------- Essential Climate Variable
EGU---------- European Geosciences Union
EO---------- Earth Observation
ESA ---------- European Space Agency
ET---------- Evapotranspiration
EUMETSAT------ European Organisation for the Exploitation of Meteorological Satellites
GCOS---------- Global Climate Observing System
GHRSST---------- Group for High Resolution Sea Surface Temperature
ILSTE-WG------- International Land Surface Temperature & Emissivity Working Group
IMGW-PIB------ Institute of Meteorology and Water Management - National Research Institute
IPCC---------- Intergovernmental Panel on Climate Change
IPMA---------- Instituto Português do Mar e da Atmosfera
IST ---------- Ice Surface Temperature
JPL---------- Jet Propulsion Laboratory
KIT---------- Karlsruhe Institute of Technology
LPV---------- Land Product Validation
LSA-SAF---------- Land Surface Analysis Satellite Application Facility
LSE---------- Land Surface Emissivity
LST ---------- Land Surface Temperature
MEaSUREs------ Making Earth System Data Records for Use in Research Environments
MODIS ---------- Moderate Resolution Imaging Spectrometer
MSG---------- Meteosat Second Generation
NASA---------- National Aeronautics and Space Administration
NOAA ---------- National Oceanic and Atmospheric Administration

NWP---------- Numerical Weather Prediction
QA4ECV--------- Quality Assurance for Essential Climate Variables
QA4EO---------- Quality Assurance for Earth Observation
S3MPC---------- Sentinel-3 Mission Performance Centre
S3VT---------- Sentinel-3 Validation Team
SEVIRI ---------- Spinning Enhanced Visible and Infrared Imager
SLSTR---------- Sea and Land Surface Temperature Radiometer
SST---------- Sea Surface Temperature
TAG---------- Technical Advisory Group
TOPC---------- Terrestrial Observation Panel for Climate
UCM---------- User Consultation Meeting
ULeic---------- University of Leicester
WCRP---------- World Climate Research Programme

2. ILSTE-WG Status

2.1. Calendar of Events

Considerable progress has been over the course of 2014 (Phase-1 of the GlobTemperature Project) towards foundation and subsequent progress of the ILSTE-WG. With the scientific and administrative resources provided by the ESA-funded GlobTemperature project for the first three years of its lifetime, the ILSTE-WG has been able to establish both a Steering Committee of key experts and stakeholders, and a wider membership consisting of further experts in the retrieval and validation of LST products and users across the broad spectrum of LST applications. The key progress during its first year of existence can be summarised as follows:

- A number of LST experts agreed to work together internationally to initiate the ILSTE-WG – these being representatives of NASA-JPL and members of the GlobTemperature Team (specifically the University of Leicester in the UK and IPMA in Portugal).
- An initial Steering Committee was set-up to provide momentum to the process and have been holding quarterly teleconference meetings to define ongoing strategy for the Group.
- Invitations were issued to a number of key people and organisations to be members of the ILSTE-WG.
- The 1st General Meeting of the ILSTE-WG was organised and took place in the framework of the GlobTemperature 2nd User Consultation Meeting [AD-2], and in conjunction with the EarthTemp 3rd workshop. The Steering Committee was confirmed at the meeting, with co-chairs as John Remedios and Simon Hook.
- A number of task-orientated Technical Advisory Groups (TAGs) are being considered - these are to focus on particular elements of LST and LSE work.

The General Meetings themselves were originally anticipated to be once per year in a chosen location with additional teleconferences in smaller groups depending on the activities desired by the members. Following discussion among the principle initiators of the ILSTE-WG (ULeic, IPMA and NASA-JPL) it was agreed to hold quarterly teleconferences of the Steering Committee (Section 2.1.1) and two General Meetings per year (Section 2.1.2); all other actions will be by email. A detailed calendar of events is presented in Table 3.

