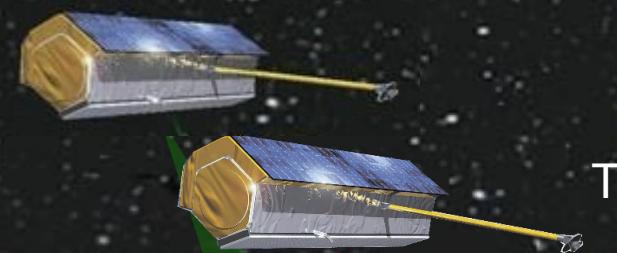




## Workshop: “The Shuttle Radar Topography Mission – Data Validation and Applications” June 14-16, 2005 , Reston, Virginia, USA



TerraSAR-X

Can we do any better than SRTM?

Marian Werner

# TanDEM-X

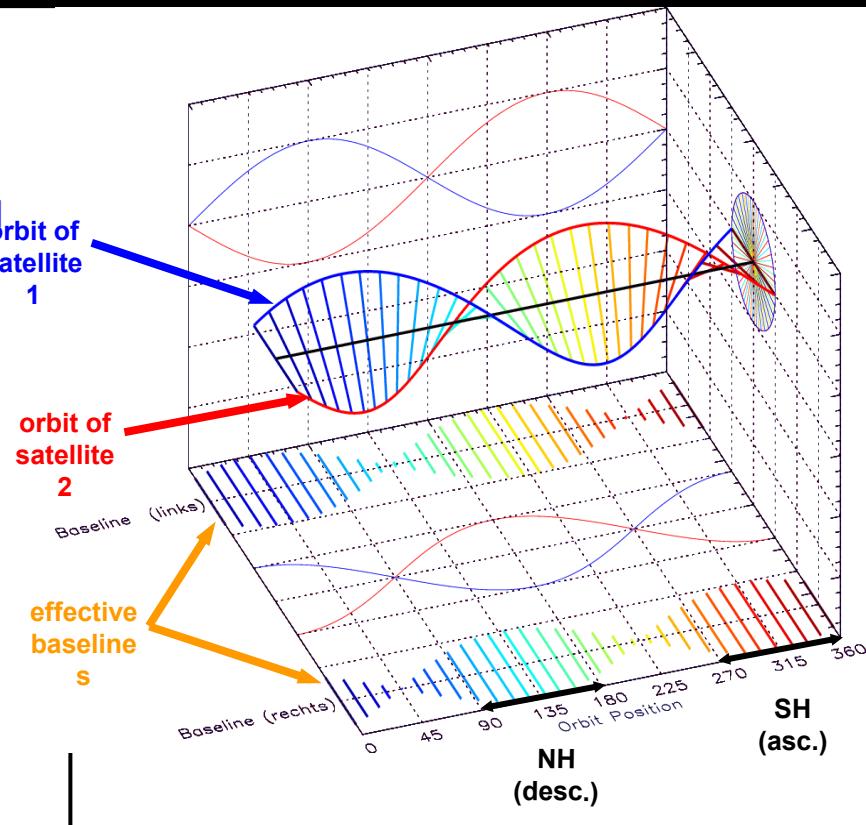
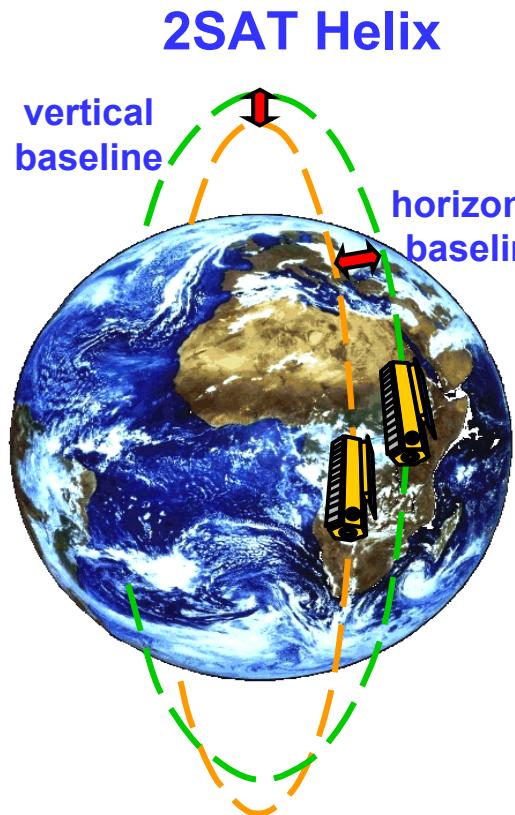
Response to DLR Call  
for Proposals for the next  
National Earth Observation Mission