Table 3: Calendar of events (upcoming events are indicated in red)

Date / Month	Event Type	Description
12-Dec-2013	Meeting	First meeting of interested parties during the American Geophysical Union (AGU) Fall Meeting 2013 (ULeic – Darren Ghent, NASA-JPL - Glynn Hulley and Pierre Guillevic, KIT – Frank Göttsche) prior to first teleconference of ILSTE-WG Proposers

Date / Month	Event Type	Description
31-Jan-2014	Teleconference	1st (Kick-off) meeting of the ILSTE-WG Proposers (ULeic, NASA-JPL, IPMA) to discuss concept
18-Mar-2014	Teleconference	2nd meeting of the ILSTE-WG Proposers (ULeic, NASA-JPL, IPMA) to discuss implementation
Feb-April 2014	Action	Slides developed for Simon Hook (NASA-JPL) for NASA-HQ approval
March 2014	Action	Slides on LST as ECV developed prompted by request from member of Terrestrial Observation Panel for Climate (TOPC), which is jointly sponsored by the Global Climate Observing System (GCOS) and the World Climate Research Programme (WCRP)
April 2014	Action	Slides developed for invitation package to ILSTE-WG
1-May-2014	Action	Invitations issued to prospective members of the ILSTE-WG
6-Jun-2014	Teleconference	1st meeting of the ILSTE-WG Steering Committee (IG#1)
13-Jun-2014	Action	First version of proposed harmonised format for adoption by ILSTE-WG circulated to members
26-Jun-2014	Meeting	1st General Meeting of ILSTE-WG (IG#2) - Karlsruhe, Germany - following the 2nd GlobTemperature User Consultation Meeting
8-Jul-2014	Meeting	Visit of Simon Hook (NASA-JPL) to ULeic to discuss ongoing strategy of the ILSTE-WG
Sept 2014	Event	ECOSTRESS instrument funded for deployment on the International Space Stations – NASA-JPL lead
15-Sept-2014	Teleconference	2nd meeting of the ILSTE-WG Steering Committee (IG#3)
Sept-Nov 2014	Action	Promotion of ILSTE-WG in US ahead of meeting planned to link with NASA MEaSUREs (Making Earth System Data Records for Use in Research Environments) meeting
10-Oct-2014	Action	Proposed Common Nomenclature circulated among members for feedback
Oct 2014	Action	First ILSTE-WG documentation in preparation – Terms of Reference, Implementation Strategy, Progress Report

Date / Month	Event Type	Description
Dec 2014	Meeting	2nd General Meeting of ILSTE-WG (IG#4) – San Francisco, US – to be held during the American Geophysical Union (AGU) Fall Meeting 2014

2.1.1. Teleconferences

It was agreed amongst the proposers of the ILSTE-WG concept to form a Steering Committee, whose membership and structure is described in [AD-1]; and this forum would meet on a quarterly basis by means of a teleconference. Outline agendas are agreed at the previous meeting; with detailed agendas organised by the Co-chairs and GlobTemperature Project Scientist, and circulated a few days in advance of the meeting.

The meetings themselves are chaired by one of the Steering Committee chairs. The GlobTemperature Project Management Team acts as the co-ordination support for the Group and records minutes of the key parts of the meeting; these minutes are distributed for feedback within a week of the meeting. Actions are recorded in the minutes, and an Actions Database is maintained by the GlobTemperature Project Management Team with progress discussed at the next meeting. Key outcomes from the meeting are communicated to the General ILSTE-WG Membership via email. Meeting synopses are presented in Section 3.

2.1.2. General Meetings

As agreed amongst the proposers of the ILSTE-WG concept there will be two General (and open) Meetings of the wider ILSTE-WG membership (and other interested participants) twice every year. These meetings will initially be split between Europe and North America, and be collocated with an appropriate meeting of overlapping interest. The open nature of these meetings are designed both to encourage wider participation, and to potentially expand the membership of the Group. Meeting synopses are presented in Section 3.

The European meeting was decided to be collocated with the GlobTemperature User Consultation Meetings (UCMs) for the duration of the GlobTemperature Project, which by default also means collocation with the EarthTemp Networking Meeting (at least during the lifetime of the EarthTemp initiative). The rationale being that this provides optimum opportunity for the ILSTE-WG to interact with both consortium members of GlobTemperature and a larger number of LST experts and users during these meetings. As such, the 1st General Meeting of the ILSTE-WG (IG#2) took place in Karlsruhe, Germany following on from the 2nd GlobTemperature UCM and the 3rd EarthTemp Networking Meeting. Early ideas on future European meetings include collocation with the annual European Geosciences Union (EGU) General Assembly.

The North American meeting was decided, at least for the time being, to be collocated with the annual American Geophysical Union (AGU) Fall Meeting. The rationale being that this encompasses the largest gathering of LST scientists and users each year in North America. As such, the 2nd General Meeting of the

ILSTE-WG (IG#4) is scheduled to take place in San Francisco in December during AGU 2014. Additionally, this year the plan is to schedule IG#4 to follow a pre-arranged science meeting of the NASA MEaSUREs Project. This represents a perfect opportunity to create a tangible link between the ILSTE-WG and the NASA MEaSUREs Project (as there exists between the ILSTE-WG and GlobTemperature).

2.2. Group Membership

Table 4: Current membership of the ILSTE-WG (including Steering Committee members highlighted in bold)

Name	Institute	Country
Andrew French	USDA-ARS	USA
Azwitamisi Eric Mudau	Council for Scientific and Industrial Research	South Africa
Benjamin Bechtel	University of Hamburg	Germany
Benjamin Scarino	Science Systems and Applications, Inc. / NASA Langley Research Center	USA
Catherine Prigent	Estellus	France
Cesar Coll	University of Valencia	Spain
Chris Hain	USDA-ARS	USA
Chris Taylor	Centre for Ecology and Hydrology (CEH)	UK
Christopher Merchant	University of Reading	UK
Claude Duguay	University of Waterloo	Canada
Corinne Frey	DLR	Germany
Darren Ghent	**University of Leicester**	**UK**
Desmond Manatsa	Bindura University Of Science	Zimbabwe
Dorothy Hall	NASA-GSFC	USA
Elizabeth Good	Met Office	UK
Frank-Michael Göttsche	Karlsruhe Institute of Technology	Germany
Glynn Hulley	**NASA-JPL**	**USA**
Hector Nieto	University of Copenhagen	Denmark
Isabel Trigo	**IPMA**	**Portugal**

Name	Institute	Country
Jacob Hoyer	Danish Meteorological Institute	Denmark
Jakub Walawender	Institute of Meteorology and Water Management - National Research Institute (IMGW-PIB)	Poland
John Remedios	**University of Leicester**	**UK**
Jose Sobrino	Universidad de Valencia	Spain
Katarzyna Dabrowska-Zielińska	Institute of Geodesy and Cartography	Poland
Lothar Schuller	**EUMETSAT**	**Germany**
Marcel Urban	Friedrich-Schiller-University Jena	Germany
Maria Fabrizia Buongiorno	INGV	Italy
Martha Anderson	USDA-ARS	USA
Monika Hajto	Institute of Meteorology and Water Management - National Research Institute (IMGW-PIB)	Poland
Monika Tomaszewska	Institute of Geodesy and Cartography	Poland
Nathan Forsythe	Newcastle University	UK
Patrick Minnis	Science Systems and Applications, Inc. / NASA Langley Research Center	USA
Philippe Goryl	European Space Agency	Italy
Pierre Guillevic	**NASA-JPL**	**USA**
Raquel Niclos	University of Valencia	Spain
Robert Knuteson	University of Wisconsin-Madison	USA
Simon Hook	**NASA-JPL**	**USA**
Simon Pinnock	**European Space Agency**	**UK**
Sorin Cheval	National Meteorological Administration	Romania
Thomas Holmes	USDA-ARS	USA
Yunyue Yu	**NOAA/NESDIS**	**USA**

Membership was initially limited to identified LST experts / users in retrieval, validation and exploitation whose knowledge and connections were considered critical to community acceptance of the initiative, and multi-agency support. Following the 1st General (and open) Meeting of the ILSTE-WG membership has increased considerably, and the intention is to build upon this interest in future years.

3. Meeting Synopses

3.1. 1st Steering Committee Meeting (IG#1)

Table 5: IG#1 List of Participants

Meeting Date	6-Jun-2014
Location	Teleconference
Participants	**Institute**
Darren Ghent	U. Leicester
Simon Hook	NASA-JPL
John Remedios	U. Leicester
Isabel Trigo	IPMA
Yunyue Yu	NOAA/NESDIS

3.1.1. Synopsis

Overview

A brief overview of the structure and functions of the ILSTE-WG was presented utilising the invitation presentation as a basis for discussion. This included the general ideal as a forum for interaction between LST data providers and users, but also covered more specific themes such as product format, requirements for future sensors, and contributions to the Committee on Earth Observation Satellites (CEOS) Land Product Validation (LPV) group.