# Interferometry with TanDEM-X



Digital Elevation Model (DEM)  
from SRTM Mission



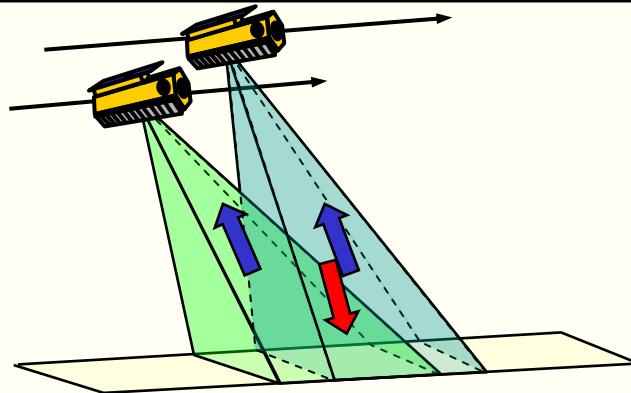
## Single-Pass Cross-Track Interferometry with TerraSAR-X Tandem:

- no temporal surface decorrelation (as opposed to repeat-pass interferometry)
- almost no atmospheric distortions (as opposed to repeat-pass interferometry)
- large selectable interferometric baselines



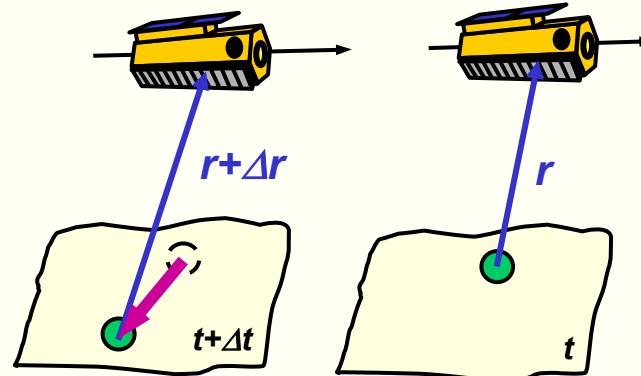
# Capabilities of TanDEM-X

## Cross-Track Interferometry



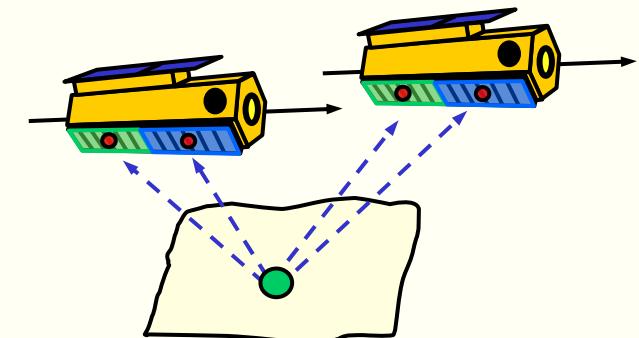
- Digital Elevation Models
- Spatial Coherence (forest, ...)
- Double DInSAR (change maps, ...)
- High Resolution Radar Maps

## Along-Track Interferometry



- Large Scale Velocity Fields  
(ocean currents, glacier flow, ...)
- Moving Object Detection
- Temporal Coherence Maps

## New Techniques



- 4 Phase Center MTI (traffic, ...)
- PollInSAR (vegetation height, ...)
- Digital Beamforming (HRWS)
- Bistatic Imaging (classification, ...)

**TanDEM-X is a very flexible system which enables multiple powerful imaging modes**

cross-track baselines  
(0 km to several km)

along-track baselines  
(0 km to several 100 km)

interferometric modes  
(bistatic, alternating,  
monostatic)

SAR modes: Stripmap, ...)

bandwidth / resolution  
(0 ... 150/300 MHz)

incident angles  
(20° ... 55°)

polarisations  
(single, dual, quad)

...



## Classification of Products

Definition of TanDEM-X products in accordance with the users *and* the TanDEM-X mission performance

### Cross-Track

**HRTI-3**  
(global)

**HRTI-4**  
(regional)

**Custom DEM**  
(global)

- $\Delta h = 1 \text{ m}$  (90%)
- $\Delta x = 25 \text{ m}$  (*indep.*)
- InSAR-DSM
- ...

### Along-Track

**ATI-Glacier**  
(regional)

**ATI-Ocean**  
(regional)

- $B_{\text{along}} \leq 200 \text{ m}$
- ScanSAR  
( $100 \times 1000 \text{ km}^2$ )
- ...