The Group were also informed that a modified version of the Invitation Presentation was submitted to NASA-HQ and that this received very positive feedback.

Interaction

A discussion took place on the sharing of documents and data – particularly in situ data – and this was an ideal for which the Group agreed should be a priority and should actively encourage. The GlobTemperature Web Portal was suggested as offering an immediate solution to sharing information and data within the Group, whereby a dedicated area of the Website could be assigned to the ILSTE-WG.

A key discussion then began on how to capture the user requirements and exploitation of the different LST datasets, and how to better to support the user community. This would be a theme that the Steering Committee aim to revisit in subsequent meetings

Harmonised format

Following the development of a harmonised format for GlobTemperature products participants begun the discussion on how the Group could promote a harmonised format across the community of data providers, and the process towards a harmonised approach in future product / re-processed data releases. A complementary approach, at least for existing products, was suggested as running the data through a re-formatting engine as per the Group for High Resolution Sea Surface Temperature (GHRSST). The ILSTE-WG should be in a position to recommend good practice to agencies on different approaches to re-processing of their archives of LST and LSE data.

Schedule

As detailed in Section 2.1, agreement on the meeting schedule resulted in the decision that General ILSTE-WG Meetings should be held bi-annually with one in Europe (in conjunction with the GlobTemperature UCMs) and one in the US (during AGU, which also this year has a dedicated EarthTemp session). Steering Committee meetings (by teleconference) were agreed to be held no less than quarterly. Items for 1st General ILSTE-WG Meeting were also discussed: i) Terms of Reference; ii) harmonised formats; iii) how we support users and respond to their requests; iv) LST and LSE as an Essential Climate Variable (ECV); and v) the need to arrange remote participation and enquire about recording the meeting.

3.1.2. Key Points Raised

- The need to get buy-in from other agency HQs, which may for example make it potentially easier for physical meeting attendance
- To encourage document and data sharing both within the ILSTE-WG and amongst the wider LST user community
- To think about how to engage with the staff at the NASA Distributed Active Archive Centers (DAACs) who deal with user data requests and support. A general email address could be created which would be monitored by the ILSTE-WG members
- To agree a harmonised approach particularly for common quality control flags and uncertainties
- To assess how the Group could influence the adoption of a harmonised approach for future data re-processing

3.1.3. Actions

Table 6: Action List from IG#1

Action ID	Responsibility	Description	Status	Date Closed
IG1_01	Yunyue Yu	Send presentation to NOAA HQ	In Progress	
IG1_02	Darren Ghent	Circulate harmonised format developed for GlobTemperature	Closed	13-Jun-2014
IG1_03	Darren Ghent	Enquire about facilities for remote participation and recording of the 1st General Meeting in Karlsruhe	Closed	26-Jun-2014

3.2. 1st General ILSTE-WG Meeting (IG#2)

Table 7: IG#2 List of Participants

Meeting Date	26-Jun-2014
Location	Karlsruhe Institute Technology, Germany
Participants	**Institute**
Darren Ghent	U. Leicester
Simon Pinnock	ESA
John Remedios	U. Leicester
Lothar Schueller	EUMETSAT
Isabel Trigo	IPMA
Yunyue Yu	NOAA/NESDIS
Approximately 30 additional attendees from the GlobTemperature User Consultation Meeting (UCM #2)	

3.2.1. Synopsis

Introduction

An overview of the structure and functions of the ILSTE-WG was presented, following by a plenary discussion. Key points presented include:

- The ILSTE-WG will address issues related to a wide variety of sensors including higher resolution sensors.
- LSE is a product in its own right, and there is a considerable interest in this data stream.

- ILSTE-WG will look to support the case for future sensors - current sensor usage and future need to be quantified to construct case for future sensors.
- Standardised data products could become a reality with projects such as GlobTemperature and NASA MEaSUREs similar to the harmonisation in GHRSST.
- The group is initially to be 'owned' by the LST community. The example of GHRSST was highlighted, now being a part of a formalised group. Other fields have identified working groups that identify key issues, which could also become a model for this group.
- Topics for Technical Advisory Groups (TAGs) need to be discussed within the group with recommendations sought; topics could focus on product development and applications (e.g. Urban Heat or Evapotranspiration).
- The Group will look to establish a wider membership, and a possible blurring of lines between members of the Steering Committee and the General Membership.

Terms of Reference

The original concept of the ILSTE-WG was defined as being to bring together different groups, methodologies and systems to improve technical development and user interaction. The ILSTE-WG will look to quantify user patterns; share agencies experiences from dealing with users; and to coordinate projects and funding opportunities as a group. Three specific issues raised here were: i) unifying validation activities; ii) standardisation of atmospheric correction techniques; and iii) product uncertainty.

Validation activities need to be unified through data and technical exchange. In particular, a strategy for validation and intercomparison of all the products available should be established. It was pointed out that a validation protocol has indeed been adopted by GlobTemperature; and this protocol could form a baseline for a "best practices" document for the CEOS Land Product Validation (LPV) LST and Emissivity sub-group. The ILSTE-WG is strongly positioned to take this forward with members leading this LPV sub-group (namely Simon Hook and Jose Sobrino).

Uncertainty in products should be internationally agreed to provide an international standard. Users within the ILSTE-WG can advise and guide external users as to how and what products to use and how to use the attached uncertainty.

Harmonised format

Material on the GlobTemperature harmonised format was presented which initiated a discussion on the process towards a community-wide harmonised format. Several key issues were discussed:

- User advice was sought in the derivation of the GlobTemperature harmonised format. For example, users often do not want large datafiles, thus data has been split into mandatory and optional fields in separate datafiles.

- Further feedback from the user community was requested on mandatory fields and naming conventions.
- Information contained within the quality control flags would be a matter for further community agreement.
- The ILSTE-WG would support working with the data providers on overcoming the barriers towards a community-wide harmonised product across multiple projects.
- Customisation of a harmonised format was raised as a key point as the data will become increasingly large as the number of variables available is increased. A proposed harmonised format is confirmed as very customisable. Fields will also be empty where no selection has been made.

ECV Status

LST is currently only considered useful as an auxiliary variable to aid in land cover. The ILSTE-WG as a Group needs to demonstrate its actual usefulness rather than it just appearing to be useful. Numerical Weather Prediction (NWP) integration of LST would be very helpful in this respect. A major barrier is the bias of the clear sky radiance, whereby disentangling clear sky only data from climate model is difficult. Sea Surface Temperature (SST) though is already included despite this issue; however it does not have the same sensitivity to dynamic heating. Observation operators are used in modelling; and could be implemented for clear sky bias. It was highlighted that potential ECV status would aid funding opportunities and governmental support.

GCOS is currently undertaking a review of ECV adequacy and implementation. The current understanding is that it seems less likely that LST will be made an ECV, but possibly that all surface temperatures may be brought under a surface temperature ECV.

3.2.2. Key Points Raised

- The Steering Committee to consider the name “International LST and Emissivity Working Group”. While being technically accurate, the Group may benefit from a more memorable acronym.
- Current setup of the Steering Committee should last for the first year to proactively push forward the group’s strategy; with membership assessed after this period - additional microwave expertise should also be added to the group.
- Climate communities should be an integral part of the Group; representation from the European Centre for Medium Wave Forecasting (ECMWF) and other NWP users are recommended.
- The group should actively work towards a harmonised format for new releases of existing products. This process should include standardisation of naming conventions, and ancillary

data provided in the products such as land-sea masks, land cover classification, elevation - the group should seek recommendations for globally compatible classes.

- To distinguish between the current and the potential standardisation; and between standardised codes and the requirement to include ancillary data utilised in the retrieval maintaining precision throughout.
- The need to standardise uncertainty fields, and the processes used to derive them. Geophysical values and variation should be considered - the accuracy related to the change of these variables.
- To standardise Quality Control information in products, which should include cloud flagging.
- The ILSTE-WG need to manage and advice on conflicts in terms of regional uses of data, and the specific requirements of such users.
- Recommendation for harmonised data documentation - including information on data size guidance – both in condensed form (fact sheet) and more detailed technical form for advanced usage.
- To look to the climate community to understand better what they require from an ECV; evidence of use for data simulation makes the case for usage in climate models stronger.