### New Techniques

**4-Phase DBF**  
(local)

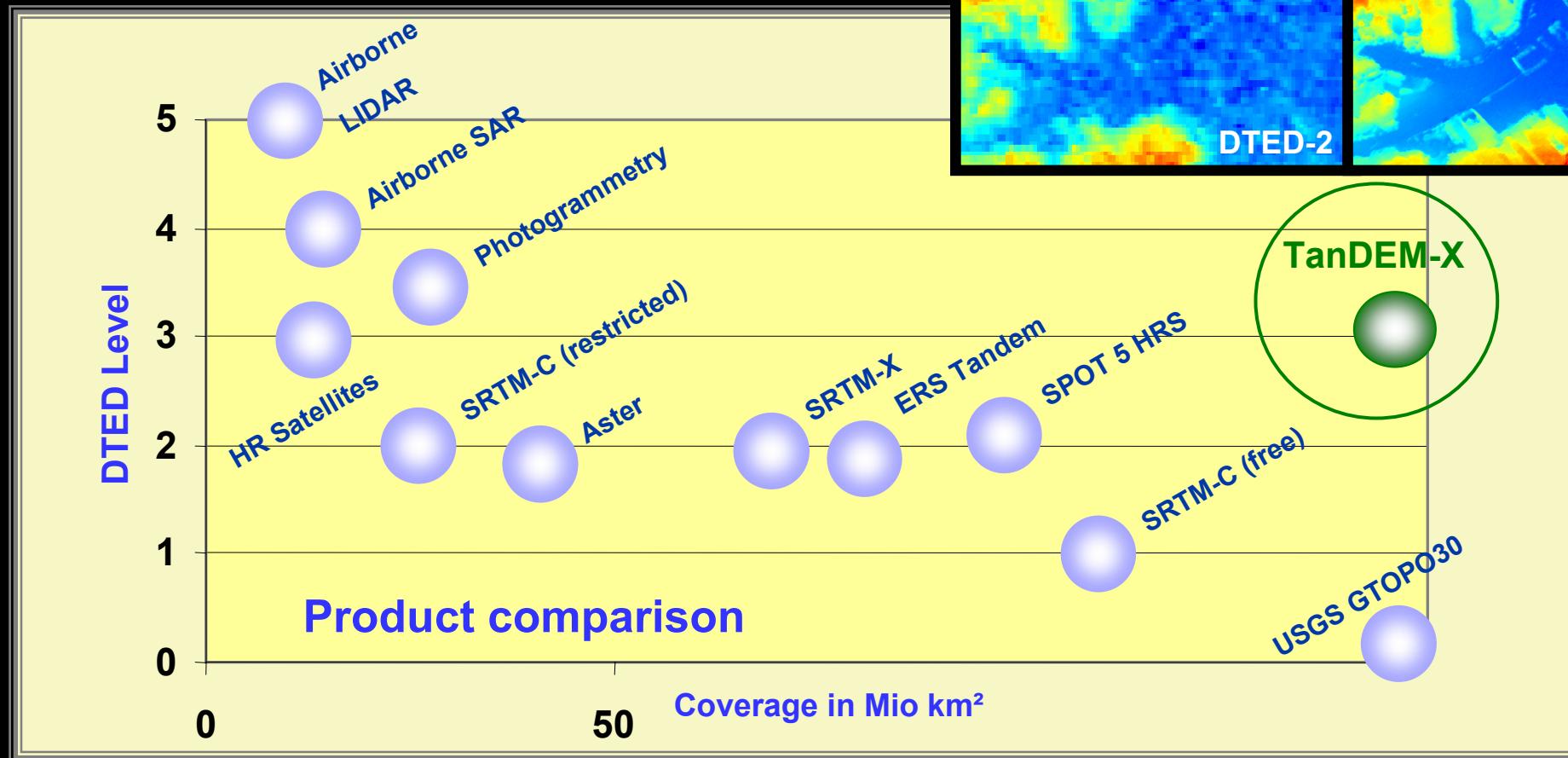
**D-DInSAR**  
(local)

**Pol-InSAR**  
(regional)

- *fully polarimetric*
- *strip map*
- $B_{\text{rg}} \geq 150 \text{ MHz}$
- ...



# *Primary TanDEM-X Mission Goal*



→ acquisition of a global DEM according to HRTI -3 standard in three years



## TanDEM-X Phase A

### *Main challenges to be investigated in Phase A:*

- *PRF and Phase Synchronisation (design upgrade)*
- *Precise baseline determination using differential GPS and phase measurements*
- *Close formation flying capability*
- *Bi-static and interferometric data processing (HRTI-3)*
- *Mission Planning and Data management*
- *Interferometric calibration (Ocean data takes, tie points)*
- *Scientific applications and opportunities*