3.2.3. Actions

Table 8: Action List from IG#2

Action ID	Responsibility	Description	Status	Date Closed
IG2_01	Darren Ghent	Update the ILSTE-WG membership based on requests obtained following IG#2	Closed	01-Jul-2014
IG2_02	Darren Ghent	GlobTemperature to produce trial datasets and distribute to select users to check usability and usefulness	Closed	16-Oct-2014

3.3. 2nd Steering Committee Meeting (IG#3)

Table 9: IG#3 List of Participants

Meeting Date	15-Sep-2014
Location	Teleconference
Participants	**Institute**
Darren Ghent	U. Leicester
Simon Hook	NASA-JPL
Glynn Hulley	NASA-JPL
John Remedios	U. Leicester

3.3.1. Synopsis

Arrangements for the 2nd ILSTE-WG General Meeting

The next General Meeting was agreed to take place during AGU 2014 in San Francisco. The plan being for this meeting to be collocated with, and follow, a NASA MEaSUREs meeting scheduled to take during one evening of the Conference. Costs for the hire of the room for the ILSTE-WG section of the meeting are to be covered by NASA-JPL. The decision on date and time will be made during the organisation of the NASA MEaSUREs meeting and disseminated to the community.

A brief agenda was discussed, with suggested items being: i) introduction to the ILSTE-WG; ii) presentation on ECOSTRESS; iii) new LST datasets that have been made available to the community; iv) LST and LSE as Essential Climate Variables (ECVs); and v) time for other participants to raise items for discussion.

ECOSTRESS

A new instrument has been approved for deployment on the International Space Station [RD-3]. This new project is being led by NASA-JPL who would like to see an affiliation with the ILSTE-WG. The instrument itself, the ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) was briefly described:

- ECOSTRESS is the 5-band thermal radiometer which was recently selected for the ISS. It will have the high resolution of approx. 60x40 m pixels, a swath width of 385 km and a 5 day revisit.
- A primary driver is the measurement of evapotranspiration (ET) and the orbit means it will acquire observations at different times of the day.

- The instrument will always be on (no pointing) and will be calibrated on-board with two blackbodies. In-flight calibration and validation will use the Lake Tahoe site, and FLUXNET sites for ET.

LST and LSE datasets and ECVs

Two key NASA datasets will be coming online this year:

- The MOD21 archive is currently being processed and is due later this autumn
- A similar timeframe on the Global ASTER Emissivity processing

Priorities over the next several months

Several key priorities were discussed for focus during the next few months by the ILSTE-WG:

- How we as a group promote LST and LSE data in the public area, and how we go about engaging the public more. A real opportunity exists here to propel LST into the public domain
- The continuation of EarthTemp – the next networking meeting will take place at Reading, UK and will focus on urban heat islands. This is the last of the currently funded cycle, although opportunities for future funding are being examined. The intention is for the 3rd ILSTE-WG General Meeting to take place in conjunction with this and the 3rd GlobTemperature User Consultation Meeting
- Preparations for the launch of Sentinel-3, in particular the potential to look at US funding for collaborative CalVal activities

3.3.2. Key Points Raised

- To promote the 2nd ILSTE-WG General Meeting amongst NASA MEaSUREs participants, EarthTemp participants at AGU, the General Membership of the ILSTE-WG, and the GlobTemperature Mailing List
- To actively promote the ECOSTRESS instrument during both the 2nd ILSTE-WG General Meeting and the EarthTemp session at AGU
- To formulate a plan to maximise exposure and consolidate dissemination of the new LST and LSE datasets that are due for release; and to think about steps towards a possible GHRSST like reformatting
- To find out more details on the current ECV assessment and to discuss with appropriate individuals (Peter Thorne, Gabriela Schaepmann)

3.3.3. Actions

Table 10: Action List from IG#

Action ID	Responsibility	Description	Status	Date Closed
IG3_01	Glynn Hulley	To promote the ILSTE-WG meeting amongst both NASA MEaSUREs participants and EarthTemp participants at AGU prior to the start of AGU	In Progress	
IG3_02	Darren Ghent	To promote the ILSTE-WG meeting amongst the General Membership of the ILSTE-WG and GlobTemperature users	In Progress	
IG3_03	Darren Ghent / John Remedios	To find out more details on the current ECV assessment and to discuss with appropriate individuals	Open	
IG3_04	Darren Ghent	To question the Steering Committee on their views on what the priorities should be over the next 6 to 12 months	In Progress	
IG3_05	Darren Ghent	Check on latest information regarding the launch date for Sentinel-3	Closed	14-Oct-2014

4. Summary of Activities

In addition to the activities of described on formalising the Steering Committee and wider Membership (Section 2), arranging and running the Teleconferences and General Meetings (Section 3), many individual related activities have also been carried out by members of the ILSTE-WG. Although some of these may have been undertaken within existing Projects the association with the ILSTE-WG is explicit in all these activities:

- Review of GlobTemperature documents with high relevance to the objectives of the ILSTE-WG and thus the international community:
  - LST Common Nomenclature Technical Note [AD-3]
  - GlobTemperature Harmonised Format – part of [AD-4]
  - ILSTE-WG Terms of Reference [AD-5]
- Working towards LST and LSE as ECVs:
  - Presentation on LST and LSE as potential ECVs made during a GCOS TOPC meeting
  - Discussions between ILSTE-WG members and individuals within the Atmospheric Observation Panel for Climate (AOPC) on the process of the current review on Adequacy and Implementation [RD-4]
- EarthTemp Networking Meetings [RD-5] and Conference Sessions:
  - Although not founded by the ILSTE-WG these remain key associations for the ILSTE-WG to interact within and influence
  - ILSTE-WG exposure at Earth Sessions during EGU 2014 and planned for AGU 2014
- Linking in with new / existing Project / Initiatives:
  - The ECOSTRESS Proposal [RD-3] was successful and this Project has now started. NASA-JPL remain keen to affiliate this with the ILSTE-WG
  - Close ILSTE-WG involvement and collaboration within the Sentinel-3 Validation Team (S3VT) LST activities [RD-6] with regards to data sharing and the adoption of the LST Validation Protocol [RD-7] discuss current agreements and how JPL would like to request further funding to support this
  - The adoption of the LST Validation Protocol [RD-7] within the framework of the Sentinel-3 Mission Performance Centre (S3MPC) CalVal Plan
  - Ongoing effort for the adoption of the current LST Validation Protocol [RD-7] as the CEOS LPV “Best Practices” guideline for LST and LSE
- Adoption of a harmonised format:

- NASA-JPL are proposing the output LST and LSE products from the NASA MEaSUREs Project to adopt the ILSTE-WG (and thus GlobTemperature) harmonised format
- IPMA are proposing the next LSA SAF reprocessing of SEVIRI data, and backward processing of the Meteosat 1st generation data to adopt the ILSTE-WG (and thus GlobTemperature) harmonised format

5. Summary of Recommendations and Action Plan

During the course of the first year in the life of the ILSTE-WG, much important progress has been made including the establishment of an overall body with a steering committee. Many people have contributed and important points have been made, both during Steering Committee Meetings and General Meetings (Section 3). Several key recommendations for the ILSTE-WG to address in subsequent months are evident. Table 11 summarises these recommendations with reference to the Implementation Action Plan IDs from [AD-1].

Table 11: Action Plan towards implementation of recommendations; where quantifiable target dates are proposed

Recommendation ID	Strategy	Target Date	Implementation Action Plan ID
IG-REC-1	❖ Request priorities from Steering Committee individuals ❖ Collate information and circulate among ILSTE-WG Membership	Jan 2015	IG-IAP-8
IG-REC-2	❖ Assess the possibility of the GlobTemperature Web Portal hosting a dedicated area for the ILSTE-WG ❖ Define the layout and structure of the ILSTE-WG web pages; build the pages; and populate with information and documentation ❖ Define and build the access rights for the Steering Committee and General Membership	Feb 2015	IG-IAP-3
IG-REC-3	❖ Circulate draft Common Nomenclature to selected ILSTE-WG members ❖ Amend nomenclature based on comments and upload to ILSTE-WG Website / sub-section of GlobTemperature Website	Feb 2015	IG-IAP-2

Recommendation ID	Strategy	Target Date	Implementation Action Plan ID
IG-REC-4	❖ The 2nd General Meeting will take place during AGU 2014 and be collocated with a NASA MEaSUREs Meeting ❖ The 3rd General Meeting will be collocated with the 3rd GlobTemperature UCM and 4th EarthTemp Network Meeting ❖ Discussion with the appropriate individuals to ensure the 4th General Meeting is suitably collocated	Sep 2015	IG-IAP-1
IG-REC-5	❖ Email the GlobTemperature and ILSTE-WG Mailing Lists ❖ Liaise with EarthTemp Project Manager to arrange email to EarthTemp community ❖ NASA-JPL to promote ILSTE-WG amongst NASA MEaSUREs Project Partners	Jun 2015	IG-IAP-4
IG-REC-6	❖ Individual ILSTE-WG experts and data providers to promote the concept of a Harmonised Format among their contacts in the corresponding Data Processing Chain ❖ Continue to make suggestions regarding the harmonised format in terms of possible additional auxiliary data or Quality Control flags	Mar 2015	IG-IAP-2
IG-REC-7	❖ Build existing ILSTE-WG concepts such as harmonised formats and validation protocols, where feasible, into affiliated projects (NASA MEaSUREs, ECOSTRESS, S3VT, S3MPC) ❖ Promote these concepts within new Projects / Initiatives, and build into upcoming Project Proposals	Dec 2015	IG-IAP-9

Recommendation ID	Strategy	Target Date	Implementation Action Plan ID
IG-REC-8	❖ Identify members of the ILSTE-WG to be points-of-contact with international agencies and external groups ❖ Contacts to assess potential for building solid partnerships and to progress these where applicable ❖ Invite representatives from potential partners to upcoming ILSTE-WG meetings	Jun 2015	IG-IAP-9
IG-REC-9	❖ Examine how the GHRSST community has managed to engage with operational services of SST data ❖ Consult with identified operational users, such as the UK Met Office and ECMWF, what is required of LST data to create an operational need ❖ Build such requirements into future LST developments	Dec 2015	IG-IAP-10
IG-REC-10	❖ Propose to the Steering Committee and agree upon a more memorable acronym for the Group ❖ Ensure the Group's activities are publicised at Conferences, on the Web Portal, and through dedicated Press releases ❖ Publicise data of general public interest, such as urban heat islands, hottest temperature regions, interannual trends	Sep 2015	IG-IAP-5

Recommendation ID	Strategy	Target Date	Implementation Action Plan ID
IG-REC-11	❖ Continue constructive engagement with the user community during the GlobTemperature UCMs and circulate feedback amongst the ILSTE-WG ❖ Encourage strong user participation in the General Meetings structured towards extracting user opinions ❖ Build a mailing list of users for the ILSTE-WG to facilitate communication using the GlobTemperature Mailing List as a baseline ❖ Develop a periodical ILSTE-WG Newsletter	Sep 2015	IG-IAP-5
IG-REC-12	❖ Discuss the adoption of the standardised LST and LSE Validation Protocol with representatives of the CEOS LPV Group ❖ If successful, work with the LPV Group to transform the Validation Protocol into “Best Practices” guidelines	Jun 2015	IG-IAP-7
IG-REC-13	❖ Identify experts tasked by GCOS in the current review of ECVs ❖ Provide supporting evidence, such as the GlobTemperature (CDR), to build a case for re-classification ❖ Engage with the preparation for ESA CCI-2	Dec 2015	IG-IAP-6

6. Conclusions

Significant progress has been during the first year in the lifetime of the new International LST and Emissivity Working Group (ILSTE-WG) initiative. From the original concept of a science team to provide independent advice and review of GlobTemperature deliverable, the Group has become truly international with much interest generated within the community of LST experts and users. The Group has started to settle into a routine of regular Steering Committee teleconferences and open General Meetings, with substantial non-scheduled activities also being carried out – both by GlobTemperature partners and by international collaborators with no formal link to GlobTemperature.

In addition to GlobTemperature, the ILSTE-WG is embracing other Projects, examples being NASA MEaSUREs and ECOSTRESS, where it is hoped this forum can also be a source of advice and expertise. The General Membership has also grown considerably from the initial invitees, particularly following the successful, and well attended, 1st General Meeting in Karlsruhe. Indeed, this success has illustrated how important it is that the Group maintains good links with existing initiatives and Projects to be able to collocate meetings.

The Action Plan for the next year of the ILSTE-WG (Section 5) is important to provide a short to medium-term strategy for how the Steering Committee views the evolution of the Group. It consists primarily of ongoing activities to ensure the continual growth of the ILSTE-WG whilst maintaining a solid base; and focusses on the dialogue with users and building partnerships with projects and programmes, international agencies, and external groups. The Action Plan is indeed structured to keep a light touch in terms of management, reducing onerous tasks for individual members – particularly for those who are not GlobTemperature partners – since it is more important to maintain momentum as we try to build a self-sustaining entity that will thrive post-GlobTemperature.

End of document